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DECEMBER 1999

Broadcast ENGINEERING

THE JOURNAL OF DIGITAL TELEVISION

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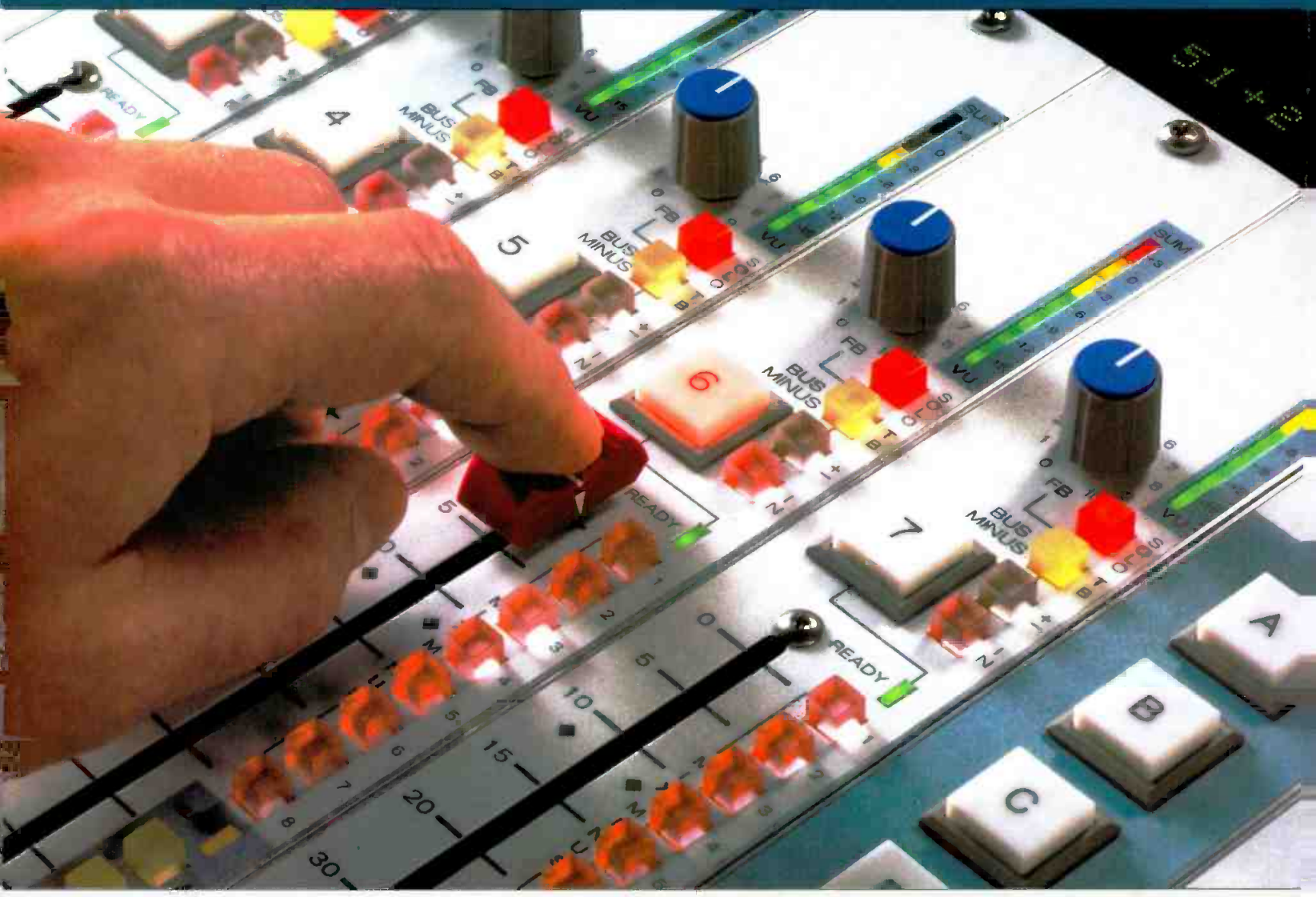

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FREEZE FRAME

A look at the technology that shaped this industry.

Do you remember?

The backbone of modern television was the quad tape machine. For the over 40 crowd, what was the equivalent linear writing speed of the two-inch quad deck? (This is not the head velocity nor the linear tape speed.) Send your answer to brad_dick@intertec.com or through our website: www.broadcastengineering.com Selected correct entries will receive a BE "digital" t-shirt.

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Editorial

The end is near

The end is near. The sky is falling. Television is doomed. Sound familiar? I've heard more reasons why TV is damned than I can count. To that mentality I say, "bunk."

There has never been such an exciting time in television. Digital makes wonderful things possible. We have better pictures, higher quality audio, cheaper equipment and more options than ever. Unfortunately, the industry's transition to even more improvements has stalled.

I recently returned from two editorial trips; one on the East Coast and one on the West Coast. I visited clients, key industry insiders and readers. I reconfirmed that virtually 100 percent of the companies you see in this magazine are excited about the future of digital television. These folks have bet their futures on digital by bringing out a complete array of new products.

Unfortunately, the response from many of you has been to collectively sit on your hands. In many areas, broadcast equipment sales for the past year have been as flat as the Kansas prairie. Is it because new digital solutions aren't available, as was the case two years ago? No, it's because many stations are simply refusing to invest in their future.

I've said before on this page that it's high time we all help lead this country towards digital television. If we don't, our children may someday ask, "Why don't we still have free, over-the-air television?"

Most commercial stations (more than 50 percent) still haven't applied for digital CPs, and it's a month past the deadline. Many seem to be waiting for that yet-to-be-defined digital "killer application." Those people are whistling in the dark, hoping that if they wait long enough, someone will hand them a magic digital goose that lays golden eggs. Well, that's not going to happen. Either get on with business or be put out of business.

The most important step to take now is to get a digital signal on the air. Viewers need to see that digital and HD are there for the watching. Then begin a studio rebuild, converting everything (which needn't be done all at once) to digital. Build for the new digital signals that are going to develop – including data.

Finally, stations need to redouble promotion efforts and be visibly promoting DTV at as many public events as possible. Every station should become *the* local information source on digital and HD. You can even use articles from *Broadcast Engineering* on your website to help viewers understand HD and digital. Cross-promotion with local electronics stores selling digital sets will generate interest in digital – and your station. Support the local set vendors. You need them as much as they need you.

While it would be easy for me to just offer constructive criticism of you in the trenches, I'm also offering some help. This month's issue contains a special report, "The Future of Television," which begins on page 64. Here, experts from a variety of fields will help you understand the changes coming to our industry. You'll learn what key steps can be taken now to protect your future and help you remain profitable.

Part of the problem is that it's tough to know exactly where we need to be in 10 years. Despite this uncertainty, the successful stations in 2010 will be the ones that began the process in 2000. So invest now in digital broadcasting – and in your future. If you don't, the end really is near.

Brad Dick

Brad Dick, editor

Send comments to:
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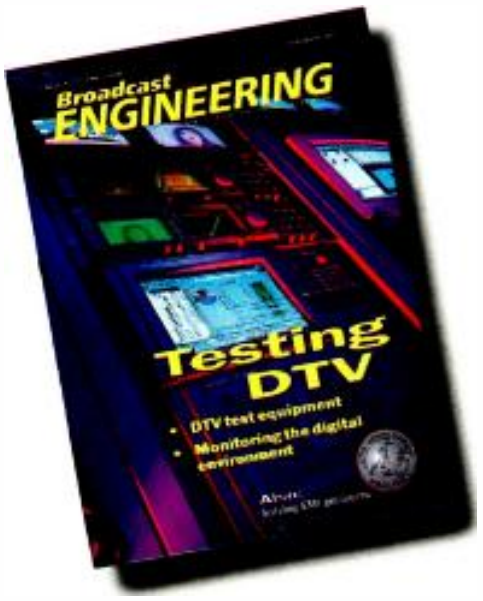

So how dry is Mongolia?

Dear Don Markley:

We are operating a 5kW solid-state Larcan transmitter in the PAL system on channel 8 in Ulaanbaatar, Mongolia. Our Jampro antenna is about 500 feet up and does a good job of covering this city of about 650,000 people. We have a dehydrator on the heliax feedline, but I have always wondered if it is really necessary. After all, this part of Mongolia is very, very dry. A 4kW UHF transmitter next door has no such system on its feedline. Any comments?

PAUL SWARTZENDRUBER, GM & CE
EAGLE TELEVISION, MONGOLIA

Don Markely replies:

Good question. I would still pressurize the lines. If your area is quite dry, it will simply extend the time until water forms in the lines. Even in the desert, some condensation can still form when the temperatures change significantly.

This is my first comment from Mongolia. Just proves that you never know who will read the column.

Truth in advertising

Dear Brad,

I'm sorry to hear about the results of your picture taking at your family reunion. Pictures are an important part of our heritage and legacy. I always advise people to use a decent "snapshot" camera and get prints of their kids and other family events. Photo albums and eyeballs will be around a long time after VHS, VHS-C, 8mm, digital cameras and many other unknown belch-fire formats.

I have family pictures from three generations ago. In generations to come will my great-great-grandchildren be able to look at their ancestors' pictures? Will they find a VHS or 8mm cassette in the closet and wonder what the hell it is, let alone be able to find something to play it?

False and misleading advertising is a normal and accepted practice (not acceptable to me, mind you). Just look at our own industry. We are bound by truth in advertising. For example: we see advertising for cars that tells us what a wonderful deal we can get for only x dollars a month. I've seen very few television sets that can reproduce the fine print at the bottom of the screen. Even if my own high-end set could reproduce it, I'd never be able to read it fast enough. Radio is no better. Mr. Speed Talker reads a disclaimer at 5000 words per second at the end of a spot. Truth in advertising? I think not.

I'm truly sorry about your family pictures. I would cry also. It borders on tragedy. You probably missed the one point wedding text notice on the label. Or, maybe you just thought it was a dead ant.

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Freezeframe winners

The August Freezeframe question on digital tape formats was a hit with more entries (and winners) than any other question. Here's the latest in the long list of those who could name at least 10 digital tape formats. For the record — the contest is over.

Brian T. Bees
University College of the Cariboo
Kamloops, BC

Jason Dixson
Falcon Cable
Tillamook, OR

Heather Weaver
Bay Area Video Coalition
San Francisco

Andrew Schultz
KGTV-10
San Diego

Andy Levine
North Shirley, NY

Boris Nekrasov
Moscow

Boris provided one of the most complete answers received. Here's a list of responses received:

D-1: Component digital on ¾-inch
D-2: Composite digital on ¾-inch
D-3: Composite digital on ½-inch
D-5: Component digital on ½-inch
D-6: Uncompressed component digital HD on ¾-inch
D-7: Component digital on ¼-inch (DVCPRO)
D-8: Component digital on ½-inch (Betacam SX)
D-9: Component digital on ½-inch (Digital S)
Digital Betacam: Component digital on ½-inch
DVCAM: Component digital on ¼-inch
D-5HD: High definition compressed to fit on a D-5 tape
Ampex DCT on ½-inch
D-VHS:Component digital on ½-inch
W-VHS:Component HD on ½-inch ■

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News

DTV Utah on the air

BY LARRY BLOOMFIELD

In 1998, eight Salt Lake City broadcast stations formed a consortium to build a common digital transmitter site for the nation's 36th largest television market. The first two of the eight stations went on air in late October, as DTV Utah became an operational reality.

DTV Utah, under the guidance of managing member Greg James, met or exceeded every goal originally set for the completion of the initial phase of the DTV Utah project. Those tasks included building a facility to accommodate eight transmitter systems, getting additional power to the facility and constructing a new 330-foot tower with antennas on nearby Farnsworth Peak. Farnsworth Peak is located west of Salt Lake City at an elevation of 9273 feet and is named for native of Utah and father of electronically scanned television, Philo T. Farnsworth.

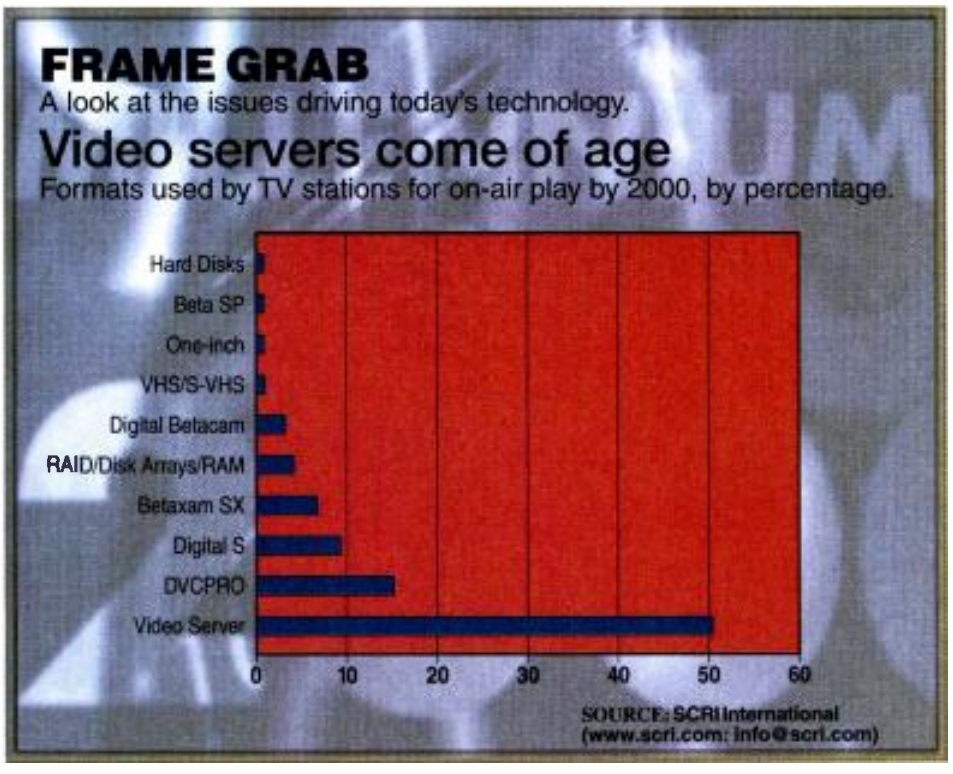
DTV Utah is a coalition of Salt Lake City broadcasters — KBYU, KJZZ, KSL, KTVK, KUED, KULC, KUTV and KUWB. The eight evenly split the expense, approximately $7 million, of erecting the tower and building the facility to house the respective transmitter systems.

There are viewers in the Salt Lake City area. Salt Lake retailer RC Willey reported 29 percent of the TV sets it sold in recent months were digital, instead of the four percent they expected.

Greg James, who shepherded the project to completion, is both the vice president of engineering for KSL-TV and managing member of the consortium. Robert Furlong, KTVX general manager, said, "It took a while for everyone to see the big picture. Television people are not used to working together." DTV Utah is the result of those cooperative efforts. Each station in the consortium remains independent but shares one tower.

"The big winners are the citizens of Utah." James said. "They are going to fall in love with digital television, which in my mind is the most significant innovation in television since the advent of color TV. I think Mr. Farnsworth would be proud of this technology and how eight highly competitive Utah TV stations came together to build this great site."

DTV Utah is a stellar facility in many respects and an example of what results when competing broadcasters cooperate with each other. Despite the fact that the broadcasters in Salt Lake City are not required to offer digital broadcasts until May 1, 2002, they proved what cooperative engineering efforts can do with proper planning. At the center of the new transmitter building are KSL-DT, broadcasting with a Thomcast transmitter, and KTVX-DT, operating with a Harris transmitter. Various spaces around the remainder of the building's interior mark the locations where the remaining six broadcasters will locate their digital transmission equipment. The alliance between the eight stations of DTV Utah is unusual in the competitive television industry but has proven to be econom-



Send questions and comments to:
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DTV Utah's transmitting facilities on Farnsworth Peak near Salt Lake City include a 330-foot tower. Currently, two of the eight consortium broadcast stations are transmitting a digital signal.

ically worthwhile for them.

At a gathering atop Farnsworth Peak on Oct. 28, 1999, Utah Gov. Mike Leavitt participated in a ribbon-cutting ceremony after touring the new facility. Having seen the superior quality of digital television, the governor commented, "I now realize that there is a reason we've put off buying that new television set for our family room."

Several challenging issues had to be dealt with. The window of opportunity and logistics to get construction equipment, materials, a new tower, antennas and other broadcast-related equipment up the dirt, switchback road was limited to only a few productive months. Salt Lake City isn't exactly noted for its mild winters and with Farnsworth Peak some 5000 feet above the valley floor, the project called for nearly errorless planning and flawless execution.

The new tower shares the mountaintop with KSL's older NTSC main and back-up tower/antenna systems along with other shorter communications towers. The new DTV antenna sits atop the highest DTV site in the U.S. and is designed to withstand wind velocities of up to 254 mph and the icy conditions of a typical Utah winter.

The tower will be topped by a Kathrein-Scala antenna system consisting of two eight-bay, three-panel-per-bay systems mounted inside a 1.6-meter diameter, glass reinforced, self-supporting plastic radome, which is 72 feet tall. Each of the two eight-bay antennas is capable of handling the full power of four transmitters or individually up to 50 percent power of all eight transmitters.

A complementary pair of transmission lines and combiners, supplied by Dielectric, feeds the antenna system. Each of the eight transmitters will feed an input port to the combiners, which, if required, can provide 100 percent backup at 50 percent of full power, in an emergency, for all eight broadcasters. The combiners are constant impedance devices and are expandable, should it be necessary to add additional partners to the DTV Utah consortium. An emergency back-up antenna port is also provided for and will probably be installed next spring. Farnsworth Peak is not accessible all year round and should a problem occur, redundancy through the combiner's switching system will keep everyone up and working, with only a 3db reduction in power, until someone can get up there and fix the problem.

There are viewers in the Salt Lake City area. Salt Lake retailer RC Willey reported 29 percent of the TV sets it sold in recent months were digital, instead of the four percent they expected.

About a week after the turn-on date at Farnsworth Peak, James said KSL-DT received reports that its signal was reaching Preston, ID, about 126 miles north of Salt Lake City. In some subsequent testing, James reported that they had taken a standard, off-the-shelf receiver to various points where Farnsworth Peak was totally blocked and they got perfectly good reception.

"I invite any of the flat-earth people on the East Coast who are questioning the abilities of 8VSB to come on out here to Salt Lake City," he said, "and see the robustness of our signal and see how we do things here. It works." ■

IBM develops hybrid transistor

A team of IBM researchers has fabricated the first transistors from hybrid organic-inorganic semiconducting materials with performance similar to that of amorphous silicon, the material used in the drive circuitry of flat-panel displays.

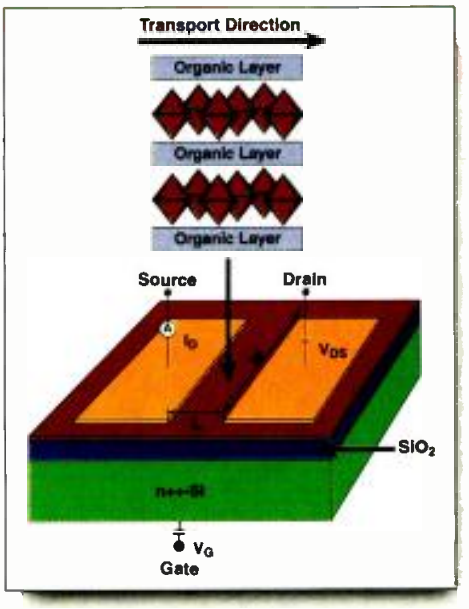
This new technology raises the possibility of inexpensive flexible or curved displays on glass, plastic or other materials.

Best described as a hybrid, the materials blend the useful electrical properties of the inorganic materials used in many of today's transistors with organic materials.

IBM developed these hybrid transistors using a low-temperature solution process known as spin coating. IBM claims this is the first demonstration of an organic-inorganic hybrid material in a transistor. These hybrid materials may promise the performance of inorganic semiconductors with the low-temperature processing techniques common to organic materials.

The electrical properties of silicon make it ideal for use in transistors demanding fast switching capabilities. However, the difficult manufacturing process makes it prohibitively expensive to use in a large-area application like displays. Added to this, inorganic semiconductors, like the silicon used in today's transistors, require very high temperatures to process them, making it impossible to deposit them on plastic or other heat-sensitive materials.

Until recently, organic materials that



IBM researchers have developed an organic-inorganic transistor that could be applied to plastics, other materials or silicon substrates as shown here.

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achieved device performance comparable to amorphous silicon still required the use of vacuum techniques. IBM claims the new organic-inorganic materials appear to solve both cost and the temperature problems.

The new hybrid materials solidify from a liquid at low temperatures to form layers of organic and inorganic material with the necessary semiconducting properties. The low-temperature processing could offer the possibility of depositing these materials onto plastic substrates for flexible device applications.

To demonstrate this new class of organic-inorganic hybrid materials, the hybrid materials were spun onto thermally oxidized silicon substrates. The silicon acts as the gate electrode, modulating the conductance of the organic-inorganic semiconductor, across the silicon dioxide layer, which is the gate insulator. Metal source and drain electrodes are deposited to define the transistor. The organic-inorganic hybrid materials are spin-coated onto these substrates. ■

Programs build viewership with websites

Interactive television, to date, isn't exactly what one could call a smashing success, but it seems to be growing in popularity. The sale of such services as WebTV and Tivo testify in support of this kind of thinking. This might be the reasoning behind why some TV show producers are looking at the Internet as a means to help improve on their show's draw.

A good example comes from our nation's Public Broadcast Service (PBS) where you can see inserts, from time-to-time, referring viewers to the Internet and a particular URL, where they can expand the scope of their involvement in the particular programs' subject matter.

It's no secret that the success of commercial television here in the U.S. hinges on the ability of a station or network to deliver viewers to advertisers; the more viewers delivered, the more the station or network can charge for the time. Anything that can enhance this draw is worth considering.

Paramount Digital Entertainment (PDE) recently announced it launched websites for two of its more popular television talk shows, "The Leeza Show" and "The Montel Williams Show." PDE joined with AppNet to develop these sites.

The Leeza and Montel sites include a polling section to measure interest in a particular on-air segment or issue; subscription to newsletters; show-driven chat rooms; and broadcast information. Irrespective of the show, gathering this kind of demographic information is nearly instantaneous and is an invaluable resource for both programmers and the sales department. The obvious benefits include the creation and enhancement in the direct relationship between the show and its audience, fans and participants.

There are also a growing number of stations that offer their viewers additional information on news stories, with the associated URL paced in one of the lower corners, increasing the number of hits on their news webpage. This could be true on days there are a heavy number of local interest stories. ■

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HDTV via the Internet

While many users struggle to get 33kb/s over the Internet, a group of research institutions recently demonstrated what can be done with a little more bandwidth. Sponsored by Research TV, and with the participation of more than 160 U.S. universities, the October Internet2 (I2) Conference illustrated how a wide bandwidth backbone connection infrastructure can allow many new services to be delivered for both research and consumer applications.

From a consumer standpoint, the demonstration produced by the University of Washington was certainly the hit of the show. ResearchTV teamed with Sony for the first-ever demonstration of streaming HD video over the Internet2. The source material was originated at Stanford University in Palo Alto, CA, and transmitted over the I2 backbone to the University of Washington in Seattle. The October demonstration was transmitted at two data rates: 40Mb/s MPEG-2 DVB-ASI, and Sony HDCAM 143Mb/s embedded in an SDTI transport data stream of over 270Mb/s. (See Figure 1.)

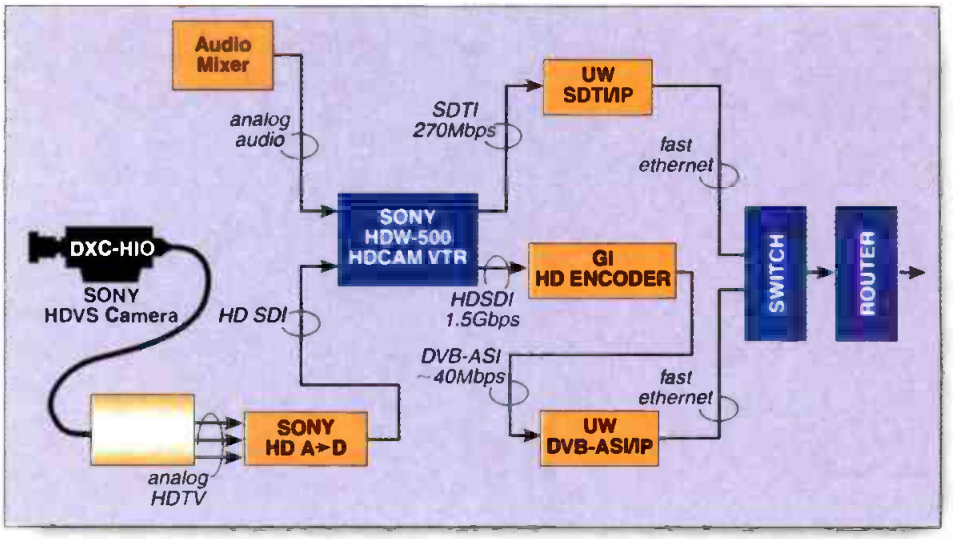
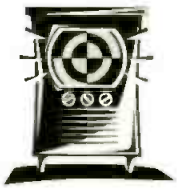


Figure 1. ResearchTV demonstrated the transmission of HD video over and I2 background during the October Internet2 Conference at the University of Washington, Seattle.

Two programs were shown. The first was an episode of the 22-part series from "The Secret Adventures of Jules Verne" and a special animated welcome skit from NBC's Jay Leno show called, "Virtual Jay." The demonstration illustrated the capability of I2 to a crowd ready to embrace the technology.

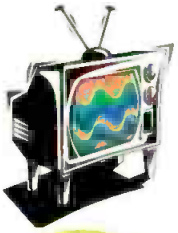
"HDTV over the Internet brings us closer to a more perfect transfer of visual data," said Amy Philipson, executive director of Research TV. "This is one of the highest speed applications every run over the Internet."

"With these (demonstrations) we have seen the future and we know that with more work this quality can be something everyone will be able to enjoy,"said Michael Wellings, Research TV chief engineer at the University of Washington. See www.abilene.iu.edu/index.cgi for the network map and data-traffic information. ■



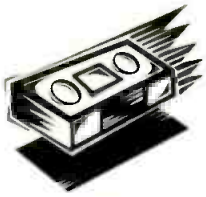
1936

First Television Broadcast



1954

First Color Broadcast

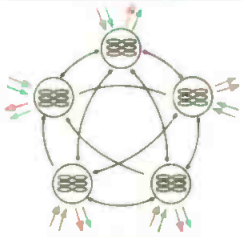


1956

Video Tape Introduced

1962

First Satellite Transmission



1998

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FCC sells spectrum

The days of the mom-and-pop radio and TV stations are rapidly fading into history. Only those large corporations with the deepest pockets can afford to compete in the auctions for the broadcast spectrum. With the recent announcement of new duopoly rules, the spread of ownership is bound to narrow greatly with only a few able to afford the price of admission. Mid-October saw 118 construction permits (CP) sold in the FCC's first broadcast spectrum auction to 91 winning bidders. This event was a special closed event in which only certain prior applicants could participate. The U.S. Treasury is $57,820,350 richer as the result of this round with an average of nearly half a million dollars per CP.

Winstar Broadcasting cast the highest bid at $8,752,000 for a CP in Virginia Beach, VA. Winstar also picked up a CP for Butte, MT for the bid of $160,000.

Television wasn't the only thing up for bid. Radio CPs were also part of the action with Arizona Lotus Corporation casting the highest bid of $5,055,000 for a new FM in Oro Valley, Arizona near Tucson. MAS Communications picked up a CP for the bargain bid of $10,400 in Belle Fourche, SD.

For more information see: www.fcc.gov/wtb/auctions/auc25/da992153.pdf. ■

Feedback from readers

Readers cited Ray Dolby, David Sarnoff and Ted Turner as the most influential figures in television and noted new developments in technology would focus on display devices

Approximately 36 engineers were asked to respond to a series of seven questions ranging from determining the industry's most notable luminaries to the most impressive developments to the future of the industry.

Readers were asked to name the single greatest technological achievement in television. Some of the answers included the digital time-base corrector, compression technology, the videotape machine, color, scanning technology, global satellite links, the CCD, virtual studios and, the most common response, color.

Readers were also asked, in hindsight, what changes might have been made to television. Among the responses were: improved scan technology, developing a worldwide television standard, pushing for a digital broadcast standard for SDTV in the 1980s, the abandonment of interlaced signals and making FM the modulation standard for television.

Individuals and teams who respondents cited as having the greatest impact on the industry included Philo T. Farnsworth, David Sarnoff, Ted Turner, Ray Dolby and Joe Flattery.

Future developments will offer the promise of advanced display technology, most respondents noted. New products that are likely to appear in the future include large high-resolution flat screen displays, micro-display devices, solid-state displays and a universal recording format. ■

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FCC Update

Old CPs given new life

BY HARRY MARTIN

The Commission added an additional year to the construction period of permits outstanding as of Feb. 16, 1999, allowing additional time for construction of stations that had less than a year left under construction permits when the FCC changed the standard from 18 months to three years.

A number of parties filed petitions seeking reconsideration of the FCC's decision to apply the new three-year construction period to old construction permits. Some parties argued that the application of the new rule to such permits was either impermissibly retroactive or that insufficient notice was provided.

The Commission rejected both of these arguments in the reconsideration order. Nevertheless, the FCC will provide relief to permittees who held a valid initial authorization or extension as of Feb. 16, 1999, the effective date of the initial streamlining order. For these permittees, the authorizations will now be automatically forfeit either one year from the effective date of the reconsideration order or on the existing expiration date, whichever is later. The Commission also stated that, in appropriate circumstances, its tolling provisions could be applied to the one-year extension period.

Tolling

In the initial streamlining order, the Commission determined that it would no longer extend construction periods but that it would allow for tolling in the event of (1) pending judicial review of a zoning decision, (2) problems in meeting a Commission-imposed condition, (3) "acts of God," such as natural disasters, or (4) judicial or administrative review of the grant of the permit.

Lotteries to decide duopoly conflicts

Six days before the Nov. 16 effective date of the FCC's new TV duopoly and TV/radio cross ownership rules, the FCC issued an order intended to resolve conflicts among applicants who find that their proposals to buy additional stations in their markets are mutually exclusive with other such proposals.

The new rules permit common ownership of two television stations within the same DMA if eight full-power television stations (eight independent "voices") will remain post-merger and one of the stations is not among the top-four ranked stations in the market based on audience share.

The new TV/radio cross ownership rule similarly permits a party to own two television stations (if permitted under the eight voice test) and up to six radio stations in the same market if at least 20 independent voices (radio, TV, newspapers and cable) would remain post-merger. Where 10-19 independent voices exist, ownership of two TV and four radio stations is permitted. Mutual exclusivity would occur if two or more broadcasters in the same market simultaneously propose combinations that together reduce the number of voices below these thresholds.

The Commission is planning to use lotteries to resolve these types of conflicts. Thus, a lottery would be used where, for instance, two television station owners in a nine-station market filed applications to acquire an additional television station on the Nov. 16 effective date of the new rules. Before determining how many voices exist in a market for purposes of applying the new TV duopoly and TV/radio cross ownership rules, the Commission will consider the following categories of stations as a single voice: (a) duopoly proposals eligible on the basis of the rule waivers available for failing, failed or unbuilt stations; (b) applications proposing the combination of a single radio and a single television station, which are permitted without regard to the number of remaining voices and (c) radio-only combinations that do not invoke the new radio/TV cross-ownership rule.

All pending or granted applications as of the date a new duopoly filing is made will be considered a single voice for purposes of assessing the voice count applicable to the new application. Applications which are not dependent upon a voice count and which are filed on the same day as a duopoly proposal that is dependent upon a voice count would have priority over a voice-count application.

With respect to TV LMAs, those existing before the Aug. 5 adoption date of the new rules will be considered to have constituted a single voice prior to the Nov. 16 effective date of the rules. As with other duopoly proposals, however, a proposal by an LMA operator to purchase a station subject to an LMA could become mutually exclusive with an application filed on the same day which is not dependent upon a voice count but which, if granted, would reduce the number of voices in the market to a number below the threshold for the proposed TV/LMA combination. ■

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

Dateline

Biennial ownership reports are due on or before Feb. 1 for television stations in the following states: Arkansas, Kansas, Louisiana, Mississippi, Nebraska, New Jersey, New York and Oklahoma.

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

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Interactive TV: Killer app or technical curiosity?

JERRY WHITAKER, BE CONFERENCE COORDINATOR

One of the great strengths of the ATSC DTV standard is its considerable flexibility. The options for moving pictures, sounds and data are great, and seem to be increasing with each standards meeting as system planners fill-in the specifics of the ATSC framework. Clearly, one of the most exciting capabilities of the DTV system is its ability to move data — lots of it — in addition to top-quality video and audio.

The technical sessions and exhibit floors at IBC were abuzz with talk of what interactive television could do — and indeed was doing — for broadcasters. As with any new concept for providing a public service, marketing is an integral element. It is no secret that the consumer electronics business is littered with great technology ideas that nobody wanted. Could interactive TV become the next "quad?" After hearing about the new services interactive TV can provide it is easy to get caught up in the excitement of the technology and lose track of what Ma and Pa consumer might really want and use.

This issue will — for better or worse — shape the business plans of stations across the country as the DTV rollout progresses and broadcasters look for ways to generate new revenue streams from their new data streams. The outcome of these efforts will, to a large extent, dictate whether broadcasters remain focused on conveying sounds and pictures to consumers or expand into the realm of data services.

This month, we present two very different views on interactive TV, one from Paul Mitchell from Microsoft, and the other from Marvin Born from WBNS-AM/FM/TV in Columbus, OH. ■

Send questions and comments to: jerry_whitaker@intertec.com

VENDOR

Paul Mitchell, Microsoft

Interactive television has been an unrealized dream for decades. Billions of dollars have been spent on high-profile, but profitless, experiments. So, what's different now?

With the digital television evolution, we are seeing real convergence between the worlds of computing and television. PCs are becoming capable television receivers, and will, in fact, be the first economical, true digital television receivers, due in large part to the economies of scale in the PC industry.

The television industry has the opportunity to make a critical choice between remaining only video and audio (albeit with higher-quality pictures and sound), or getting into the business of data delivery, in which video and audio are just one form of the data.

In Internet portals like yahoo.com, snap.com (NBC/GE), go.com (Disney) and the rise of America Online and new companies like broadcast.com (acquired by Yahoo), we are seeing the rise of an entirely new kind media distribution system. With this trend comes the beginning of the democratization of content choice, where the viewers can select what they want, and largely when they want it.

Communications companies are rapidly investing in infrastructure in order to provide high-bandwidth connections to the Internet to consumers. While the number of "viewers" on the Internet is still small when compared with television, it is already clear that Internet usage is increasingly taking viewers away from television and threatening what has been the traditional broadcast business.

Fourteen leading companies in television content and distribution, software platforms, and consumer electronics cooperated to form the Advanced Television Enhancement Forum nearly two years ago. That effort, now supported by nearly 90 companies from around the world, has created a specification for Interactive television that leverages internet standards, and the investments that content owners are already making in interactive applications.

These trends provide a new opportunity for broadcasters to leverage these digital technology and Internet content investments together, thereby delivering a new content experience.

Consumer interest in interactivity

Clearly, the growth of the Internet itself is ample indication of consumer interest in interactivity of some form. At the last CES show, CEMA conducted several focus groups on DTV. The following examples were shown to the participants:

- A BMW car commercial with downloaded specs that were printed out on demand.
- A local used car dealer advertisement in 4:3 with a free oil change coupon.
- A baseball game with a player statistics option.
- PBS' Bill Nye "The Science Guy" presenting a DTV tutorial with a classroom of the future where students could watch DTV programs on classroom PCs and download associated materials.
- Real-time polling: An evening news program with a story about tenants who became homeless because of a fire caused by poor safety preparations by their landlord. Viewers were asked in a real-time poll whether laws surrounding landlord responsibilities

should be tightened.

The focus group report showed that only 25 percent of the participants would buy DTV for picture and sound alone, while 75 percent would buy it for picture, sound and interactivity.

According to the report, "Consumers expect TV commercials to provide greater value. After viewing the demonstrations of digital TV showcasing the potential applications for commercials, such as printing out coupons, focus group members suggested additional ideas such printing cooking directions, saving contact numbers or information about products, or accessing additional product information on-demand. The majority of consumers felt they would benefit from the new capabilities. Consumers were extremely interested in the potential interactive capabilities of DTV."

Broadcasters have the opportunity to leverage the migration to digital technologies for the creation of new business opportunities by using bandwidth for new services in addition to video. The trends in the industry and the availability of a standards-based approach to creating content that leverages investments already being made will turn the dreams of past decades into the new decade's reality. ■

Paul Mitchell is senior group manager, Interactive Television, Microsoft Corp.

EXPERT

Marvin Born, WBNS-AM/FM/TV

Interactive TV — now that term brings back memories. I remember a company's booth at an early '80s NAB that had slot machines that didn't need any money. They didn't pay back anything either. In retrospect, that should have been a clue. The company was called TV Answer and their "answer" was interactive TV. As I recall, the idea in a broad stroke was as follows: the viewer is watching TV and sees a pizza commercial. He has instant hunger pains, picks up his remote and click —within 30 minutes the pizza arrives, minus anchovies. This was to be the "killer app" for television, much like Lotus 123 for the computer industry and cell phones for the communications industry in the same era.

During this time period, the FCC was lobbied to allocate a block of frequencies for interactive television. A set of specifications was drawn, the frequency, bandwidth, baud rate, and other parameters set, and after many years the FCC allocated spectrum in the 218MHz to 219MHz range in two bands: A and B, very similar to the cell phone plan for competing wireline and non-wireline companies. This got the immediate attention of the TV broadcast industry, which opposed this spectrum plan because it was adjacent to channel 13 and could interfere with that channel. The new service was bi-directional with a set-top box that contained a 218MHz transmitter that talked to a base station, which, in turn, would answer and download the requested data. Initial experimentation showed some interference, especially to older sets in the area. Significant restrictions were placed on the service. Initially, the set-top box power was limited to 100mW with a very short transmitter duty cycle, just a few seconds per hour. No mobile service was allowed at all. The base stations were limited to 20W and were height restricted via their license to maintain a given market area.

The FCC named the service IVDS, Interactive Video and Data Service, and auctioned the frequencies. Many were sold to investors; two even went to broadcasters. Prices were typically $1.5 million per band for middle-market sizes. The initial crowd seemed to be current (at that time) cell phone licensees. However, unlike the phones and computers, there was no "pent-up need," no ready market and no equipment — in other words, a business with no customers. Not only did the new licensees of interactive services have to build the business, they had to build "a need in the market" as well as the infrastructure.

There was no "pent-up need," no ready market and no equipment — in other words, a business with no customers.

The killer app is DOA

Some of the investors were surprised that no one knocked down their doors with checks wanting to use their frequencies. Many failed to pay the FCC the auction fees and were placed in default. Others elected to pay the fee over time. There were meetings and more meetings, but now the killer app had a problem that turned out to be the killer itself. When the IVDS service was conceived, it was the early 1980s and a 300 baud was high tech, with 1200-baud modems still on the horizon. It was subscriber limited with ASCII text only. Some companies did some experimenting with the system; one group put a working system on the air with 50 set-top boxes. But it could not compete with the Internet and the experiment died.

The pizza idea was good. The interactive remote had a credit card reader built in the handle, so once you ordered the pizza you could pay for it via your credit card. When a car commercial ran, there was an interconnection between the TV station and the IVDS, so the viewer/subscriber could just click on "additional information" and the viewer's address and request would be sent the to car dealer. One company had an idea of a video catalog to "point and click" orders. A good idea, but it doesn't work too well without graphics.

Fast-forward to 2000

These were all great, maybe even killer apps, but their time had not yet come; frankly it probably has yet to arrive. Maybe the data channel in the DTV bitstream will hold the key to bringing these services to the consumer. The throughput of the dynamic data channel can handle thousands of subscribers. Now, if we can just get the channel 13 interference problems solved, maybe the set- top box as a back channel can make a comeback ... but I think "Road Runner" type services will eat its lunch.

On the subject of interactive TV, I am reminded of the saying "Those who fail to understand history are doomed to repeat it." ■

Marvin Born is vice president at WBNS-AM/FM/TV in Columbus, OH.

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Transition to Digital

Compression concepts, part 2

BY MICHAEL ROBIN

Last month, we covered the basics of how video signals are assembled, as well as how we perceive the images produced by those signals. This month's article explores how the amount of data used to transmit images can be reduced through compression.

Data reduction

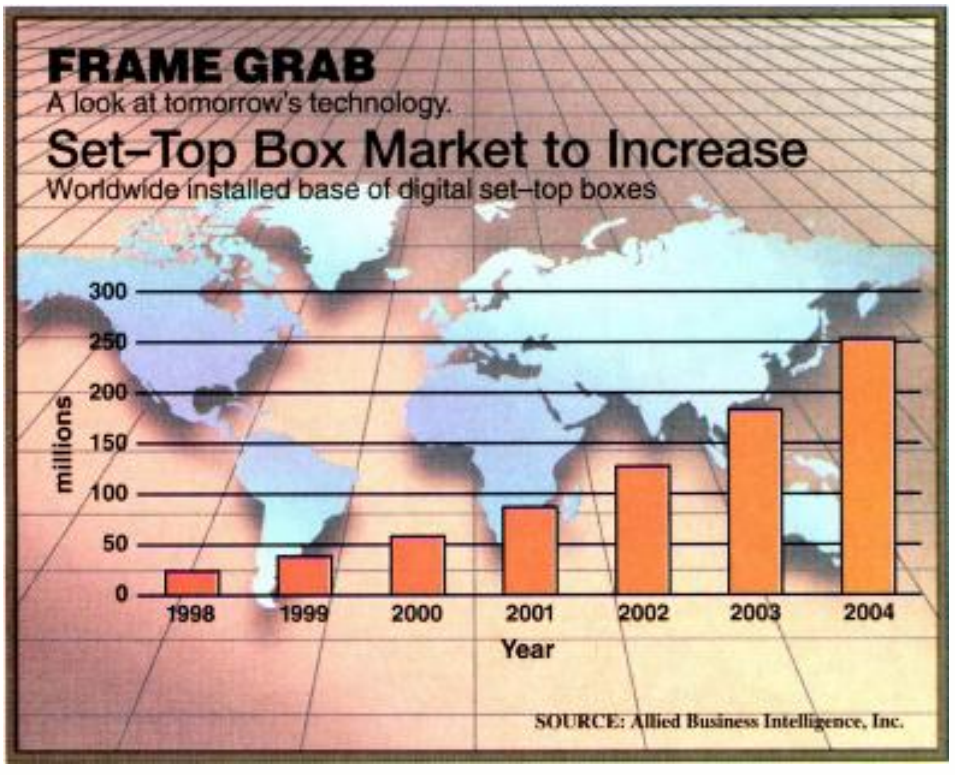
Data rate reduction can be achieved through a combination of tools. For the most part, the goal is achieving bit-rate reduction of the original signal to a minimum value without causing unacceptable degradation of the picture quality level. Picture quality level can vary, and is chosen based on the intended application. A higher quality level is required for contribution signals (undergoing further processing in a studio) than for emission signals (direct-to-home broadcasts).

There are two complementary data reduction techniques used, namely *bit-rate reduction* and *compression*. Bit-rate reduction reduces the data rate by discarding superfluous or imperceptible information. Compression uses statistical and higher-order mathematical means to remove redundant information. Over the years, many *lossless* and *lossy* reduction techniques have been developed. Figure 1 summarizes the data reduction techniques that are combined to generate JPEG and MPEG signals. Taken separately, none of these techniques generate significant data reduction. However, the right combination of several techniques can provide a very efficient data reduction system.

Analog compression schemes have been with us since the beginning of the storage and transmission of video and audio signals.

Data rate reduction is lossless when it allows the recovery of the original signal after decompression. Lossless data rate reduction is a fully reversible process, however, only modest compression ratios (typically <3:1) are achievable. Lossless techniques commonly used include:

- *Blanking removal*: Non-essential data in the horizontal and vertical blanking interval are removed without affecting the picture. The bit stream is reduced to the active (essential) picture area content.
- *Discrete Cosine Transform (DCT)*: The forward (in the encoder) and inverse (in the decoder) DCT process is totally transparent if the transformed frequency coefficients have a word length of 13 to 14 bits for input signals with eight-bit word samples. With 11 bits or less, the DCT process becomes lossy.
- *Variable Length Coding (VLC)*: Also called Huffman coding and entropy coding, takes into consideration the probability of identical amplitude values in a picture and assigns short code words to values with a high probability of occurrence and long code words to others. A historical VLC method, predating Huffman by a long stretch, is Morse code. Morse code assigns short codes to the most frequently used letters of the alphabet (E=dot and T=dash) and longer codes to less frequently used letters.
- *Run Length Coding (RLC)*: Generates special codes to indicate the start and the end of a string of repeated



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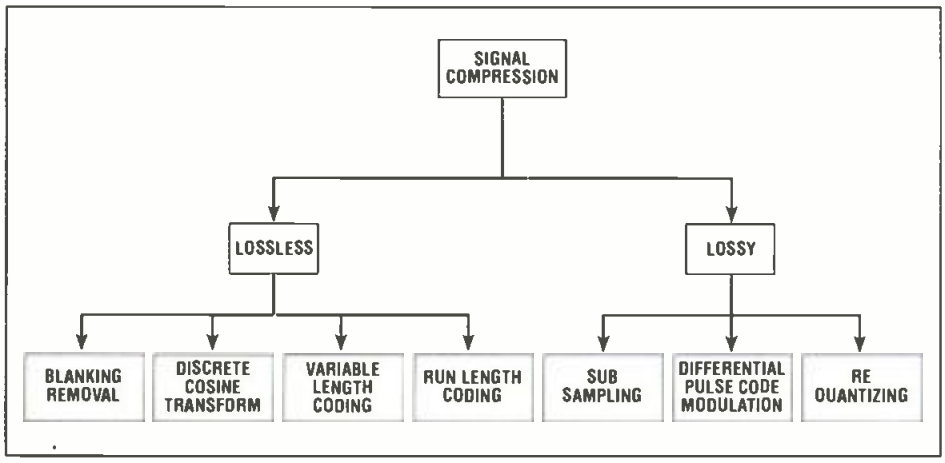

Figure 1. Summary of the various lossless and lossy data reduction techniques used for signal compression.

values. Only non-zero values are encoded along with the number (run) of zero sample values along the scan line.

Data rate reduction is lossy when information is lost and the original image can only be approximately reconstructed. Lossy data rate reduction combines several data reduction techniques to achieve considerably higher compression ratios (from 3:1 to 100:1) and is an irreversible process. The picture is degraded as a result of data rounding or discarding within a frame or between frames. Among the lossy techniques are:

• *Subsampling*: A very effective method of lossy data reduction, subsampling is generally applied to chrominance signals resulting in sampling schemes such as 4:2:2, 4:1:1 and 4:2:0. A special video conferencing subsampling scheme, called common source intermediate format (CSIF), subsamples luminance as well as chrominance and is claimed to have a resolution similar to that of a VHS recorder. Table 1 shows examples of several bit-rate reduction approaches and the resulting total bit rate.

• *Differential Pulse Code Modulation (DPCM)*: This is a predictive encoding scheme that transmits the sample-to-sample difference rather than the full sample value.

• *Requantization*: A process of reassigning the available number of bits per sample in a manner that increases the quantizing noise of imperceptible (to the HVS) picture details. In addition, the bit rate is controlled to avoid digital buffer overload.

The right combination of several compression techniques can provide a very efficient data reduction system.

Compression ratio

The performance of different compression schemes is judged by comparing the respective compression ratios. The comparison is valid only if the picture format is identical. A meaningful comparison involves the definition of the picture format (number of lines per image, number of pixels per line and number of frames per second), the sampling structure used (4:2:2, 4:1:1 and 4:2:0) and the sample resolution (eight or 10 bits per sample).

Once the picture format has been defined, the total bit rate of the original image (before data reduction and compression) can be calculated. The total video bit rate (TVBR) is calculated as follows:

TVBR (Mb/s) = T_P x T_L x Fv x n

where:

T_P = Total number of pixels per line = 1716 for the 4:2:2 format

T_L = Total number of lines per frame = 525 lines

Fv = Number of frames per second = 29.97 frames per second

n = Number of bits per digital sample = 10

TVBR = 1716p x 525l x 29.97fps x 10bits = 270Mb/s.

The essential bit rate is obtained by eliminating all unused samples in the horizontal and vertical blanking interval. A complicating factor is due to the varying numbers of vertical interval lines transmitted by the system. Variations are mostly encountered in the VTR formats.

The essential bit rate (EBR) is calculated as follows:

EBR (Mb/s) = A_P x A_L x Fv x n

where:

A_P = Number of active pixels per line = 1440 for the 4:2:2 format

A_L = Number of active lines per

FORMAT	Y BIT-RATE	Cb/Cr BIT-RATE	TOTAL BIT-RATE
4:2:2 @ 10 BITS	858p x 525l x 29.97fps x 10bits ≈ 135 Mb/s	429p x 525l x 29.97fps x 10bits ≈ 67.5 Mb/s	270.00 Mb/s
BLANKING REMOVED	720p x 480l x 29.97fps x 10bits ≈ 103.58 Mb/s	360p x 480l x 29.97fps x 10bits ≈ 51.8 Mb/s	207.18 Mb/s
4:2:2 @ 8 BITS	720p x 480l x 29.97fps x 8bits ≈ 82.86 Mb/s	360p x 480l x 29.97fps x 8bits ≈ 41.43 Mb/s	165.72 Mb/s
4:1:1 @ 8 BITS	720p x 480l x 29.97fps x 8bits ≈ 82.86 Mb/s	180p x 480l x 29.97fps x 8bits ≈ 20.71Mb/s	124.28 Mb/s
4:2:0 @ 8 BITS	720p x 480l x 29.97fps x 8bits ≈ 82.86 Mb/s	360p x 240l x 29.97fps x 8bits ≈ 20.71 Mb/s	124.28 Mb/s
3:1:1 @ 8 BITS	540p x 480l x 29.97fps x 8bits ≈ 62.14 Mb/s	180p x 480l x 29.97fps x 8bits ≈ 20.71 Mb/s	103.56 Mb/s
CSIF MPEG-1	360p x 240l x 29.97fps x 8bits ≈ 20.7 Mb/s	180p x120l x 29.97fps x 8bits ≈ 5.18 Mb/s	31.06 Mb/s

Table 1. A sampling of the various ways bit-rate reduction can be achieved.

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1962
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1964
529 Waveform Monitor

1966
520 Vectorscope

1968
528 Waveform Monitor

1969
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1974
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1985
WFM300 CAV Waveform Monitor
TSG300 CAV Signal Generator

1986
1700 Series Waveform Monitors

1987
VM700 Video Measurement Set

1988
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1989
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1993
WFM601 Series Serial Component Monitor

1994
WFM90 Waveform/ Vector/Picture/Audio Monitor

1995
MTS100 Series MPEG Test System

1998
PQA200 Picture Quality Analysis System

1999
WFM1125 High Definition Digital TV Waveform Monitor

1999
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TDS500D/700D Series Digital Phosphor Oscilloscopes
U3661 Spectrum Analyzer

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AV601 Digital Audio/Video Monitoring Systems
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SPG422 Component Digital Master Sync Generator
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frame = 480 for the 4:2:2 format

EBR = 1440p x 480l x 29.97fps x 10bits = 207.18Mb/s

Given the bit rate after compression it is possible to calculate the compression ratio as follows:

Compression ratio = Essential bit rate/Compressed bit rate

There are several ways of expressing compression ratios. Calculating the compression ratio of digital VTR's introduces several new terms as follows:

CVBR = Compressed video recorded bit rate. This is a manufacturer choice and depends on the class of the VTR and the compression method used.

TBR = Total recorded bit rate including CVBR, EBR, digital audio and error correction codes. This is a manufacturer choice and depends on the tape-to-head speed and the compression method used.

FORMAT	SAMPLING	n	TBR (Mb/s)	EBR (Mb/s)	CVBR(Mb/s)	COMPRATIO
D1	4:2:2	8	225	172	172	N.A.
D5	4:2:2	10	300	220	220	N.A.
DV	4:1:1	8	35.5	125	25	5:1
D7-DVCAM	4:1:1	8	35.5	125	25	5:1
DVC-PRO	4:1:1	8	41.8	125	25	5:1
DVC-PRO 50	4:2:2	8	100	168	50	3.3:1
D9-DIGITAL S	4:2:2	8	83.6	168	50	3.3:1
BETA SX	4:2:2	8	40	176	18	10:1
DIGI BETACAM	4:2:2	10	128	219	95	2.3:1

Table 2. Some digital tape formats as well as the bit rates and compression ratios associated with them.

The number of active (recorded) video lines per frame is also a manufacturer choice and varies from product to product. Table 2 summarizes the characteristics of several component digital VTR formats. The calculation of the compression ratio takes into account the number of video lines per frame.

Some disk-storage manufacturers use minutes per gigabyte (GB) to express the compression capability of their system. Let's assume a system advertised as six minutes per gigabyte (GB). This can be expressed as:

360 seconds/GB or 360 seconds/1000MB or 360 seconds/8000Mb.

The compressed data rate is 8000/360 = 22Mb/s.

Note that in some calculations relative to the computer world, 1024 (2^{10}) is used instead of 1000. Manufacturers of editing systems use kilobytes per frame (kB/frame) to express the compression capability of their systems. Let's assume a system advertised as 100kB/frame. This can be expressed as:

800kb/frame or 24,000kb/s or 24Mb/s.

Cable and satellite systems often use terms such as "4:1" or "5:1" for a transponder or cable channel. This usage refers to the number of television signals that can be delivered with compression within the digital capacity of the channel. The real compres-

sion ratio applied to each of the television signals is much higher, for example 25:1.

The concept of compression is not new. Analog compression schemes have been with us since the beginning of the storage and transmission of video and audio signals. These schemes have provided rudimentary but viable and essential bandwidth saving methods. The general concepts of digital bit-rate reduction were developed a long time ago by a number of specialists such as Nyquist, Shannon and many others. The revolution in compression that we have witnessed for the last 15 years or so is due to several relatively recent developments such as:

The performance of different compression schemes is judged by comparing the respective compression ratios. The comparison is valid only if the picture format is identical.

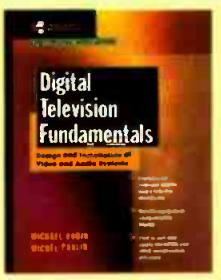
- The increasing use of a digital representation of video and audio signals.
- An improved understanding of the HVS and HAS characteristics.
- Application of spin-offs of the computer technologies to carry out fast mathematical calculations allowing us to predict future pictures based on past pictures, compare them to reality and transmit the difference.
- The development of the revolutionary MPEG concepts that provide the toolkit used in the development of continuously improving compression methods and systems.

As technology continues to develop at an ever-increasing speed we can confidently predict that the future will offer us means of storing and transmitting improved video and audio signals at reduced bit rates. ■

Michael Robin, former engineer with the Canadian Broadcasting Corp. 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

Michael Robin's book may be ordered directly from the publisher by calling 800-262-4729. It is also available from several booksellers.



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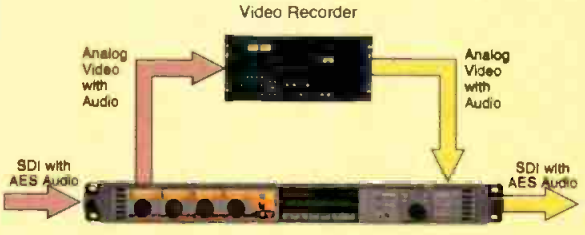

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Upgrading computer systems

BY BRAD GILMER

Sooner or later, the time will come to upgrade a major computer system in your facility. Depending on your previous experience, this will either be something you will really look forward to or something you find as exciting as a root canal. The upgrade might be a simple software upgrade or involve a complete change of hardware, software and operating system. Although it is tempting to think that a simple software upgrade is much easier than replacement of a complete system, that may not be the case—especially if the replacement system comes preconfigured with all the software you need. Regardless, there are things you can do to ensure the success of your next computer upgrade.

Software upgrades

Software upgrades can be challenging for several reasons. First, software packages are becoming increasingly complex. Interaction between the upgraded software components, hardware and external systems can involve thousands of potential interface points and processes. In some cases, it is statistically impossible for manufacturers to test every line of code and every possible option. Second, good code control, meaning control of revisions and fixes, takes an iron discipline that some manufacturers have not followed. If revision control gets out of hand, bugs that were repaired in an earlier release could reappear in subsequent upgrades. Third, variations in hardware may mean software that functions perfectly on a test system at the factory does not work at all in the field.

Based on this, do not expect everything to go smoothly even with the simplest software upgrade. The consequences of a botched software upgrade can range from minor to catastrophic, depending on the importance of the system being upgraded. With critical systems, it is usually prudent to assume the absolute worst. If things go better than that, you will come out a hero. If not, at least you are equipped to deal with whatever may come your way.

The consequences of a botched software upgrade can range from minor to catastrophic, depending on the importance of the system being upgraded.

Assuming that the system you are working on is not critical (are there any of those anymore?), you may be able to walk up, put the upgrade disk or CD into the computer, type INSTALL and see how it goes. There are few systems on which I would suggest this approach. Having a plan for the upgrade allows you to have all the appropriate pieces in place, and gives you an opportunity to think through the upgrade before you do it.

There are a surprisingly large number of private pilots in the broadcast business, so perhaps this analogy will help. Private pilots flying in instrument conditions are constantly trained to always have an out, to always have a way of getting safely on the ground if something unexpected occurs. While the consequences of a surprise in an airplane flying on instruments may be a little more extreme than encountering a surprise while doing a software upgrade, you might want to consider some of the techniques used by instrument pilots when doing your next upgrade of a mission-critical computer system.

The following concepts can be applied to almost any large project.

- Always have an out. Always have a plan for how you will recover if something goes wrong during the upgrade.
- Plan your flight, then fly your plan. Once you plan how you are going to perform the upgrade, follow the plan. It may be tempting to deviate from the plan along the way, and there are times when this is appropriate. However, if you did your homework during the planning phase, then deviations from the plan will be the exception rather than the rule.
- Have a backup. Many aircraft flown in instrument conditions have backup systems in case something goes wrong. Having a backup before you start your upgrade can take many different forms. It goes without saying that it is a good idea to perform a complete software backup before starting the upgrade. If the system is critical, it may be worth getting a complete backup system and installing the upgrade on the backup *first*. Once the backup is thoroughly tested, then it can be put on line and the main system can be upgraded. This may not be practical for everyone, but it can be relatively easy to justify for critical applications.
- Test the backup. It is always a good idea to test your backup *before* you need it. Pilots check their backup systems as part of their regular preflight inspections. Most software backup programs allow you to verify the data that is contained on tape. (You did make a boot disk, didn't you?)
- Continue planning while you fly, things change. For pilots, weather, traffic congestion and even computer failures can cause changes to the plan. As you perform the upgrade, evaluate how things are going, what you have learned so far and what you might need to change in your plan later.
- Deviate from the plan when neces-

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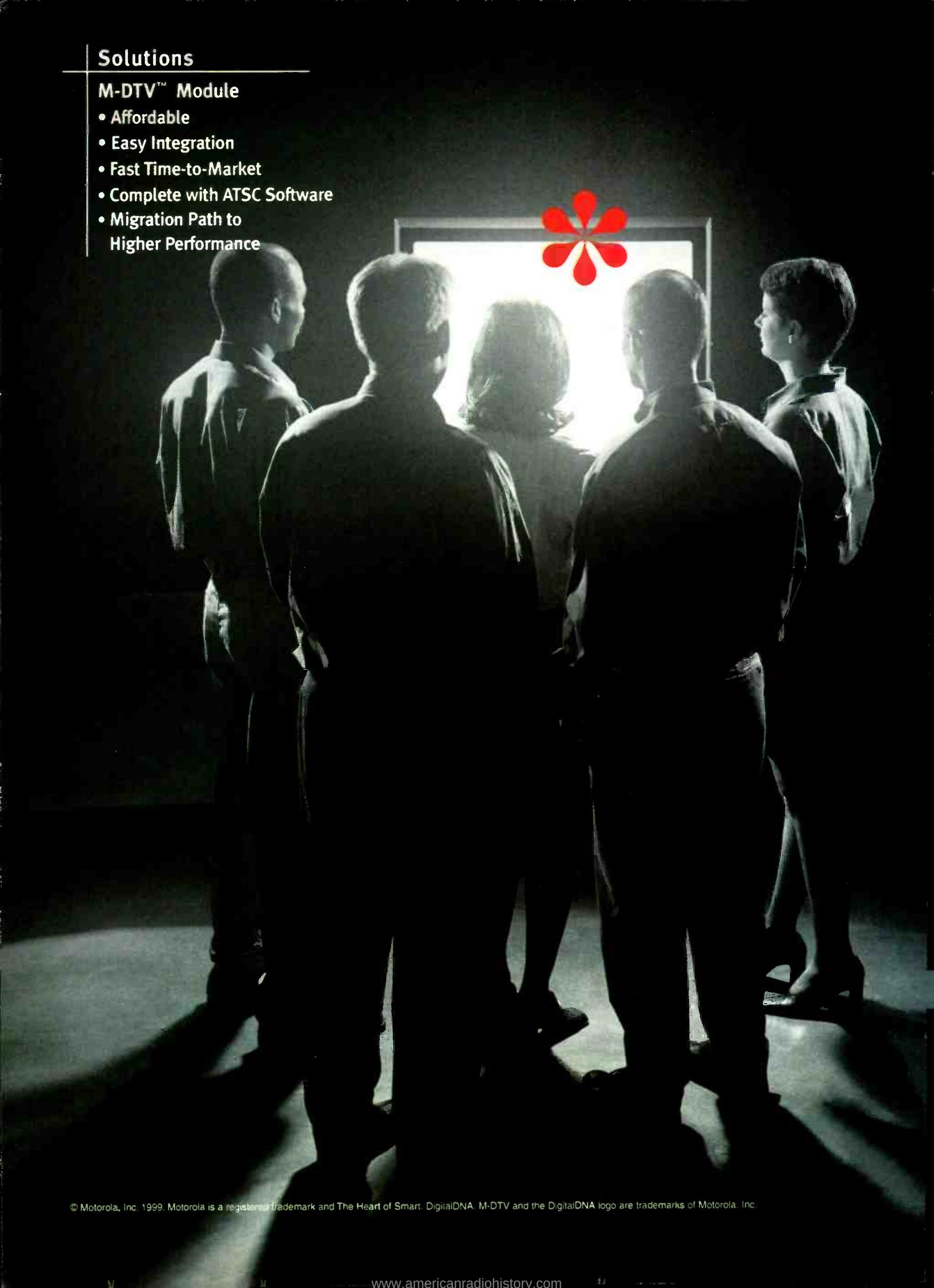

sary. If conditions require it, do not hesitate to deviate from the plan or back out of the upgrade completely. If you get into a situation where you do not know how to answer a question, or where things are getting uncomfortable, your best bet may be to stop the upgrade, revert to the earlier software version, and then consider what to do on the next try. Once, I was almost finished with a file server upgrade. I got to one question I did not anticipate, guessed at the answer and spent the next six hours rebuilding the system from the start. (My backup plan was not that good!) Pushing ahead when things get foggy is not a good idea whether you are performing an upgrade or flying a plane.

• The flight is not over until the plane is parked at the gate. More than one pilot has landed, relaxed his attention and crashed the airplane before reaching taxiing speed. It may be hard to keep focused once the cover is back on the computer, but this is the time when you should be at your best, checking to be sure that everything is back in place, that all the functions work properly, and that testing is complete.

Many of the principles above will be overkill for simple software upgrades. However, if you follow the ideas presented, you will be ready for a really big upgrade. I can assure you that if you are sitting in the GM's office after a failed upgrade without a plan, you may feel as if you are lost in the clouds with a thunderstorm looming near by.

Having a plan for the upgrade allows you to have all the appropriate pieces in place, and gives you an opportunity to think through the upgrade before you do it.

Complete system upgrades

How hard can it be? The system comes preconfigured from the factory and all the software has been installed and tested for you. All you have to do is take it out of the box, plug it in and turn it on. Sounds simple, and perhaps it is. Complete hardware and software upgrades may be the easiest way to upgrade your system. Depending on the manufacturer, the scenario above may be available to you, and it may be the best way to go. Nevertheless, here are some things to consider when looking at a complete system upgrade.

Does the system do what you need? Sometimes a preconfigured system is pretty rigidly fixed in its capabilities, features and available options. While getting a preconfigured system can save you a lot of work, you may end up losing time if you have to reload everything from scratch to get the configuration you need.

Does the system come with extras you do not need? Whether you are talking about a desktop PC or the latest hot UNIX box, it is very common for manufacturers to bundle applications with the system. This may not make any difference to you, but extra applications can slow system performance, decrease available hard disk space and potentially create conflicts with software or hardware that you add later.

Will you have to maintain the system once it is installed? If the answer is yes, one of the best ways to build knowledge about the system is to build it yourself. I do not mean that you should go out and buy an empty chassis, some boards and disks and put the thing together as if it were a Heathkit project. If the system is not too complex, consider asking the vendor to provide the components (computer, software, drivers, etc.) and telephone support needed to allow you to load the software and get the system up and running. Some vendors will balk at this, preferring to load and test the system at the factory. However, if you have the time, this is by far the best way to learn about your new system.

If you are upgrading an entire system, you may be able to retain the old system and use it as a backup. This has several advantages, it can give you a place to test out upgrades before you put them on line and also give you a place to learn without jeopardizing critical operations. Many of us are reluctant to play with a computer system that is on-line for fear of damaging it. As a result, you can end up training on the system only during a crisis—not exactly an optimal solution. Having a backup system available for training is clearly a better way to go.

Specific recommendations

Here are a few more recommendations on getting through upgrades successfully:

• Go to school. Many manufacturers offer training, and this can help you later when faced with a major upgrade.

• Read a book. You may be able to find an after-market book on your system that provides information on upgrades that are not covered in the factory documentation.

• Read the manual. Not an all-together bad idea really.

• Read the release notes. OK, I am as guilty as anyone. The installation is finished, and the last message says, "Do you want to read the read me file?" Of course, I say no. Perhaps reading these ahead of the upgrade might be another good idea.

• Use the Internet. There is a wealth of upgrade information on the Internet. In fact, it is likely that you have already downloaded upgrades over the Internet. Manufacturers have support sites and expert databases available to answer questions about potential upgrades. Do not forget Internet newsgroups. It is very likely that there is a newsgroup on the Internet that is specifically geared to your computer and operating system. Look through the FAQ for the newsgroup and check the archive. If you do not find the information you are looking for, post away. ■

Brad Gilmer is president of Gilmer & Associates, a management and technology firm. He is also an instrument-rated private pilot.

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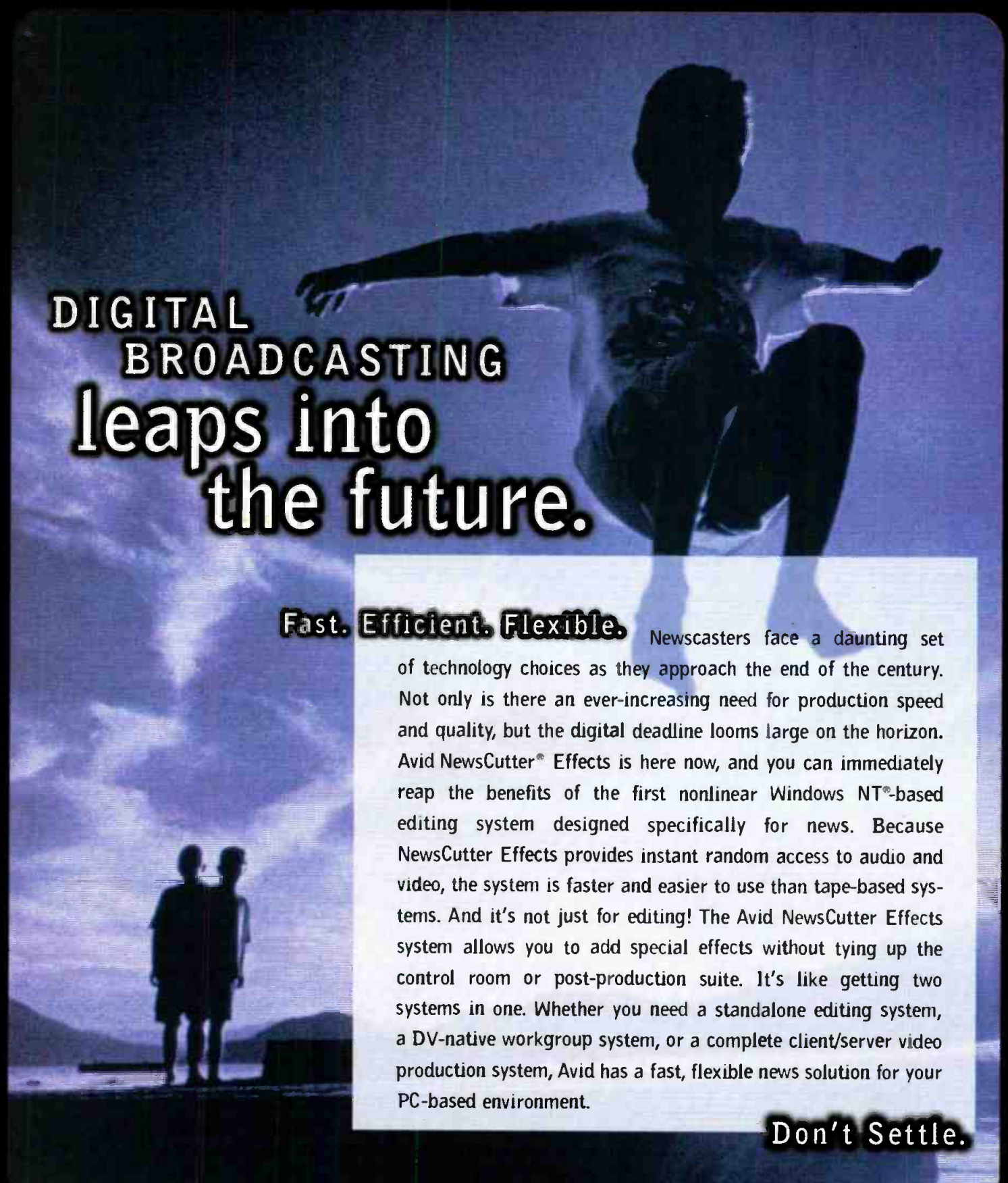

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Closed captions on DV?

BY STEVE EPSTEIN, TECHNICAL EDITOR

How does the DV format deal with closed captioning? We used a D-2 master with captioning to make a DV dub. Upon playback, our CC-enabled TV will not decode the CC information that should be there. Has it been stripped out during the dub somehow? Can DV be used as a CC-compatible dub master?

Rich Reilly
Attainment Co. Inc.

I did some looking into this one and came up with a variety of answers, most of which depend on the particular model of DV recorder you are using. Closed-caption information is located in line 21 of the composite analog NTSC signal. The DV format does not record the VBI, but there are provisions to strip the signal off of line 21 and record it in the video auxiliary data area. On playback, the signal is reinserted into the video. How, and if, this is implemented on a particular DV deck varies. For the most part, the more professional formats (DVCAM and DVCPRO) support this capability through most, if not all, I/Os. However, the consumer-level decks are another matter.

In general, it appears that consumer-level decks do not support CC unless they include a tuner. Apparently, an assumption was made that unless the deck was going to be feeding a TV, the capability would not be needed. Also, these decks may only support CC through the analog I/O. To answer your question, yes, DV can be used as a compatible dub master, but you have to have the correct decks, and even then you might have to use the analog I/O ports – something you might not want to do if the original is digital.

Captioning is something that can easily be overlooked in a large facility. Checking your facility to verify that it passes VBI information correctly is something that should be done regularly. Numerous devices within a facility can render closed captions and other VBI info useless. Proc amps, non-linear editors, TBCs and VTRs can strip off or displace the information, preventing it from being properly displayed on the viewer's TV. Years ago, before closed caption sets were common, I received a series of viewer complaints concerning my station's closed captioning. A quick check on a pulse-cross monitor showed the signal was there, but it did not tell me what line it was on. A closed caption decoder revealed that it was on the wrong line. This made it quite simple to make the necessary adjustments to get it back where it belonged. The culprit in this particular example was the vertical phase adjustment on an old 900 series GVG proc amp.

Numerous devices within a facility can render closed captions and other VBI info useless.

Another thing that can easily destroy closed captioning is that dirty little secret of making time through the use of a Lexicon. Speeding up a video transport and correcting the audio pitch with a Lexicon causes the video (and the CC info) to jump up and down a line because fields are played back as needed – a field that was recorded as field 1 may be played back as field 2 and vice versa. Unless extra steps are taken to place the CC information back on line 21 field 1, the viewer will see only intermittent closed captions, if any.

Facilities that handle tapes with closed captioning (nearly everyone today) should have a decoder/monitor available to verify that the information passes through the facility properly. It is a good idea to regularly verify proper operation.

Is your facility struggling with the transition to digital? Are you looking for a way to breathe a little more life into old equipment? If you have a question or comment, drop me a note at *drdigital@compuserve.com*. ■

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GMA moves to Times Square Studios

Times Square Studios Ltd. is a 47,000 square foot digital facility spanning three floors and including two separate studios. The 4600 square-foot Marquee studio, picutured above, looks out over the heart of Times Square and serves as the primary broadcast setting for *Good Morning America.* (Photo courtesy of Ida Mae Astute/ABC)

By Jeffrey C. Hartnett

It is somehow fitting that ABC chose the "crossroads of the world," Times Square, as the hub for its 26-hour broadcast of worldwide celebrations marking the beginning of the Millennium. And it chose New York's latest attraction, a production studio named, appropriately enough, Times Square Studios Ltd.

Times Square Studios Ltd. (TSSL), is located at 1500 Broadway between 43rd and 44th Streets in the heart of Times Square. With Times Square as its backdrop, this multilevel television production facility serves as the new home of its premier tenant, ABC News' *Good Morning America*, which airs live five days a week. Another ABC News program, *20/20* began broadcasting from TSSL at the end of October.

TSSL will also be available to other ABC and Disney productions, as well as third-party productions. The facility incorporates a number of technical innovations offering an unparalleled level of flexibility.

Walt Disney Studio Operations, with advanced technical support from the Walt Disney Imagineering and

Times Square Studios

Research Group, created this new facility. ABC's Broadcast Operations and Engineering provided additional consultation to the project. Disney Studio Operations awarded Sony Systems Integration Company (SIC) with the task of integrating the broadcast systems into 1500 Broadway providing TSSL with one of the most sophisticated teleproduction studios in the world.

The building looks nothing like its former self, the RKO National Twin Movie Theater. The old theater had fallen into decline and was a perfect setting for the new studios. Construction began in July 1998 and involved rebuilding the entire north side of the building interior from the cellar through the fourth floor, covering 70,000 square feet of space. Over 300 tons of steel were used for the build, which employed 200 construction workers on site at the peak of construction, working two shifts and weekends. The facility opened for business on Sept. 13, 1999, with the inaugural broadcast of ABC News' *Good Morning America*.

From the building's exterior, it is apparent that TSSL is no ordinary production facility. The first thing that catches the eye is the animated light sculpture on the northeast corner of the building's exterior, above and below the second floor studio windows.

Inside, the 47,000 square foot state-of-the-art digital facility spans three floors and includes two studios. A 2400 square-foot street-level studio is currently designed like a restored Times Square subway station. The 4600 square-foot Marquee studio on the second floor serves as the primary broadcast setting of *Good Morning America*. It includes an 855-square-foot Marquee section that's cantilevered 18 feet from the building over the Broadway sidewalk.

Studio features

The studios employ seven Sony BVP-950 12-bit DSP portable and studio cameras. Six of the cameras are either installed on Vinten Quattro four-stage pedestals or used as handhelds. The seventh camera can be used on one of two Vinten Osprey Elite two-stage pedestals or on a Vinten VIN100 tripod.

A Canon J20X Super studio lens is mounted on each pedestal camera along with a Q-TV 14-inch flat screen LCD prompter. Finally, the pedestal cameras are topped off (literally) with National Display Systems 14-inch flat screen LCD monitors with feeds that originate from the video router.

The main second-floor Marquee studio is equipped with a moving-hoist lighting grid system developed by a coventure between Arriflex Corp. and Transtechnik of Holzkirchen, Germany. The PC-based control system operates either with a touchscreen console or a wireless handheld remote. The system consists of 46 grid-mount hoists or lighting bars that can be moved horizontally on travel tracks as well as vertically. Each hoist contains one 50A and seven 20A dimmer circuits. HMI 50A circuits are also scattered throughout the grid. A total of 1000 dimmable circuits is available to the first and second floor stages.

Advanced lighting control is provided by a ETC (Electronic Theatre Control Inc.) Obsession II system. The Lighting Design Group developed and designed the whole system with Production Arts Inc. providing the installation. The dimmer design consists of a ETC SR48AF Sensor rack system with ETCLink and other advanced monitoring features. This system is totally redundant with a dual processor system (DPS), a backup Obsession II control console, ETC network patching, remote video interfaces, remote focus units and a DMX protocol routing matrix. The lighting equipment is housed in its own control room just outside of the Marquee studio.

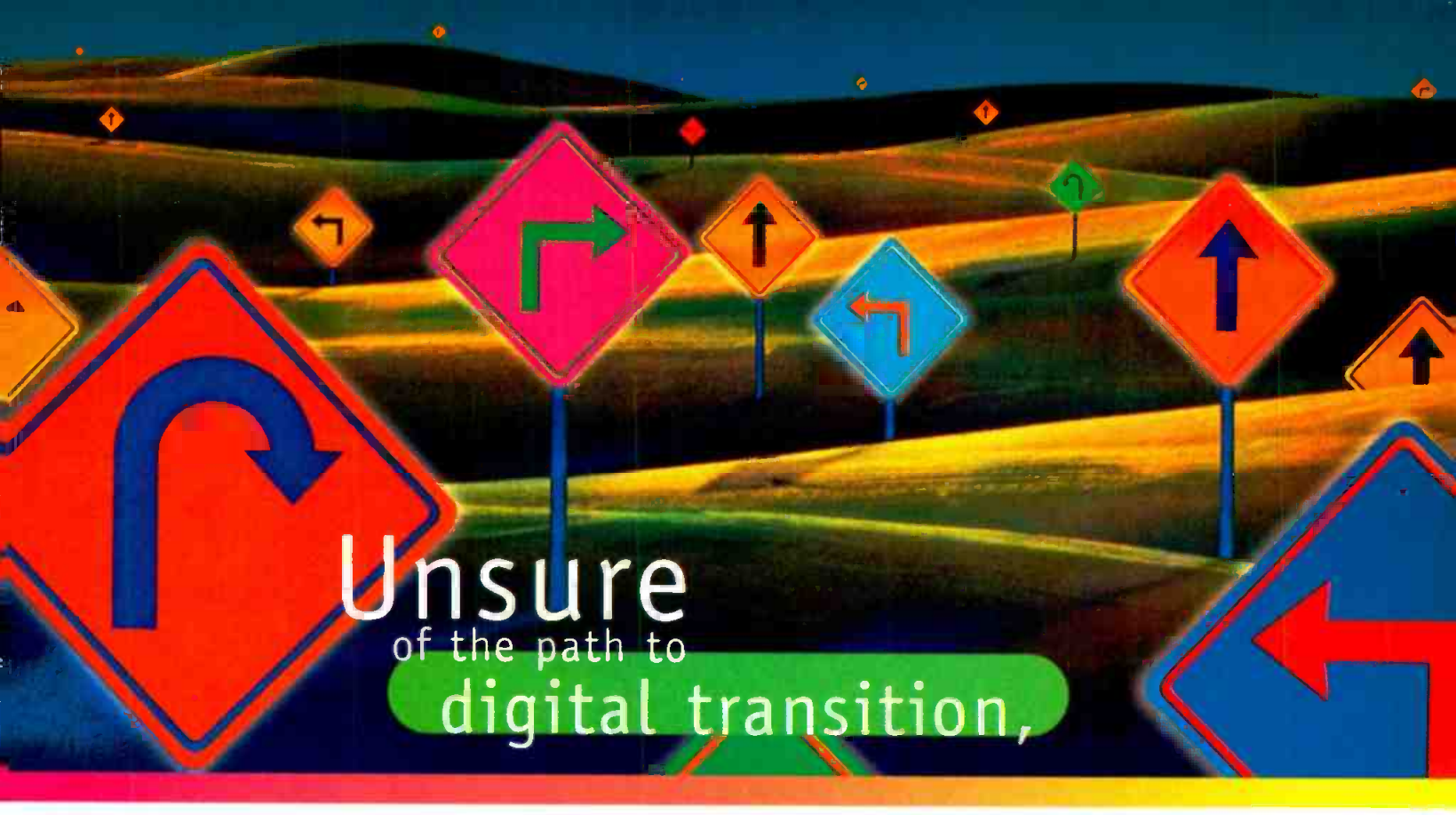
One of the first things a visitor notices upon entering either studio is the crystal clear, spectacular views of Times Square that the unique window walls offer with no glare and no reflections. It soon becomes apparent that the noises from the hectic streets outside are surprisingly absent. Although cabs may be honking, fire trucks screaming and street performers singing, inside all is quiet, with the noise level in the center of the Marquee studio down to NC-25.

Special windows that are composed of the largest anti-reflective coated, multilayered, trapezoidal glass in the world accomplish this. Walt Disney Imagineering provided the design and supervised the installation of these windows.

Another unique aspect of the windows is their roller shade system. Each window has a choice of four roller shades. One shade is for black out, two shades contain neutral density filtering and the last is a proprietary variable density shade.

Early in the project, it was decided that the lighting design should be engineered for a color temperature of 5600 degrees Kelvin, which more closely resembles daylight. This, together

Production staff in *GMA*'s state-of-the-art control room. Over a dozen PC stations, called pods, are situated throughout the production control room and other technical areas. The PCs themselves are located together in the central equipment room. (Photo courtesy of Ida Mae Astute/ABC)



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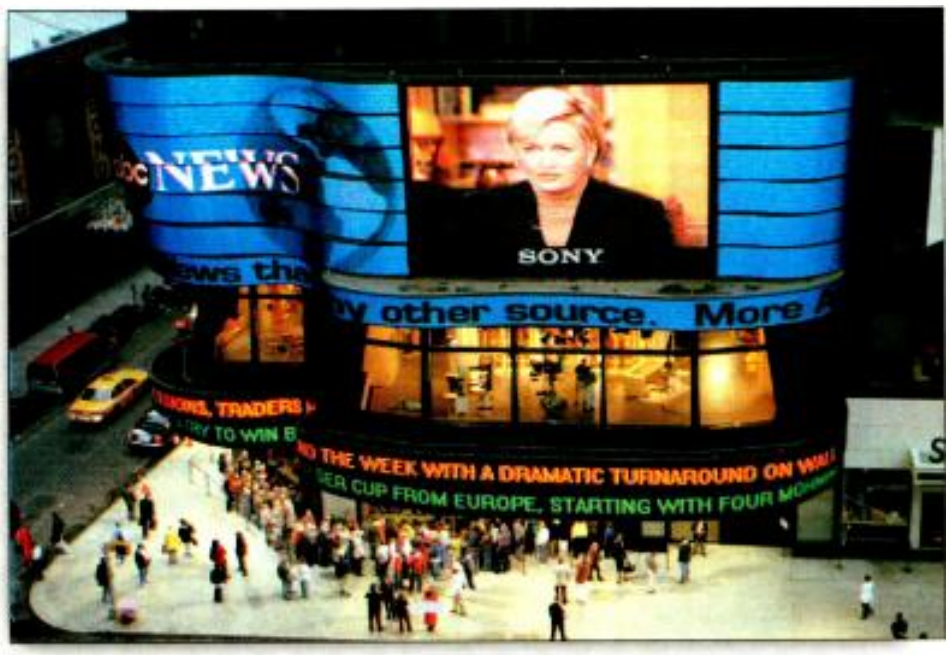
The glass walls in the street level studio have one additional feature. Three of the four window walls can be rolled away, offering a new dynamic to a production by opening up the studio directly to the street. *Good Morning America* has taken advantage of this unique feature. These windows are mounted on an air caster system that requires only two or three people to move each of the seven-ton window walls.

Tremendous attention was paid to the installation of wireless equipment at TSSL. Times Square is located in one of the more challenging parts of Manhattan for RF frequency use. With this in mind, a great deal of time was spent laying out the antenna distribution system for both transmitted and received signals. TSSL uses Sennheiser UHF SK-50 transmitters and EM-3532 receivers for the wireless mics, along with Vega UHF/VHF QX600 RF intercom systems and Lectrosonics T1/R1 IFB systems for talent cueing.



The 855-square-foot Marquee features the Sony JTS-L15 LED display, the largest JumboTron in the U.S. used as an outdoor billboard. (Photo courtesy of Ida Mae Astute/ABC)

Moving signal

TSSL incorporates a digital video infrastructure built around a serial component (360Mb/s), 480i, Sony DVS-V6464B (128x128) series router. A pair of Sony DVS-A3232 (128x128) AES/EBU digital audio routers handles four channels of digital audio. Video monitoring throughout the facility is either digital, analog or both, and almost every video monitor, including viewfinder returns and studio floor monitors, is fed from either a Di-Tech Inc. 5881A/4 (192x192) analog video router or the Sony SDI router. All three routers are tied together via Sony S-Bus to form one large multi-level routing matrix. Two Sony BKPF-R70A controller boards (one as back-up) act as the primary interface to all three routers on the S-Bus network.

To support ABC's programming, one of the more challenging aspects of TSSL's router system design was interfacing it with ABC's large BTS router on Manhattan's upper West Side. The huge ABC matrix needed to be mapped into the TSSL matrix to form one rather large virtual matrix. Using tie line management, an operator can call up a source in one matrix and route it to a destination in another with just a couple of keystrokes.

Fiber and microwave connectivity was installed to make this and other connections with ABC. The ABC fiber installation uses 10BaseT circuits that connect TSSL with the BTS router uptown. Sony uses its BKPF-IF-300 interface as a protocol translator, allowing the two routers to communicate with each other. 100BaseT and RS-422 circuits are also used in the fiber installation. Two 100BaseT circuits are employed to remotely connect the TSSL Sony MAV-1000 digital video server (soon to be a MAV-2000) with ABC. This allows an operator at a filing station uptown at ABC to locally ingest materials, edit them, then stream them downtown to the TSSL MAV-1000 for playout. The MAV-1000 can be set up to automatically record feeds and control VTRs at ABC.

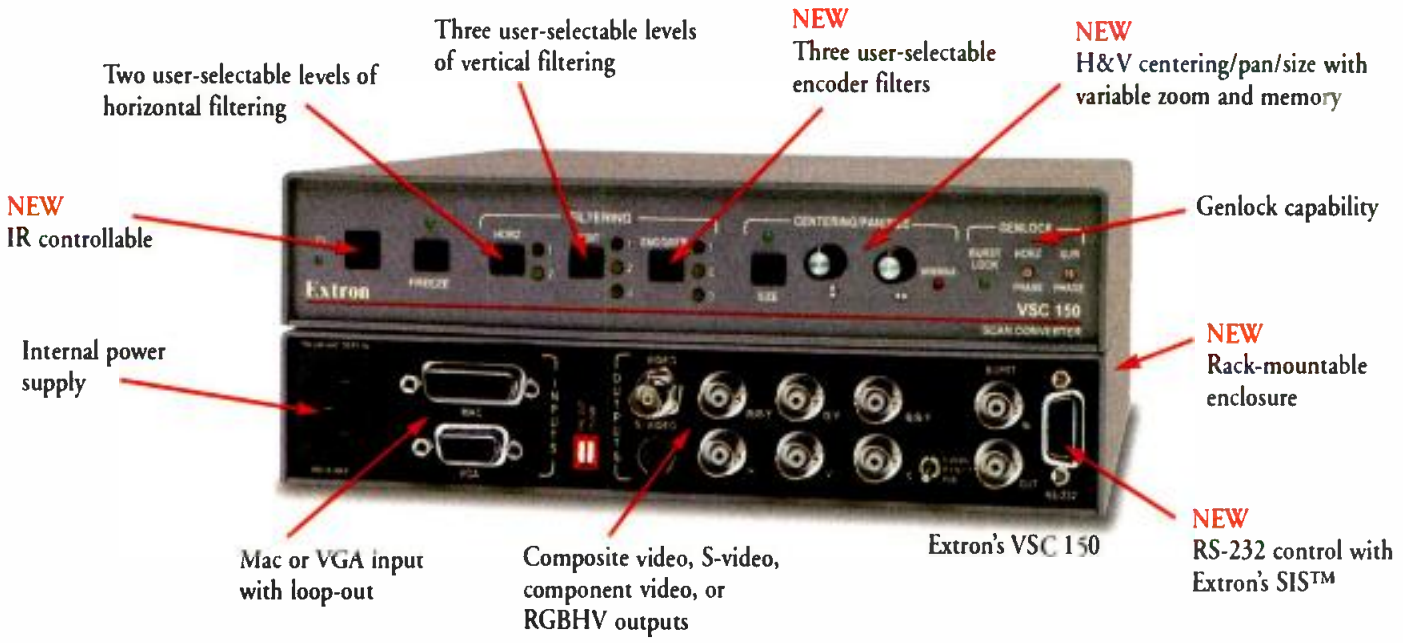
The MAV-1000 has eight I/O channels and four can be used simultaneously for high-resolution playout. At the same time, the facility's high-end Sony DNE-1000 editor could be using the server and a filing station could be ingesting materials. The MAV-1000 works together with a Sony ClipEdit server for low-resolution work with its own RAID arrays.

The DNE-1000 digital editing station is networked into the Sony NewsBase system, allowing shared clips with other workstations. The DNE-1000 is a powerful nonlinear editor which contains more than 400 preset effect patterns, more than 30 background patterns, storage for user-defined effects, and a number of keyers, including a chroma key and a downstream key.

Audio is not forgotten, as there are a wide-range of equalizer and filtering sections, and a built-in 20-channel audio mixer for mixdown to up to four channels. Using the SMPTE 259M spec to full advantage, AES/EBU digital audio is embedded and de-embedded in the SDI tie lines with ABC. On the large AES/EBU Sony router, these audio lines are available to the sound mixers independently and not restricted by changing video routes. This was crucial to the design of the facility, since audio needed to be flexible in handling a variety of applications.

The production control room is built with three tiers of seating areas for production personnel. The rear deck is sectioned off somewhat with sliding glass windows and a separate side door for offline producers. The second tier hosts the technical manager and producers while the lower tier services the technical director, director and assistant director.

The digital video switcher is a 36-input Sony DVS-7350 with three chan-



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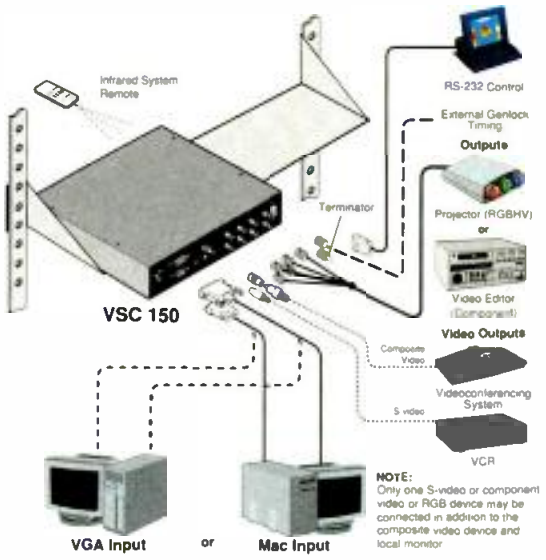

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nels of DME-7000 digital multieffects installed and with wiring in place for a fourth. The DME can be controlled directly at the switcher control panel or by a separate controller to the left of the technical director.

The switcher employs the DMK-7000 digital multikeyer, which provides up to four downstream keys, allowing 10 simultaneous key layers. In keeping with TSSL's design philosophy, the DVS-7350 has a FlexiPad feature that provides recall of wipe and DME-LINK patterns and snapshots. TDs at the studio can remotely control VTRs at ABC through a device called AMACS (made by Vasco Inc.) which, along with an EEG DI422 digital VBI inserter, multiplexes RS-422 control onto a video line. AMACS also allows remote control of the MAV-1000 server and its four playout channels.

Each computer additionally has access to Sony's ClipEdit system. This allows low-resolution browsing and editing of material on the Sony NewsBase video server. A Gigabit switch for acquisition of streaming video on dual RAID arrays allows for streaming via 100BaseT to these cuts-only desktops using the ClipEdit software. Once the editing is completed, the high-resolution version can be conformed and made available almost instantaneously for playout on the MAV-1000 server. Incoming feeds can be viewed and edited as they come in, and rundowns created and reviewed. All users can access the same material at the same time.

The Times Square Studios facility features a Solid State Logic 48-fader Aysis Air digital broadcast console. (Photo courtesy Solid State Logic. Photo by Dave King)

Sound design

Moving to audio, the main mixing room features a Solid State Logic Aysis Air digital mixing desk that can store and recall session settings. The TSSL system includes three 48-input analog RIOs (SSL remote I/O units) and two 48-input digital RIOs. The RIOs take input signals, convert to digital if analog, and serially multiplex them into a digital transport called the SSL Hiway. 10BaseT Ethernet control data also is connected to each RIO. Each of the RIO's is connected to SSL's hub router.

The Aysis Air is set up for four stereo main, eight aux buss and 20 mix/minus outputs. Five Genelec 1031 self-powered monitor loudspeakers provide audio monitoring for surround capability with two Genelec 1031's for close-in PFL/AFL monitoring. During AES' New York convention, Genelec engineers came and tuned the loudspeakers to each room, adjusting them using the built-in circuitry. The audio room contains a variety of signal processing units as well as a Dolby DP569 and DP562 surround sound encoder and decoder, respectively.

Next to the main audio room is the sound editing/sweetening/playback room based on a DigiDesign ProTools 24-bit system and a Sony DMX-E3000 digital audio mixer. A voice-over room looks into the main audio control room and uses a ClearCom AB100 PI. Pro on-air announce control box. Also on the same floor is a secondary audio mix room for live music mixing that employs a Sony MXP-744 series analog console.

TSSL has a large 256-port Telex/RTS Adam intercom matrix housed in a separate communications room along with source assignment panels, four-to-two wire converters, and 24 telco phone auto-couplers and hybrids. The Adam matrix uses the latest version of the Windows-based control software. Other intercom control data and audio from ABC network are sent through the fiber infrastructure so that more Adam matrices are available to TSSL. In addition to the main Adam matrix, TSSL has access to three intercom systems: ABC plant, ABC News master control and the ABC Network Radio matrix. Additional KP-967 control panels at TSSL are used for connections to these other matrices.

Broadcast interface panels are located throughout the facility providing audio, video, triax control, intercom, SSL Hiway, LAN and other connectivity. A mobile truck connection panel, located at street level, provides easy hookup to trucks parked on 44th Street.

Looking towards the future

TSSL is prepared for further DTV growth. The facility can accommodate 16:9 production in most areas, with the cameras needing only an optical block change. The Sony S-Bus master router can easily accommodate the addition of a HD frame. Space for a second control room and its support equipment in the central equipment room have been designed into the facility, making any transition possible.

So it is only fitting that TSSL will be handling the approaching New Year's broadcasts in a large way. It is a unique facility transforming teleproduction in such a way as to redefine the art. From the sculptural ribbon signage and 16:9 JumboTron to the advanced glass window walls, TSSL provides its clients and viewers an unparalleled view of Times Square. Equally as important, the facility supports a tremendous amount of the most current digital technology. Employing design and operational flexibility with connectivity to the world, TSSL is ready for the new Millennium. ■

Jeffrey Hartnett is manager of engineering and technical operations for Times Square Studios Ltd.

Transmission & Distribution

Rethinking transmission lines

BY DON MARKLEY

As we gain more experience in transmission line systems during the DTV growth process, it may be necessary to rethink some past positions. This is particularly true in dealing with the growth of wideband systems using multiplexed antennas where several stations may be combined into one multichannel antenna.

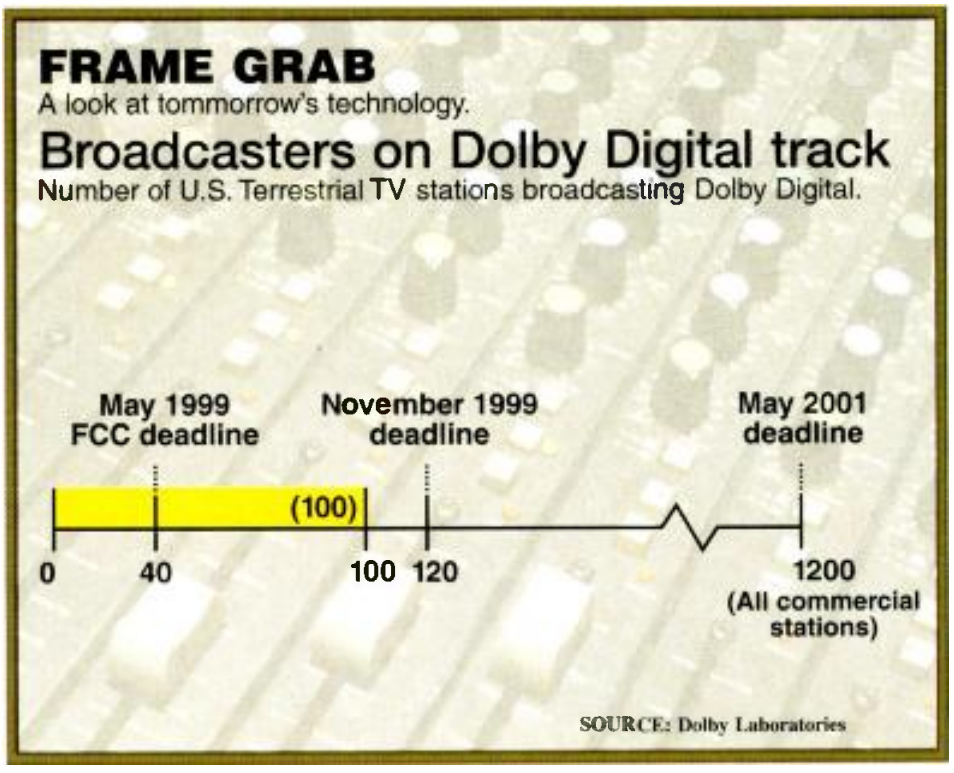
It is always interesting to look at the history of commonly held beliefs. For some reason, it has been a widely held opinion that only rigid transmission line is suitable for television stations. That is usually accompanied by completely ignoring the facts that FM stations have used semi-flexible lines for years and that high-powered television systems in the rest of the world often use such lines. In this country, the feeling has been that each station had to have its own antenna on its own tower and that the only acceptable coaxial transmission line would be rigid, preferably with good old EIA type flanges. Well, it may be time to forget those opinions based on growing system costs as well as performance.

Multichannel systems

With every station needing a second channel, there has been a significant growth in the use of multistation antennas boosted by the cost and difficulty of obtaining more tower space. Sometimes, cost isn't the primary deciding factor. The obstacles encountered in attempting to build new towers can sometimes be overwhelming. Most significant seems to be the zoning battles in which well-meaning but usually ill informed area residents put up stiff fights to prevent their area from being exposed to deadly radiation or the simple existence of another tower. Let's face it, while those of us in the industry find towers inoffensive if not downright attractive, the public doesn't always share that opinion. As to the hazards of nonionizing radiation, most people don't understand the difference between the signals from an antenna and the emanations from a nuclear blast. The bottom line is that the locals tend to fight new towers. Stations must try an alternative approach to building towers.

In using multichannel antennas, the transmission line is called upon to exhibit good performance over two or more channels, often spaced by a significant portion of the band. Rigid line is available which will do exactly that and do it well. Dielectric has had their Digitline available for some time that will work on any channel. Within the past year, Andrew has joined them with a product that promises the same type of performance although the line lengths are selected in a different manner. The purpose of both of those lines is to select line lengths that will eliminate the buildup of errors from flanges between sections. In a line with equal length sections, frequencies will exist where the reflections from the joints become in-phase at the input causing unacceptably high VSWR values. These broadband lines avoid that problem very well and will do the job quite well in the simpler systems.

The problem arises when the installation becomes complex. That refers to those installations in large buildings or on multi-user towers where the transmission line run becomes torturous. As an example, the auxiliary antenna systems in the Sears Building provide standby antenna facilities for all of the UHF stations on the building — both NTSC and DTV. However, to get from the combiners to the antennas, the lines include 16 elbows. Each elbow contributes its own reflections that are not uniform across the entire UHF band. In a conventional system, the number of elbows can often be limited to as few as four and can easily be optimized to handle multiple channels. However, as the number of elbows increases significantly, the optimization problem becomes much more complex. The complexity exceeds that which can be handled even by multiple fine matching sections. A logical solution is a change to semi-flexible lines in such systems.



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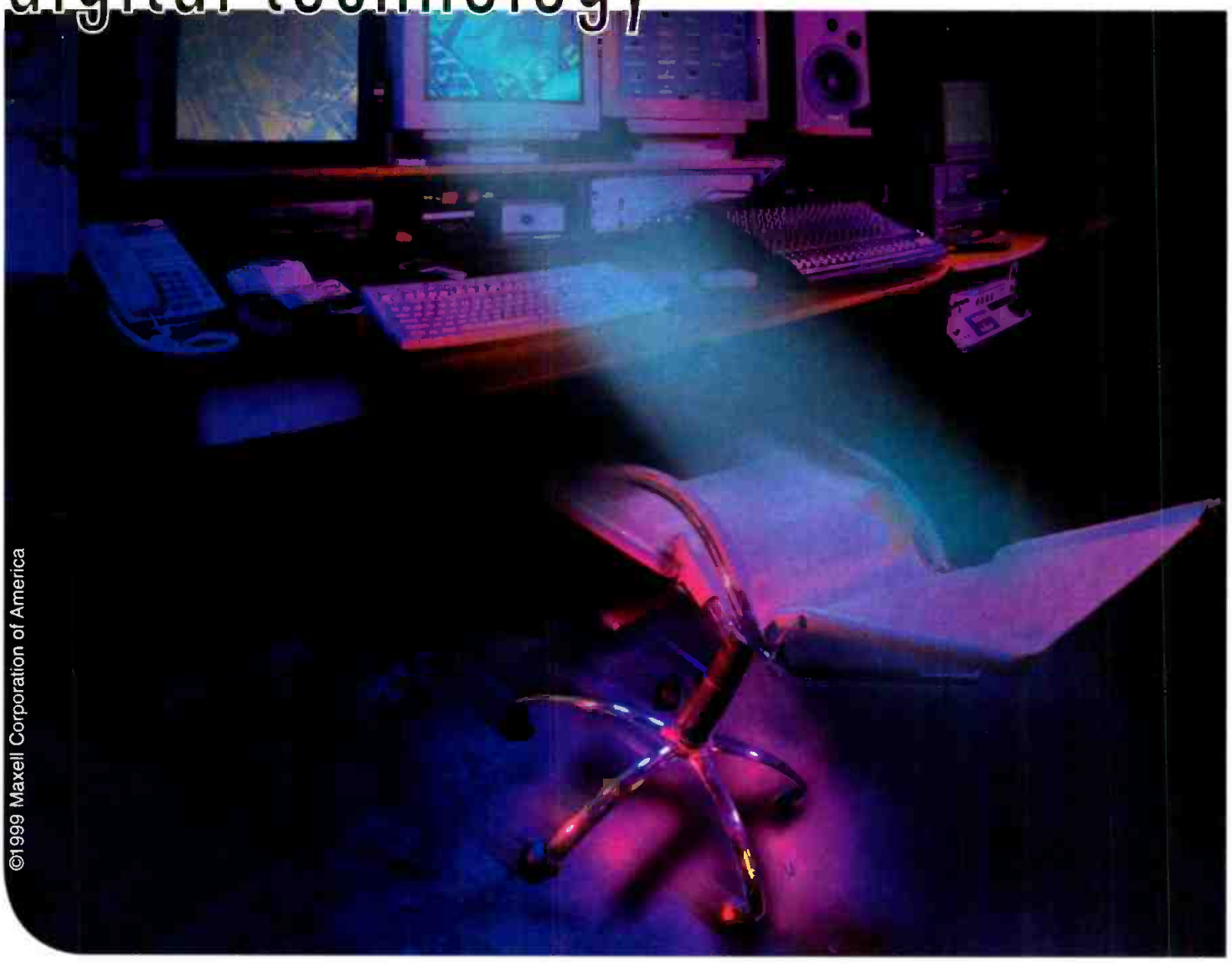

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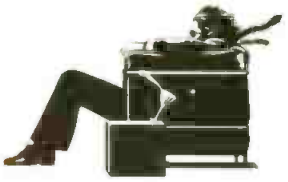

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Rigid line alternatives

The big problem here is the system response over a broad frequency range as opposed to power handling ability. In DTV systems, the power levels are normally low and big lines are primarily used for efficiency. There isn't a major difference in the efficiency of large rigid lines and large semi-flexible lines. However, there is a significant difference in the reflections that occur in those different systems. Semi-flexible lines are inherently broadband devices with the only significant reflections occurring at the input and output. Elbows become necessary only where bends must be made that are tighter than allowable for the cable. Even then, the number of elbows required is significantly fewer and the tuning problem becomes much more workable. The use of semi-flexible lines in such systems can be anticipated to grow as more DTV systems are placed into operation. For single channel systems or for simple multiple channel systems, rigid line is still a good choice and will allow the users to remain warm and comfortable. However, semi-flexible lines may be the preferred system for complex wide-band systems.

Now, on to the big pipes. Waveguide has been the choice *du jour* in many high power stations, especially where the transmission line runs are long. The old reliable version has been simple rectangular waveguide with tuners added as needed. Along with rectangular waveguide, two other types have found a significant amount of use. Dielectric has a double truncated waveguide (DTW) which is easily tunable and exhibits excellent performance. Andrew offers a round waveguide that is usually used only for the vertical run with a transition to rectangular at the top and bottom of the run. Again, this offers excellent service. As of the last NAB, Myat offers an elliptical waveguide that also holds a significant degree of promise in television systems. However, all of those waveguide systems are inherently narrowband in that they are only usable over a relatively small portion of the band. With rectangular or DTW systems, it is a matter of tuning the waveguide itself. For the round waveguide, it is the tuning of the input and output transitions. Andrew now has new tuners available which will allow the use of adjacent channels but not of frequencies separated by several channels. As a result, waveguide systems offer limited applicability in broadband systems although they are great in single or adjacent channel applications.

Rigid transmission line can be used for simple installations that involve relatively few elbows. However, more complex installations may require the use of semi-flexible lines or other alternatives.

There has also been some concern about the problem of group delay in waveguide for DTV use. Bob Plonka of Harris Corp. recently addressed this problem at DTV99 in Chicago. Plonka demonstrated calculated group delay values for the three most common rectangular waveguide sizes. He further showed calculations that clearly indicated a significant degradation in the DTV signal as a result of the introduced group delay. The amount of such degradation could change an excellent DTV signal to one that barely meets minimum requirements. The good news is that the transmitter can correct for the calculated amount of introduced group delay. If you are considering the use of waveguide for a DTV system, it is suggested that you contact Bob at Harris for further information. It would appear that waveguide may still be an excellent choice for DTV due to the high efficiency involved, especially in those cases where the run is long. However, appropriate compensation will need to be made in the transmitter precorrection circuitry.

In summary, for single or adjacent channel systems with a reasonable number of elbows, the use of rigid transmission line is highly suitable. However, in wideband complex systems, a careful look at the alternatives is in order to determine what will work best. ■

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

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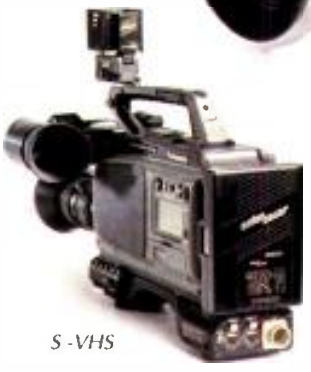

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Digital audio consoles

BY GARY ESKOW

Digital consoles, once the central audio hub for only the most exclusive recording, post-production and broadcast suites, are now available to everyone. Boards can be purchased for as little as a few thousand or as much as $500,000. Still, the essential questions that fuel every business purchase remain the same: what tools do you need to accomplish the tasks your facility handles, and will you be able to profit from your investment?

Digital consoles, such as this AMS Neve Libra Live broadcast production console at CBS's control room #43 at its New York headquarters, must be matched to a facility's needs and budget.

Automation

Automation is the greatest advantage that digital consoles have over analog boards. First offered as a retrofit, automation was so popular that it spawned the development of the digital console.

Digital consoles exist at three price points, with a wide gap separating the most expensive boards from the rest of the pack. How much power you need is often a reflection of the time your engineers have to execute the tasks that are required of them. A small recording studio charging on an hourly or project rate can operate in a more relaxed manner than a broadcast facility. Automating track playback levels but handling equalization and signal processing in real time might work fine in this application. A network broadcast facility has to be able to control multiple audio input sources and digital signal processing much more rapidly. Post-production facilities might have offline rooms that sound designers use to create their work away from clients and an audio room that charges a high hourly rate.

Layering

All digital consoles share certain technical characteristics. Layering is perhaps the most basic of these. Layering allows the manufacturer to reduce the footprint of a board and its cost.

In the analog world there is a one-for-one correlation between the number of audio sources available and the line inputs required (patch bays notwithstanding). This requirement carries over to the digital console realm as well. However, while analog boards need channel strips for each output, digital consoles can use fewer strips by layering. In theory, a digital console having only two fader strips (plus a master section) could access every mono or stereo source patched to it, simply by turning a knob that would page through the input sources. This would require the operator to have a supernatural ability to remember where all of the processing was in order to scroll back and forth through the layers. You must decide how may inputs are needed and how many strips must be available.

Handling Surround Sound

5.1 mixing is the buzz these days. First used to create realistic ambiences in the motion picture world, 5.1 — and even 7.1 — is being experimented with in both the television broadcast and recording industries.

There are huge obstacles to the transmission of Surround Sound, among them the lack of a uniform standards for the equipment that decodes these signals in the home and the placement of speakers. Interviews, for example, do not send the host and subject into separate speakers. The rears are used to create a sense of ambient space only. Though producers are aware of the problems with Surround Sound broadcast, many of them nonetheless want to mix in this format for archival purposes.

Any console that can bus audio across six outputs can legitimately claim to be a Surround Sound board, but they are not all equal. If you need to lay ambiences subtly across your audio field but the busing architecture of your board forces you to choose a single speaker or pair, you won't be able to achieve the effect you desire. On the other hand, if all you need to do is lay crowd noises from an arena across the rears and place an announcer feed into the center speaker, why pay for functionality you don't need?

Digital conversion

The process of converting analog signal into a digital stream that the ear finds acceptable is difficult. In the last few years, however, a great deal of progress has been made. How much should you spend on converters? Use your ears, and know where the audio is going when it leaves your room. Currently, all sound going out on the airwaves is converted back to an analog path, where it runs into interference before reaching the viewer. How much do you want to invest in equipment that lets you work to a higher standard than playback equipment can handle?

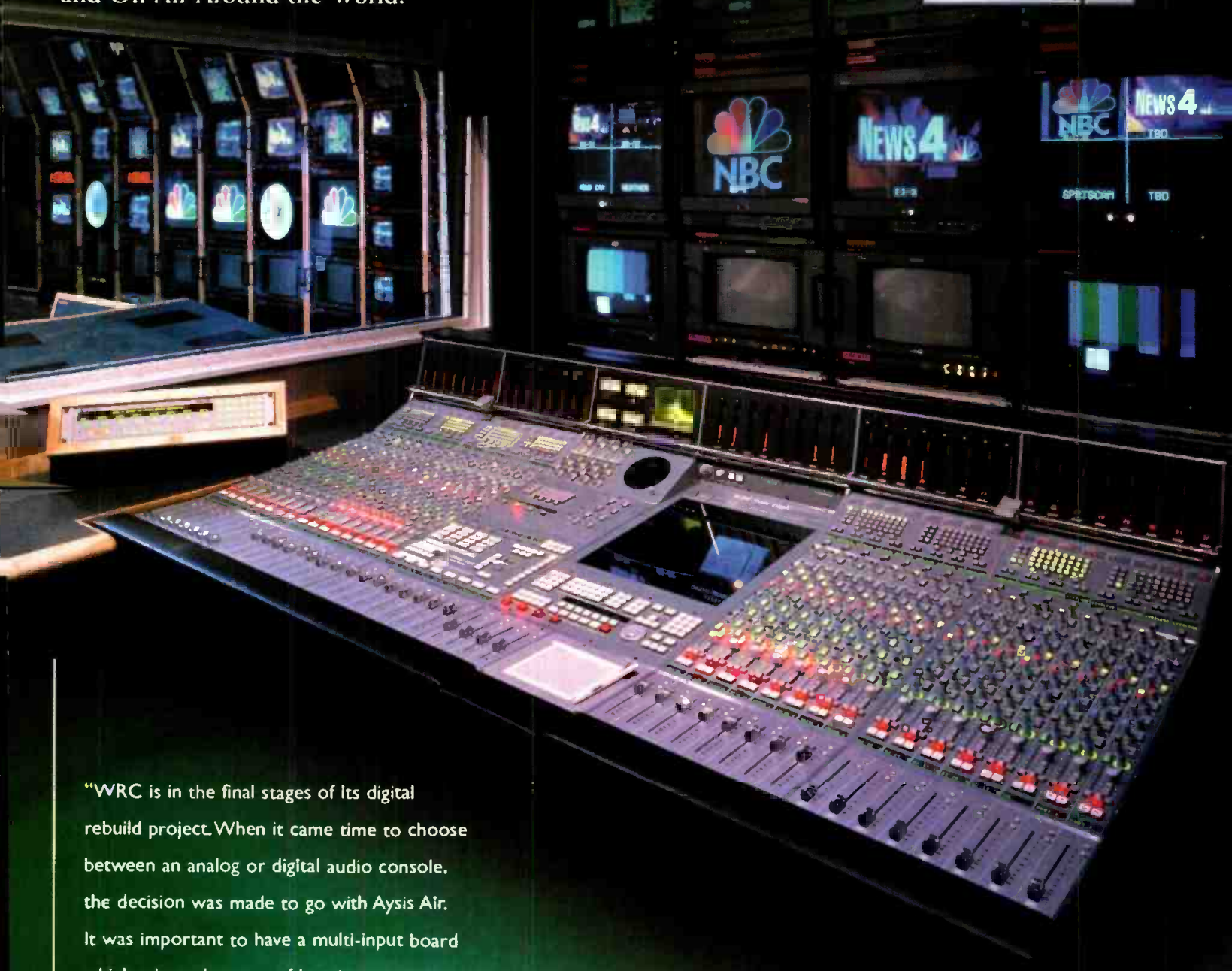
The purchase of a digital board must be tied to a savvy reading of your clients' needs. An understanding of the basic principles should help you hone in on the console that's right for your application. ■

Gary Eskow is a composer and producer who lives in New Jersey.

Born to Broadcast ...

and On Air Around the World.

Aysis air



"WRC is in the final stages of its digital rebuild project. When it came time to choose between an analog or digital audio console, the decision was made to go with Aysis Air. It was important to have a multi-input board which takes advantage of layering to present a more efficient, compact, operating desk to the audio engineers. Because the console is used for multiple productions, the file recall setup attribute became an important feature to help to ensure consistency in our product."

Jerry Agresti, Director of Engineering
NBC 4, WRC TV, Washington, DC

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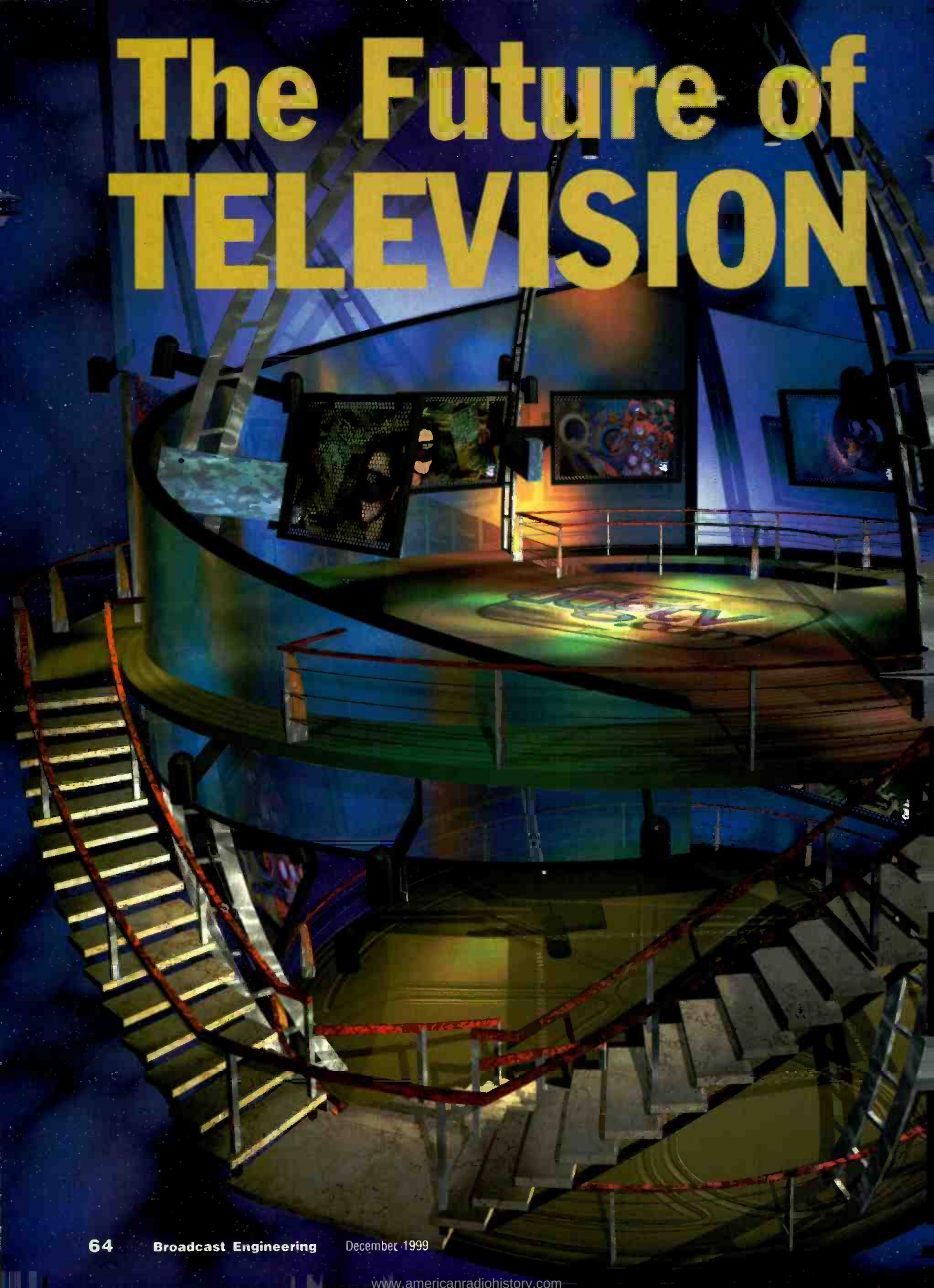
Circle (134) on Free Info Card

The Future of TELEVISION



Predicting the future is always dangerous, especially in the magazine business. Unlike in radio or TV, in the printed world, your predictions live forever. And, if you're later proven wrong, believe me someone will remind you. Despite the dangers, I felt the benefits outweighed the risks, and because *Broadcast Engineering* has a history of providing leadership in the adoption of new technology, we just couldn't renege on that duty.

To help you better understand the upcoming changes, we've assembled 10 well-respected industry experts to look towards the future. Each was asked to address one technological area and discuss what changes might take place in next 10 years. In addition, each was asked to provide guidance to engineers and managers on how to implement the technology that will best position their facilities for tomorrow.

The combined thoughts of these technical gurus will provide a solid base for making decisions on the steps you need to begin making now. You'll learn where the pitfalls are and how to avoid them. You'll learn how to build on the digital platform you may already have in place. Finally, you'll gain an insight on some important, yet not-well-known trends that may help you gain an advantage over the competition.

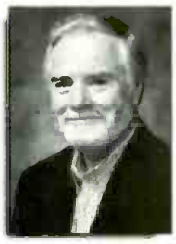
Your guidebook to the coming digital changes is just ahead. Let's compare notes in 2010. One thing I can guarantee is that the winners then will be those who implemented digital technology today.

Brad Dick
Editor

Digital acquisition

Digital cinematography takes center stage

By Laurence J. Thorpe



The past decade has witnessed a dramatic increase in the pace of professional video camera development, both in terms of the complexity of the technologies being used and the rapidly broadening range of applications. With the pace still accelerating, the next 10 years will see even more astounding advances in video cameras. Furthermore, marketplace forces will spawn innovations that will continue to blur the lines between *professional* and *consumer*.

Applications

Broadcasters must search for cameras and camcorders tailored to specific applications. Today, there are application tiers within newsgathering, electronic field production, and in studio and OB production. No searching of technical brochures will yield the requisite wisdom in tailoring the applicability of the new products. That requires practical exploration. The old practice of broadcasters creating "user requirement documents" to help push the state-of-the-art in camera development should return.

The biggest challenge of the next decade will be the management of the dual 16:9 and 4:3 aspect ratio. While 4:3 will continue for quite some time in the analog domain, widescreen will invariably dominate the broadcasting and production landscape in 10 years.

There are no simple answers to this image content dilemma as program material increasingly crosses between the two image formats. Practical experience is of paramount importance in seeking what might work for prime-time shows, news, talk shows, drama, special events and commercials. It can have substantial impact on what cameras might progressively incorporate by way of operational aid. Broadcasters and program producers alike should become aggressively involved in spurring their shooters and creative personnel to grapple with this today, or it will never go away.

The next decade will see a sharp acceleration in the use of digital cinematography. This will, in turn, spur more focused developments to make products specifically tailored to the needs of the cinematographer. Perpetuation of the film vs. video debate will be an anachronism. Those producing television shows should be opening a vigorous dialog with camera and lens manufacturers. Producers will choose between inevitably enhanced film stocks and all that is emerging in digital acquisition, but theirs will be a pragmatic

Sports and entertainment facilities are beginning to see themselves as content providers in a content-hungry world. As such, venues like the Staples Center in Los Angeles are providing fully-capable production environments to make remote broadcasts less of a financial strain on an already taxed broadcast economy. Photo by Concept: Benson and Rice, courtesy Sony.

choice based upon their scripts, storyboards and their individual creative and aesthetic aspirations, and, of course, their budgets.

By 2010, earlier ENG history will have repeated itself in primetime television production: It will be very largely electronic. Technological prowess and lowering cost will make this inevitable. The arrival of the 24p system will speed the transition in the major studios.

Optics

The golden age of the 2/3-inch format has arrived. Now a de facto standard for both SD and HD cameras, this small image format will dominate the scene for the next decade. The cost of lenses, however, will continue to be a major preoccupation, especially as HDTV proliferates. This will keep pressure on the optics manufacturers to produce more cost-effective designs. This will only intensify as competitive pressures usher in an era of HD ENG (certainly something to be anticipated in 10 years time). Lens manufacturers urgently need a closer collaboration with broadcasters and producers to better define the necessary compromises in performance, facilities and costs.

As digital cinematography takes a firmer hold during the next few years and a sizeable high-end production marketplace begins to develop, manufacturers will open a parallel track and turn their design efforts to directly meet the needs of primetime production and of movie making. A second, higher tier of 2/3-inch HD lenses will be needed to address this higher-end marketplace. Program producers and directors of production need to become actively engaged in an ongoing dialog with the optical and television camera manufacturers to help shape the direction digital cinematography will take.

Imagers

There have been striking developments in competition and broadening applications in the fifteen years that the CCD has dominated the professional camera scene. Ten years hence, we can expect as yet undreamed of technological advances, including new alternative sensor technologies.

Broadcasters, producers, videographers and cinematographers have increasingly fallen out of step with the technical pace of CCD imager developments. They still cling to anachronistic methods of assessing and technically evaluating contemporary digital cameras. They need to recognize that continuing their focus on the horsepower race in horizontal limiting resolution tells nothing of the advances in the other crucially important dimensions of overall picture quality. Learning about these and how to evaluate each in the context of taxing real-world scenes, as well as new test charts, is a must for the future. This direct end-user feedback is becoming much more important within an emerging digital era where image quality will become ever more important. Acquisition picture quality within an MPEG world cries out for re-examination by the end-users.

Widescreen will invariably dominate the DTV broadcasting and production landscape in 10 years.

DSP

This will be the fastest moving of all of the camera technologies. Propelled by the most powerful of technologies – digital processing – and aided by Moore's Law in its VLSI physical implementation, astounding advances can be expected. We cross the millennium in a 12-bit A/D era for both HDTV and SDTV alike. The new century will see the inevitable competitive march to higher bit rates.

In 10 years, DSP will have endowed broadcast and production cameras with unheard-of intelligence. Real-time analysis of picture content will facilitate automated adjustments to a variety of picture attributes critical to the capture of high-quality images.

It is this DSP capability that will also see real-time digital imaging move definitively beyond the capabilities of motion picture imaging by 2010.

Systemization

Digital cameras are becoming more powerful both in their operational dexterities and their integration into increasingly sophisticated production systems. This will continue. A new and broadening preoccupation with metadata will spawn system innovations that today are unimagined (see page 69). A great deal of energy has been expended on a "textbook" approach to metadata instead of a much-needed step-by-step exploration. Practical experimentation by broadcasters and program producers in collaboration with professional camera manufacturers is urgently needed to ensure an optimization of the practical implementation of metadata. This needs to start now rather than waiting for the ultimate production of an overly thick and daunting standardization document that might well be ignored.

On an implementation level, the present industry aversion to embracing the fiber optic link between a camera head and its CCU is understandable, but hardly helpful. Triax is ubiquitous and it is extensively installed. Any transition will be painful, but needs to be carefully measured against all that will surely happen during the next decade. While eminently practical and low-cost, triax is an aging analog technology. All of the associated technical travails of the triax communication link are removed with the broadband digital capabilities of today's fiber links, and, new capabilities are enabled. Camera links can potentially carry far more data than their present channels of component video, audio, and control data. Broadcasters and producers should be aggressively exploring with the manufacturers new ways of maximizing this powerful two-way link, especially in OB applications. Combined with metadata, this holds high promise for radically more sophisticated system installations.

Laurence J. Thorpe is vice president of acquisition systems, Sony Electronics' Broadcast and Professional Company, Park Ridge, NJ.

The future of HD production

Post houses must rely on the efficiency of digital

By Chuck Spaulding

Today, the long-awaited arrival of HD production and the looming arrival of data-based production drive the engines of change affecting the post-production industry. These developments are more significant and pose greater challenges than anything that the industry has faced in decades. These new technologies have, in recent years, been evolutionary in nature. The migration from 3/4-inch production to Betacam SP to DigiBeta, for example, was incremental. It represented improvements to existing 601 technology. High definition, because it involves a change in the standards upon which all of the production technologies and methodologies are based, is a revolutionary step. It marks a clear break from the past.

As they prepare to make this break, it would be wise for post houses to re-evaluate their role in the industry; to re-examine the way they have done business in the past; and to question whether that way will continue to serve them well in a future shaped by high definition and data.

Among the questions worth considering are: "If you were going to build a facility today, would you build it the same way you did 15 years ago?" and "What kind of facility can best prosper in a world where HD and data production are not the exception but the norm?"

Before attempting to answer those questions, it's worth examining the state of the industry today. It's no secret that at many facilities profit margins are slim, perhaps in single digits. In fact, judging by the recent number of bankruptcies and closures, it's clear that more than a few facilities are not making a profit at all.

One reason for poor profits is that facilities today have no way of differentiating themselves from one another. A facility might spend $5 million on its infrastructure. Yet, on any given day, an artist could resign, set up shop down the street and compete on par with his former employer. The new "boutique" could very well produce images about as good about as fast as the old "factory" at a fraction of the investment.

In most industries, bigger is better. General Motors can build cars faster and more cheaply than a guy working in his garage. It enjoys economies of scale. But in the post industry, being bigger can be a detriment. As a post house grows bigger it does not necessarily work faster or better, it just has more rooms. A larger facility has higher overhead than a smaller house without gaining any significant competitive advantage. This model inevitably drives profits down.

Another drag on profits is the rigid structure of most post houses. A facility with, again, $5 million in infrastructure might be set up to handle 10 projects simultaneously. If, then, it finds itself with more than 10 projects in-house, it has a production bottleneck. If it has less than 10 projects, it has empty rooms. Such a facility cannot easily scale up to meet rising demand, or scale back to lower overhead when demand sags. It may wind up selling its services at a discount simply to keep its rooms full.

What does all this have to do with high definition? Everything. Because in the world of HD, the pressures on post house profitability grow larger.

First, HD production requires post-production facilities to undergo an extensive recapitalization. High definition is a discontinuous innovation — few of the tools employed in SD production can be applied to this new standard. Post facilities therefore have to buy a whole new set of tools, tools that cost significantly more than the tools they are replacing.

With profits already low, it's not clear where the money to pay for all this expensive new gear will come from. Clients have already indicated that they are willing, at best, to share the costs associated with the transition to high definition.

Moreover, HD production is intensely demanding of technological and artistic resources. In this respect, HD production more closely resembles film production than SD video production. Imagine, for example, color correcting a beauty shot for a car commercial. Working in standard definition, you might notice a muddy reflection in a hubcap. Viewing the same shot in high

Tomorrow's post houses must be prepared to employ all the advantages digital has to offer, including it's robust capacity for sound. Studio A at Post Logic Studios in Hollywood features a 72-input Solid State Logic 6000G mixing console and an Avid Audio Vision workstation. Photo courtesy Spelling Communications.

HD production more closely resembles film production than SD video production.

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An effective model for HD production, one that enables facilities to operate profitably, must be one that allows facilities to enjoy economies of scale. The bigger a facility grows, the more it invests in infrastructure, the more efficient it becomes. It is able to turn out images faster and better than smaller rivals. This model would also allow new resources to be quickly and easily added to meet rising demand or for overhead to be reduced when demand slacks. This would give facilities the ability to control their costs. This model would also be easily reconfigurable so that, for example, a facility involved in color correcting for commercials by day could be working on film mastering and digital restoration at night. This would allow facilities to go after new revenue streams rather than engaging in a ferocious competition with one another over for a bigger piece of a small pie.

Is such a new production model a pipe dream?

No. What is needed to make this new model a reality is simply to take full advantage of existing data technologies, develop a small number of new technologies and, primarily, to apply a new way of thinking about how post production should work. Today, most facilities consist of a number of rooms, each centering on one very expensive system that empowers one artist to do one thing. These rooms are serially connected to one another. In contrast, the new data-based model would feature a collaborative work environment, with many more, but far less expensive, workstations empowering many more, but by-and-large less highly paid, artists. These workstations would be connected in parallel so that all would have simultaneous access to data. Under this model, new resources could be easily added at relatively small cost with each new resource adding to the overall efficiency of the "factory" environment. Bigger would be better. In addition, it would no longer be easy for a single artist to strike out on his own and compete with his former boss. A facility's resources could also be easily repurposed to differing kinds of projects. This model not only provides a means for facilities to manage the enormous data storage and manipulation demands incumbent to high definition and data production, it allows them to do so profitably.

The technological hurdles to implementing such a model are few. A far bigger challenge involves changing a mindset ingrained through decades of working in the 601 production model. It's not easy to teach an old dog new tricks, but for facilities that want to survive and prosper in the future world of high definition and data, it's one trick they would do well to master.

Chuck Spaulding is president of Postware.

Metadata in the new millennium

The growth of metadata will drive television

By Chuck Fuller

Few would argue that over the next 10 years, television is poised to undergo dramatic transformations in capture, production, delivery, and consumption. While many technologies, infrastructure changes, and consumer paradigms will affect these transformations, it is the advent of metadata (data about the content) that will have the biggest impact and enable the deepest, most central changes in the medium. Metadata acts like a card catalog in a library, unlocking the wealth of information in digital media content. Metadata extraction, application and exploitation are the keys to leveraging all of the other changes on the horizon. Without metadata, TV will remain TV, regardless of changes in the plumbing.

At the end of this transformation, which will be complete and stabilized by the year 2010, we will see content capture and production processes that are completely digital. Distribution will also be completely digital and will consist of a hybrid of airwave, cable, satellite and

The changes of the next decade will most greatly affect locally produced programs such as the news. Stations like Q13 will shift nearly every aspect of producion, from configuring its news studio for 16:9 to changing the way its content is archived. Photo courtesy Sparling.

Internet delivery mechanisms that are the endgame of convergence. Consumer devices in the home will exhibit dramatic increases in fidelity, flexibility and friendliness. Such statements are perhaps obvious; however, what is not obvious are the specific changes, mechanisms and features making up this future television environment. A close inspection of the definition, role and capabilities of metadata in this converged world is the key to providing insight into those specifics.

Metadata, data about data, is the key to increasing the value of a station's arch finding new purposes for previously acquired content. It will allow stations like K Seattle to see significant savings in the cost of production and archive maintenance. courtesy Sparling.

Metadata explained

Metadata falls into two major categories: Automatic information extraction and manually added information.

Automatic information extraction is index information derived automatically by signal analysis algorithms, such as keyframe storyboards, CC-text/Teletext extraction, speech recognition, speaker identification, face recognition, optical character recognition, etc. Manually added information is value-added information applied by humans as part of the production process, including e-commerce tags, hyperlinks, editorial descriptions, keywords drawn from controlled vocabularies, rights management information, version management information, etc.

Automatic metadata extraction processes will continue to advance and will include automated narrative segmentation, content summarization, object recognition and hierarchical derivative-content mapping. Value-added information will benefit from improved metadata standards, system-level awareness and use of metadata, as well as enhanced metadata packaging and transport mechanisms such as MPEG-4 and MPEG-7.

Metadata will become central to the production and value chain of video, from the camera to the consumer. This trend is already occurring, and can be seen in the feature sets of digital cameras, the industry focus on digital media asset management systems, and the emergence of searchable video on the Web. As the decade progresses, metadata extraction will move closer to the lens (see page 66), and metadata exploitation will move closer to the consumer.

Metadata increases the value of content throughout its life cycle, lowers the cost of production and archive maintenance, and significantly enhances the end-user experience by providing a "pull" metaphor with deep personalization. While the information elite will embrace this kind of personalized pointcasting and active engagement, broadcasting itself will continue to dominate the infrastructure. However, intelligent agents that can perform the personalized "pull" on behalf of the consumer, filtering through thousands of broadcast channels to create a surfable number of personalized channels, will enhance the viewing experience — a change not possible without end-to-end metadata.

Metadata will become central to the production and value chain of video, from the camera to the consumer.

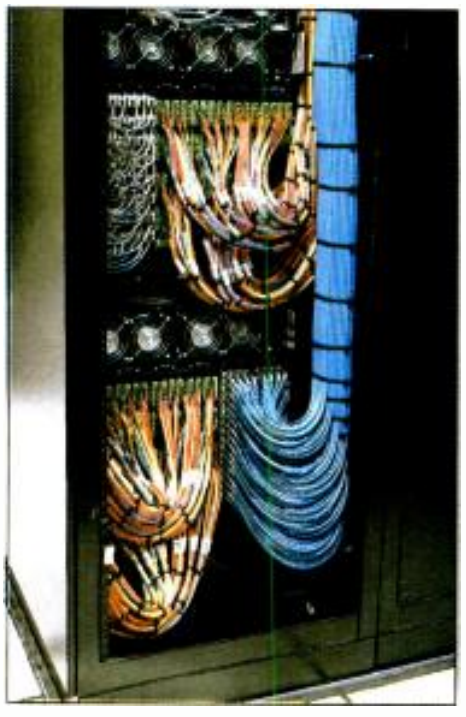
The future of television

Advances in metadata technology and the proliferation of its use in the content life cycle will drive the future of television. The key areas to watch:

- Metadata extraction moves closer to the lens: Digital cameras today capture various information about the capture process, including 'takes', time-stamps, GPS information and annotations entered by the camera operator. In the future, full-featured metadata extraction processing (including keyframes, speech, personality identification, etc.) will be part of the output of the camera, packaged in an MPEG-7 transport, and fed into the production process.
- Metadata use enhances the production process: Broadcasters will need to manage an ever increasing number of information sources, distribution channels and competitors, while at the same time dramatically reducing production costs. In this environment, being able to automatically access, edit and air digital content is mandatory. Metadata, with its ability to help journalists and producers immediately locate and manage content, holds the key to broadcasting efficiently in the 21st century.
- Metadata drives the archive: Content that is forked off to an archive (during and after production) is well prepared for the application of library-science techniques which enable long-term storage and retrieval. Assets that are not carefully indexed with metadata will be lost in the petabytes of archived content. Ready access to archived content will enable new revenue opportunities.

• Metadata provides deep personalization: Metadata offers fine-grained search and browse on demand to active information consumers, enabling efficient and accurate pull of content. Metadata also provides the necessary handles for agent-based filtering that can dynamically learn consumer preferences and interests. Intelligent agents thus maintain the passive viewing experience, but with far more targeted and interesting content. Advertising and commerce opportunities will exploit content associations and personal profiles, all within the privacy of the set-top box.

• Video-on-demand is realized at the fringes of the distribution infrastructure: Technological advancements in mass storage will continue unabated during the decade, producing multiterabyte storage devices at commodity prices. The digital VCR will converge with the set-top box housing multiple channel tuners and intelligent agent software. Thousands of hours of high-fidelity preferred content will be constantly available for searching and surfing. Metadata will stream down to the set-top along with the digital media, where it will be analyzed and compared to interest profiles. Conditional-access content will be encrypted and stored locally where it can be unlocked instantaneously. VOD will become a reality, not with massive head-end servers and fiber-to-the-home, but with highly distributed, personalized storage devices. Head-end video servers, coupled with IP-multicast mechanisms to alleviate bandwidth bottlenecks, will only be needed for live content distribution.



Today's facilities route a variety of signals, everyt hing from 601 to Internet data. Photo courtesy Technical Industries.

Regardless of the specifics you envision for the future of television, the industry changes during the next decade will surely astound us. Excepting the inventions of television and radio themselves, metadata promises to enable features and capabilities that are unrivaled in the history of the industry.

Chuck Fuller is a co-founder of Virage Inc.

Tomorrow's newsroom

Everything you need is available today

By David Schleifer

Almost everything you need to build the newsroom of the future is available today. The problem is in trying to get it all to work together.

Even making it all work together is the first challenge of integration. Just making sure that there are industry standard formats that can deliver compatibility between acquisition, editing and playback has been a struggle. The second and perhaps more important challenge is to deliver on the kind of integration that truly gives broadcasters choices and delivers new functionality and flexibility in the process or workflow.

Improving newsroom workflow

Integration directly affects workflow, and workflow determines how quickly, cost effectively and efficiently the job is done. Some elements of the job the newsroom is challenged with today are very different from the challenges of a few years ago, while others have remained constant. A constant is the need to process information, to add value to pictures and sound and to do it in the most cost-effective manner possible. A new factor is the need to squeeze more efficiency out of the process while leveraging the same information to many promising, and in some cases unproven, new outlets, like the Internet or HDTV. In facing these new challenges stations need to re-examine workflow. It would be simple if you could put an Internet publishing button on a tape deck, let several people edit from the same tape at the same time, or automatically track metadata from the field to playback and archiving on paper. Unfortunately this requires several new areas of integration.

The process of creating news easily breaks down into four general areas: acquisition, production, playback and archiving. All of these areas must be linked together. The material acquired must easily flow to the production systems. While newsroom computer systems already manage this by bringing in wire services or allowing remote dialup for reporters, the process of managing pictures and sound is not as efficient. DVCPRO and MPEG allow for compatibility, but that is just the first step. In the production cycle, systems must reduce the number of errors by eliminating retyping of information and other manual steps. Moving a video ID from a rundown into a nonlinear editor, and then onto the playback server is a clear example of this. New tools to manage the data online are also needed. Just being nonlinear is not enough; you need to find, sift, sort and use your material easily and quickly. Can you find out what clips have been used in a story, what alternate clips you might have from an interview to refresh your piece, how many stories use a particular sound bite, and can your editors all have access to the information and the media? These are important tools in today's competitive news environment.

In addition, integration must consider an Internet strategy. Users often say that the Internet is critical to their success, but that it must be free — free in the sense that it does not overly burden their efforts to get shows on the air. News production systems will have to meet that challenge. Systems will need to make it easy to repurpose and deliver both new and old content to new channels. Over time, the process of delivering news to the Internet and to the antenna will merge into one process.

David Schleifer is manager of Broadcast Field Marketing for Avid Technology.

Broadcast's digital tomorrow

Analog is dying — long live digital.

By John Luff

As the last decade of the century comes to a close it is clear that we face a growing swell of change in the technology that provides the infrastructure of our business. The changes in the next decade will be just as astounding as those we have seen in the 1990s. The last decade has brought video servers, practical high-quality CCD cameras, flat-screen displays, video servers, digital transmission to the home, practical HDTV production tools and a host of other stunning developments.

In the past we have often thought of single-purposed devices and how to connect them in a string to make the path between the camera and receiver transparent. With analog technology and full-bandwidth digital systems, we strive to get a perfect rendition of the signal to the other end of the pipe. As compressed signals become a dominant theme, as indeed they already have in VTRs and many transmission systems, we need to think more clearly about what we are trying to achieve and how to best apply the available bits in an efficient network. In planning NTSC systems, I placed myself at the signal source looking towards the destination, ultimately the home. Today I find it more illuminating to look backwards from the final destination, back into the system, and think about what signals need to be delivered to the device in order for it to do its job. For instance, an ATSC encoder needs video, AC-3 audio, PSIP, closed-captioning data and, potentially, other streams to assemble a useful broadcast.

There is a convergence occurring among the underlying technologies in consumer electronics and professional broadcast electronics. Any of us old enough to remember what "H L" stood for on the side of a portable camera realize that consumer camcorders produce pictures and sound superior to those from the state-of-the-art broadcast camera scarcely 20 years ago. Now we see DV consumer recorders from many manufacturers that share concepts and even actual hardware (codecs) with serious professional camcorders. Compression hardware that began in teleconferencing has migrated upscale to broadcast, and is now moving downscale to the Internet and other uses. As the bandwidth of wired paths to the home increases, the importance of ubiquitously available compression will continue to increase.

The linear push model of entertainment television has begun to crumble.

New engineers

In viewing the history of broadcast engineers, we might say we were the "fix-its" in a facility, without whom nothing kept running for long. However, today's electronics are highly reliable and increasingly repairable only at the subassembly level. Moreover, we once administered a complex web of interconnected pieces and made hundreds of adjustments using waveform monitors and vectorscopes. We needed to adjust NTSC signal timing to a precision of better than 5ns — not a simple task. Now digital switchers time themselves, and signal equalization is automatic up to the point where a digital signal simply disappears. Most importantly we are now becoming network managers in complex local area networks of interconnected systems controlled and monitored by computers.

In the next 10 years, we will see the death of analog systems.

In the next 10 years, we will see the death of the ubiquitous linear media video recorder in production and air operations, and the rise of HDTV to the role of predominant media. Consumer electronics will continue to penetrate the edges of our universe, and may well show up in ways that eliminate the blurry lines separating professional and consumer electronics today. Test equipment will broaden to allow tests on compressed streams to provide meaningful qualitative judgements to be made.

I do not want to ignore the most important change in our industry. The linear push model of entertainment television has begun to crumble. Our role as technologists is to provide a conduit. As programs change in form, as in news delivered 24 hours a day via the Web or other low bit-rate pipes, we must change our view of what technology must provide to our colleagues who build the business case that supports our enterprise. We have a legitimate role as technical evangelists to explain what technology can do and to use our creative energy to facilitate their dreams. When Michael Fuchs began the experiment that became HBO, few understood how fundamentally satellite transmission would revise our technical world. Digital technology gives us new tools to craft incredible systems for serving the "public interest, convenience and necessity."

John Luff is president of Synergistic Technologies, Canonsburg, PA.

Automating test and measurement

Electronic "eyes" will oversee your signal.

By Mark Everett

Estimating where this industry will be in the next 10 years is a tall order, and reducing the subject down to test and measurement is even harder. Furthermore, to limit the scope of this article, I have purposely avoided the inclusion of MPEG and ATSC testing — both of which are important, and both of which may be evaluated in their compressed state and in their reconstructed state.

One thing is fairly certain, the traditional XY deflected CRT display will be a thing for museums. We probably will have devices with a similar appearance, but they will most likely be VGA tubes or high-resolution, high-speed flat panels with progressively scanned displays rather than the continuous line CRT display of the last half of a century. Other primary changes to test and measurement will be the implementation of devices that discover, repair and report deviations from established requirements. Video production and transmission facilities will continue to have very high standards for signal quality, and they will have all sorts of difficulties finding and funding personnel who are capable of recognizing and solving signal quality problems. Further, to limit the scope of this article, I have purposely avoided the inclusion of MPEG and ATSC testing – both of which are important, and both of which may be evaluated in their compressed state and in their reconstructed state.

Evaluation

The types of devices used will work in the originating digital format (the production digital format – AES/EBU, 601, 1080i and the like), rather than in analog origination format or the transmission format (AC-3, MPEG, ATSC, etc.). Monitoring nodes or probes that will be placed in every originating path and these devices will report to a central monitoring, alarm, repair and reporting station. Products that are now available can scan, evaluate and modify live video in real time on a pixel-by-pixel basis. Data can be collected against any number of time clocks (GPS, timecode, etc.) and data can include metadata identification or similar embedded IDs to accurately control the specific information and log. A fair amount of work is in process now to lay the framework to imbed such information in original video information.

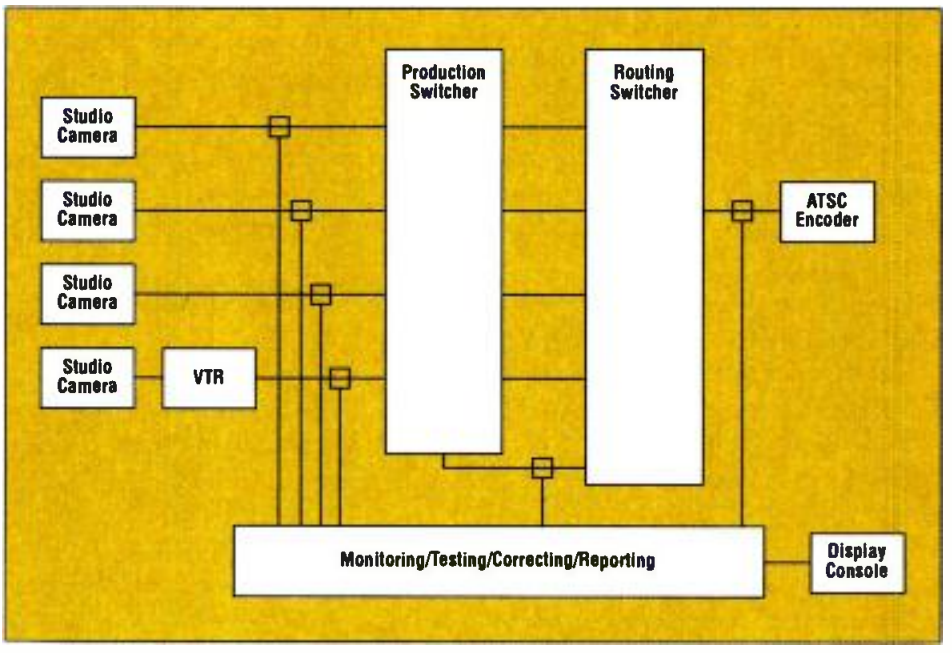


Figure 1. Automated monitoring, testing and correction makes the handling of today's digital signals much easier.

The next challenge is to develop well-defined signal profiles established to assist in judging video levels, color intensities, hues, audio levels, equalizations and similar attributes. These profiles will have to be adaptable to sports, rock concerts, movies, cartoons, news, situation comedies and the list goes on. Imagine a movie such as "Dick Tracy" with the dramatic use of specific saturated colors. This represents at least one challenge to the type of profiles to which the system must adapt.

Profiling

So, with that part of the concept understood, the next step is to apply the profile to material in real time, and to report any variances to a master control point — machine, not human. The master control point will, based on other guiding profiles and response parameters, apply corrections to the offending signal. Histograms will be developed and corrections will be issued based on continual input from the sensor. Certain signal parameters are easy, but many, such as content issues – a frozen frame, when the video should be moving, or film dirt or scratches are more challenging to capture. Algorithms can be developed and data can be evaluated against those and many other requirements.

Repair

The next function is to repair the fault. Here, again, the profiles and histograms are used to develop adjustment parameters to repair the fault. It is possible that not all faults can be repaired, but even missing picture information can be developed based on the same prediction concepts as used in MPEG. Fault repair is a necessary step as algorithms can respond more quickly and accurately than can operators, and many faults on the pixel level, will probably be missed by operators. Certain functions, such as scratch repair, noise elimination and color limiting, are common today and can also be included in the type of real-time corrections applied to all video.

Reporting

A fourth function will be logging and reporting all of these faults and the corresponding actions based on time stamps, sources, scene information, extracted metadata and other available information. From this information, engineers and managers will be

able to review and evaluate actions, review processed video often and apply the resulting information to improved functional algorithms. A natural extension of this logging and reporting is at least some recorded history and presentation of the fault and the applied correction. Expect to see high-speed Internet connections available for real-time expert intervention — let the chief engineer view it, check it and adjust it at home via his PC. While some of this functionality is present today, higher speed interconnections and higher speed processors of the future will dissolve the limitations of the current approaches.

The future of test and measurement is led by a few truths. We will have fewer qualified technical operators and engineers available to perform routine functions. Digital and compressed digital formats will all but eliminate transmission and storage-based signal degradation. Humans will continue to disrupt the best efforts of automatic controls. The wrong program material will be selected for presentation. Key equipment will fail at the most inopportune time. All of these factors lead to the necessity of automated evaluation, reporting and correction — a necessity that future test and measurement equipment will have to address.

Mark Everett is vice president, Advanced Technology for Videotek, Inc.

Digital and HDTV in 2010

Will HD ever fly?

By David Mercer

How far away is 2010? In the Internet era, some would argue that it might as well be 2100 if we are trying to predict what the world will be like. The pace of development in consumer technologies has accelerated so much in recent years that the crystal ball can seem more hazy than ever.

Our own research suggests that consumers are dissatisfied with what television has to offer today, but that they believe strongly that it will improve in the years to come. When asked to indicate how their time allocation will change, out of a selection of around 20 common household activities, consumers choose "watching television" as the activity which they expect will see the steepest decline in the coming years. At the same time they are looking forward to some of the technical innovations that will improve the television experience. Innovations that will improve digital television, flat panel displays and DVD all attract high levels of interest.

Nobody disputes the idea that digital would make much better use of that scarce resource we know as broadcast spectrum. What is debatable, however, is how we move from where we are today to where we want to be. Unfortunately for the U.S. as well as most other countries, the perceived wisdom has rested on the idea that analog television can be migrated to digital television simply through the process of introducing the new technology and expecting consumers to upgrade. Real-life experience is beginning to demonstrate that it's not that simple.

No plan

The U.S. DTV transition plan has been developed on the premise that terrestrial networks will gradually introduce HD programming and transmissions into their regular schedules. However, this is not obligatory within the FCC guidelines, and broadcasters are divided on the best way to proceed. Those that have started HD transmissions are effectively delivering to a nonexistent audience, and therefore unable to begin recouping costs. Others remain convinced that their digital capacity is best used for several SD channels and/or data services.

But the big mistake for the digital terrestrial TV strategy has been to ignore the competition. DBS satellite service providers such as DirecTV and Echostar have already persuaded 11 percent of homes to go digital. Digital cable services are now in around 4 percent of homes. By 2005 we expect 55 percent of U.S. households to have digital TV via either satellite or cable.

Satellite operators have introduced HDTV and cable is being forced, albeit slowly, to follow suit. The U.S. is one of the few places in the world where we expect a significant market for large-screen HDTV to develop. The evidence suggests that there are already one million consumers each year who spend an average $2000 on TV sets with 40-inch to 70-inch dis-

News facilities, such as the CNN newstand production facility, should prepare to repurpose and deliver video to the Internet. Photo courtesy Technical Industries.

plays. If these consumers are willing to spend this much on TV sets relying on today's NTSC standard, they would surely spend similar amounts, if not more, on HDTV sets. In fact, the arrival of HD should boost demand for TV sets of this size, as there are probably potential customers who have delayed buying a set because of the relatively poor quality offered by rear-projection display technology relying on NTSC.

Sophisticated edit rooms like this one at WCW allow facilities to be both more efficient and provide better quality content. Photo courtesy Technical Industries.

Market size

So, unlike some analysts who maintain that high definition has no future at all, we believe there is potential for a niche market to develop. The only question is how big is that niche? Today around 7 percent of U.S. homes own a TV with a display 40 inches or larger. High definition could conceivably increase this level perhaps to 15 or 20 percent. But if it is going to reach more people than this, we believe that HD sets of 40 inches or more will need to cost less than $1000. While new display technologies will continue to emerge, there is, as of yet, nothing on the horizon that makes this conceivable. Remember that the average price of a TV set today is $340. HDTV must compete in this context.

The set-top box will remain dominant for many years because the easiest way for consumers to access new services (and for service providers to build an audience) is to upgrade existing TV sets. The last thing consumers want is to spend thousands of dollars on a new TV set only to have it become obsolete within a couple of years when the next new service is launched. The TV set will continue on its path towards becoming essentially a "dumb monitor" to which one or more devices are attached.

The problems associated with ATSC have been well discussed, and the pressure to revise the standard is likely to prove overwhelming. While ATSC's technical weaknesses clearly need to be resolved, we also believe the opportunity should be taken to step back from the whole approach to the digital transition and reconsider the strategy. Terrestrial broadcasting operates in a highly competitive environment, and its capacity limitations mean that it can never offer direct competition with either satellite or cable delivery. In the not-too-distant future a fourth medium will begin to make an impact — Internet delivery of video services. Broadband Internet is not a viable competitor today, but technological enhancements are rapid and it will not be long before it starts to compete with today's television market.

Remember that the average price of a TV set today is $340. HDTV must compete in this context.

New features

Finally, consumers will soon begin to see a wide range of enhancements to their TV services, ranging from content-related features such as background information and viewer-direction, to full-fledged Internet-type services like e-mail and Internet surfing.

Something to watch out for in particular is local storage: STBs with built-in hard disk drives will make a major impact on how television is perceived. The progress of interactive television will be fragmented, since it will be supported by a range of different STBs and service providers, but its future is now assured, if only because today's TV companies know they must move in this direction to survive.

In 10 years' time, it is likely that:

- A high proportion of the households will have access to SD digital signals from satellite and cable operators;
- High definition will have a niche position within this market;
- A growing number of viewers will also be using Internet-based subscription video services;
- Many households will still own TV sets which are dependent on terrestrial analog signals, and a significant number of households — probably 20 percent or more — will still be entirely dependent on analog over-the-air TV; and,
- Interactive TV will be widespread in various forms.

One thing is certain: television will have to adapt to an Internet world or face a period of continued decline.

David Mercer senior analyst for Strategy Analytics, Newton, MA.

Tomorrow's television displays

What will your screen look like?

By Joe Kane

After years of anticipation, HD imaging is upon us. Though we have had a seemingly endless amount of time to ramp up on HD display devices, only a few companies have come forward with products that do a good job of displaying HD images.

The accommodation of higher scan rates is a new science relative to mass-market TV sets. Most manufacturers have been slow to learn the requirements of video in order to accommodate high definition, including the right colors of red, green and blue. In practice they are doing little more than adapting existing NTSC technology. There is little recognition of the fact that if a set will properly accommodate the retrace time of 1080i, covering 720p is essentially free.

Displaying true HD images requires resolution, color and luminance capability. These parameters are mutually exclusive unless you are willing to pay a lot of money. Light output goes down as resolution goes up or as we approach the correct colors of red, green and blue in a CRT. How low does the light output get? Fifteen-foot Lamberts for one brand of 27-inch professional HD monitor with the wrong colors and five-foot Lamberts for another with the right colors. If a professional tries to increase the light output he will find most of the detail missing. One would argue that a 27-inch monitor is not large enough. Certainly a five or six-foot wide image is needed to do justice to true HD video.

Direct view CRT technology is limited in size, resolution and light output. Fixed array light valves are limited in resolution and contrast in the blacks. For the time being, real picture quality is only available from a nine-inch, electromagnetically focused CRT projector, of which there are three brands. You can expect 10-foot Lamberts off of a high-quality five-foot screen from these projectors. Light will go down as image area is increased. At least one of those three brands will probably show a true 1920x1080, but only at a reduced light output. By the way, rear screen technology has come forward in quality to successfully compete with the best of front screens.

What chance is there of HDTV becoming attractive to the average consumer, let alone the broadcaster?

If displaying HDTV is expensive and probably will continue to be that way for the next 10 years, what chance is there of HDTV becoming attractive to the average consumer, let alone the broadcaster? The probability is great if set manufacturers change the way they build sets. They are being forced in that direction by fixed array display devices, but have yet to make the connection with CRT technology. Any signal received by a fixed array must be converted to the display's size before it can be shown. If applied to CRT displays, this approach could produce far better looking pictures at about the same price as today's TV set.

CRT displays can produce as much as 40 percent more light output when driven with a progressive signal as opposed to an interlaced signal. Larger sets will require more than 480 active lines to produce the best possible picture. A 13-inch set might be good at 480 lines while a 27-inch set might require 600 lines. If the converters needed for the fixed array displays were attached to CRT displays, the set itself could do the best job its size would allow. A larger set would do a better job, creating a step-up market with greater rewards in picture quality, partially because of HDTV as a source. More important, these sets become universal — saleable anywhere in the world.

The future of all imaging is in displays running at their own best rate. High-quality scan rate converters are beginning to appear at costs that would fit into consumer-priced TV sets. While the highest-quality sets will continue to be expensive, consumers can expect to see new, lower-cost options soon.

Joe Kane is CEO of Joe Kane Productions, Hollywood.

In facilities like CNN in Atlanta, acquisition, production, playback and archiving must all be linked together. Material from this newsstand, one of 27 Avid stations, must easily flow to the production systems. Photo courtesy Technical Industries.

TV's business model

Can TV survive the digital revolution?

By Stephen Turpin, Jr.

Monumental decisions are being made about the future of the television industry, not the least of which is how the current business model should evolve to meet the changing environment. With fierce competition from cable, the Internet eroding station viewership and the continuing issues regarding programming costs and availability, broadcasters are beginning to realize their future will rely on a very different type of business approach. But as we head into the next century, what will that new approach be? More importantly, what are the elements that will influence it?

It is evident that the TV business model of the future will move towards narrowcasting. We have become a more segmented society in terms of lifestyles and values, and this has resulted in television having to meet the entertainment needs of a variety of segmented audiences. Consequently, broadcasters will migrate to narrowcasting as we enter the new century, and with this significant trend will come a whole new set of challenges.

Casting about

Multicasting will create opportunities for additional revenue streams by leveraging digital transmission capabilities. This new technology will increase the amount of data that can be transmitted by allowing the current single channel to be split into four new ones. As a result, broadcasters will be able to transmit four times the programming on one signal. With 10 stations in any given market, SDTV can potentially create 40 new channels.

One of the fundamental advantages of multiple channel offerings is its ability to air prepaid block programming while at the same time airing traditional programming. Because most local programming takes place during non-prime time hours, stations additional channels to fill during the day will have the ability to generate up to four streams of revenue in the same time segment. Ultimately, this will help to cover the additional costs of going digital.

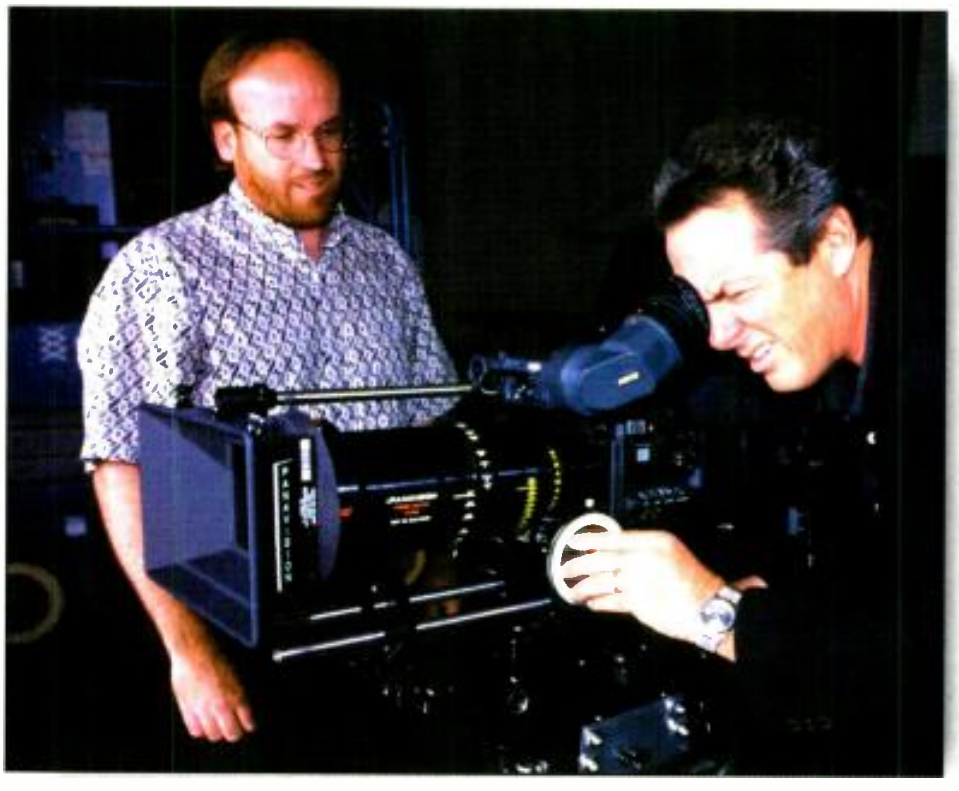
Expenditures in 2001 should total almost $38 billion, or 8 percent above the 1998 level.

Additionally, multicast programming can play an important role in filling the increasing demand for narrow or focused programming for specific audiences. A good example might be a local PBS affiliate narrowcasting programming into schools. At any given hour "Bill Nye the Science Guy," "Nova," a foreign language lesson and a history documentary could all be broadcast simultaneously to reach specific school-age groups.

Because multicast programming fits well into the trend toward narrowcasting, it has the potential to be a strong revenue source, and positively serve the marketplace. Of course all of this is academic if stations do not begin to make the commitment both financially and operationally to transition to digital. Therein lies the next challenge.

Going digital

It's apparent the federally mandated conversion to digital TV by the year 2006 will have a significant financial and operation impact on large and small stations alike. Today's estimated conversion costs at $5 million, a station worth $20 million faces some real challenges. To survive the transition, the first and most important step will be to implement a thorough evaluation of the station's current business and financial situation. Because the transition period may take up to five years (or more), and with conversion



HD cameras, like the Sony HD700 above, allow directors to produce film quality programming at 1/4 typical production costs. Photo courtesy Sony.

requiring significant up-front capital and unpredictable return on investment, broadcasters must start preparing for the inevitable negative impact on near-term cash flow.

Leveraging significant advertising revenue opportunities like the Salt Lake City Winter Olympics and the 2000 presidential election is one way to help bridge the conversion costs. Stations should also be trimming excess operating expenses to free up additional cash flow and monitor any non-essential capital expenditures. In addition to helping improve cash flow, these efforts will have a positive effect on stations' ability to finance conversion costs.

The positive economic environment and its impact in terms of generating advertising revenue in the near-term will also play an important role in offsetting conversion costs. It is projected that during the next two years TV ad revenue should continue to increase, with a record $44.5 billion being spent in 2001. On an after-inflation adjustment basis, expenditures in 2001 should total almost $38 billion, or eight percent above the 1998 level.

Out of the box

Although this short-term revenue picture is encouraging, it's imperative that broadcasters consider other new ways of generating future profits, especially from non-broadcast revenue sources. One strong option is datacasting. Even without all the answers in place, datacasting looks to hold great potential for stations. Broadcasters could capitalize on these growing trends by selling unused spectrum during off-peak hours, or even provides complete end-to-end data delivery solutions.

While these are exciting and challenging times for our industry, we have the opportunity to not just survive but thrive in what will continue to be a competitive marketplace. To do so we must adapt, prepare for and utilize the digital revolution, and embrace a new business model that may be narrower in its focus, but broad in its return.

Stephen Turpin, Jr. is vice president of the Communications/Entertainment Group of The CIT Group/Equipment Financing.

The Internet future

Is the Internet an opportunity or an opponent?

By Michael Wellings

Not so long ago most broadcasters had very little knowledge, understanding, or even interest in an network of computers. After all, the World Wide Web has only been in existence for eight years. In 1991, there were only 700,000 or so registeredInternet "hosts." Now, the number is 56 million – a figure double that of two years ago. Much has changed in broadcast technology during those same eight years. We have witnessed the development of the multilevel, multiresolution MPEG-2 specification, and the implementation of digital broadcasting and production in various formats. Digital techniques are reshaping the landscape as we watch our fundamentally analog world being converted to ones and zeros. What does this mean for the future as true convergence overtakes the entertainment/media delivery system? As more and more content is digitized, analog transmission systems will become digital and, most likely, connect to a future version of the Internet.

With digital technology heating up acquisition and transmission, it follows that the Internet will become more interesting as a potential pipeline for media delivery and archival storage (see www.washington.edu/researchtv for an example of this trend). Since we are shooting, recording and editing digital, why not deliver in digital format directly to the end-user, converting to analog only at the endpoint? DTV and IBOC-FM (in-band, on-channel digital FM) are the first steps in this direction. In television the revolution will begin in earnest when broadcasters realize that they are originating 20Mb/s of multiplexed data, not just video. As the Internet grows in speed and reach, and television and radio stations become true data broadcasters, an Internet presence becomes all the more important.

The first "cyber-station" went online at INTEROP '94 in Las Vegas (www.zdevents.com/interop), followed shortly thereafter by FM stations KUGS, WXYC, and WJHK. Today, broadcasters are among the most connected businesses in the country, with more radio and television stations going online everyday. E-mail, websites and streaming media are common themes spread across the industry. Although few stations would wish to return to the glory days of the teletype and of film cans delivered by mail, few believe that Internet delivery will replace the high-powered transmitters we have learned to love.

The commodity Internet struggles to keep up with demand. At the time the Internet was commercialized in 1995, its backbone pathways ran at a mere 45Mb/s. Large enterprises were typically connected at T-1 rate (DS-1, or 1.544Mb/s). Most were crawling along at the snail's pace of 56Kb/s. Home users connect at 28.8Kb/s or worse. Remember waiting 30 minutes for that movie trailer to download, only to watch it in a 1-inch by 2-inch window on your computer screen? This low data bandwidth available to the consumer results in disappointingly poor, postage-stamp sized images – and only after seemingly infinite download intervals. But the picture is improving. Major network service providers are making huge investments in their Internet backbones. For example, AT&T just announced that due to burgeoning demand, it is accelerating its backbone upgrade from 2.4Gb/s to 10Gb/s in six months. Major enterprises routinely connect at DS-3 rates (45Mb/s), or in rare cases even faster. A small but growing number of home users can take advantage of DSL, which ranges to hundreds of kilobits per second or cable modems (tens of megabits per second). There are now well-known companies that base their entire product line on network streaming media tools (Real Networks, for example).

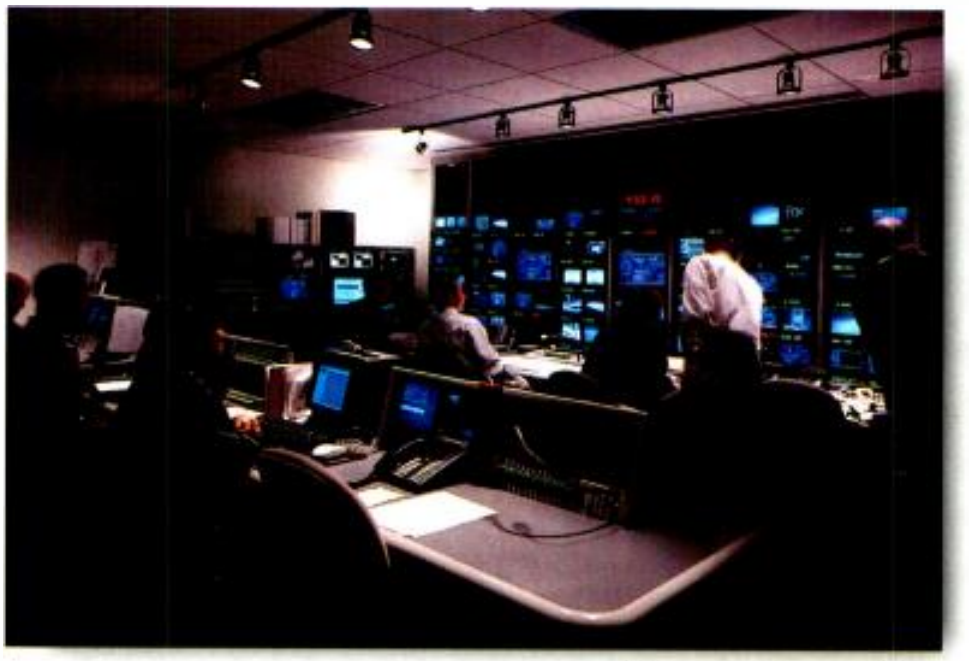
Even these changes leave us with an Internet that is woefully inadequate for handling serious, high-quality video. Technology can only take us so far when the basic network creeps along at such a dismal rate. This will not always be the case. Quickly and quietly, with few outside the network developer community realizing it, the network bandwidth is growing by orders of magnitude, and this could mean big changes for the broadcast industry. Internet2 is a reality

(see www.Internet2.org). Internet2 sites can connect to this high-speed backbone at OC12 (622Mb/s) rates today and OC48 (2.4Gb/s) connections are expected sometime next year, with development pushing this out to OC192 (10Gb/s).

Internet2 member institutions such as the University of Washington in Seattle are in the business of pushing network development along by stressing OC12 and OC48 routers, Gigabit switches, and Gigabit Ethernet interfaces. In October of this year UW, in support of the ResearchTV consortium, and in partnership with Sony Corporation, demonstrated that it is possible to transmit HDTV (at 1080i rate) over Internet2 using Internet protocol (IP) and Gigabit Ethernet interfaces (see www.washington.edu/hdtv for history and full detail).

The October demonstration was transmitted at two data rates: 40Mb/s MPEG-2 DVB-ASI, and Sony HDCAM 143Mb/s embedded in an SDTI transport data stream of over 200Mb/s. This traffic was carried over Internet2 between Stanford University and the University of Washington. Demonstrations such as these are important in that they stress the high-speed Abilene Internet2 backbone (see www.abilene.iu.edu/index.cgi for the network map and data traffic information), pushing hardware and software development along that will bring the reality of Gigabit Ethernet to the "commodity Internet."

The ability to transmit SDTI rate HDTV and the somewhat slower DVB-ASI via an IP-based network has some future implications in video transmission methods. Satellite modems and digital microwave links are no longer the biggest or fastest data pipeline. As Internet data rates ramp up, IP over Gigabit Ethernet could become the best, and most reliable, long distance form of video transmission. The convergence of broadcasting and computing could well make IP transmission a viable alternative (or addition) to the suite of data pathways into our homes. Most of us have experienced the uglier side of video-on-demand as we have stood in line to demand the latest video, only to find that the rental store is fresh out. Imagine true video-on-demand as the two-hour, HD movie we ordered is delivered at MPEG-2 rate over Gigabit Ethernet in less than three minutes. Just enough time to make the sandwiches. Those old SD films would show up on the home media server almost as fast as they were selected. While scaling video server and Internet capacity to achieve this vision will take a few years, the potential for using the Internet transport technology in other aspects of the broadcast industry is right around the corner.



In addition to tradition programming, television will be looked to for content-related features like background information and viewer-direction, as well as full-fledged Internet-type services like e-mail. By building out with this in mind, facilities like the Staples Center are a step ahead. Photo by Concept: Benson and Rice, courtesy Sony.

What does the future really hold for broadcasting? Will high-powered transmitters go the way of the dinosaur, becoming fodder for wild tales told to the young? I won't go so far as to predict the demise of electromagnetic waves as the preferred method of television delivery. RF has its place, even in the future of high-speed networking. There will always be those who are out of reach of optical fiber or coax, but the Internet is already being extended via broadcast and other wireless technologies.

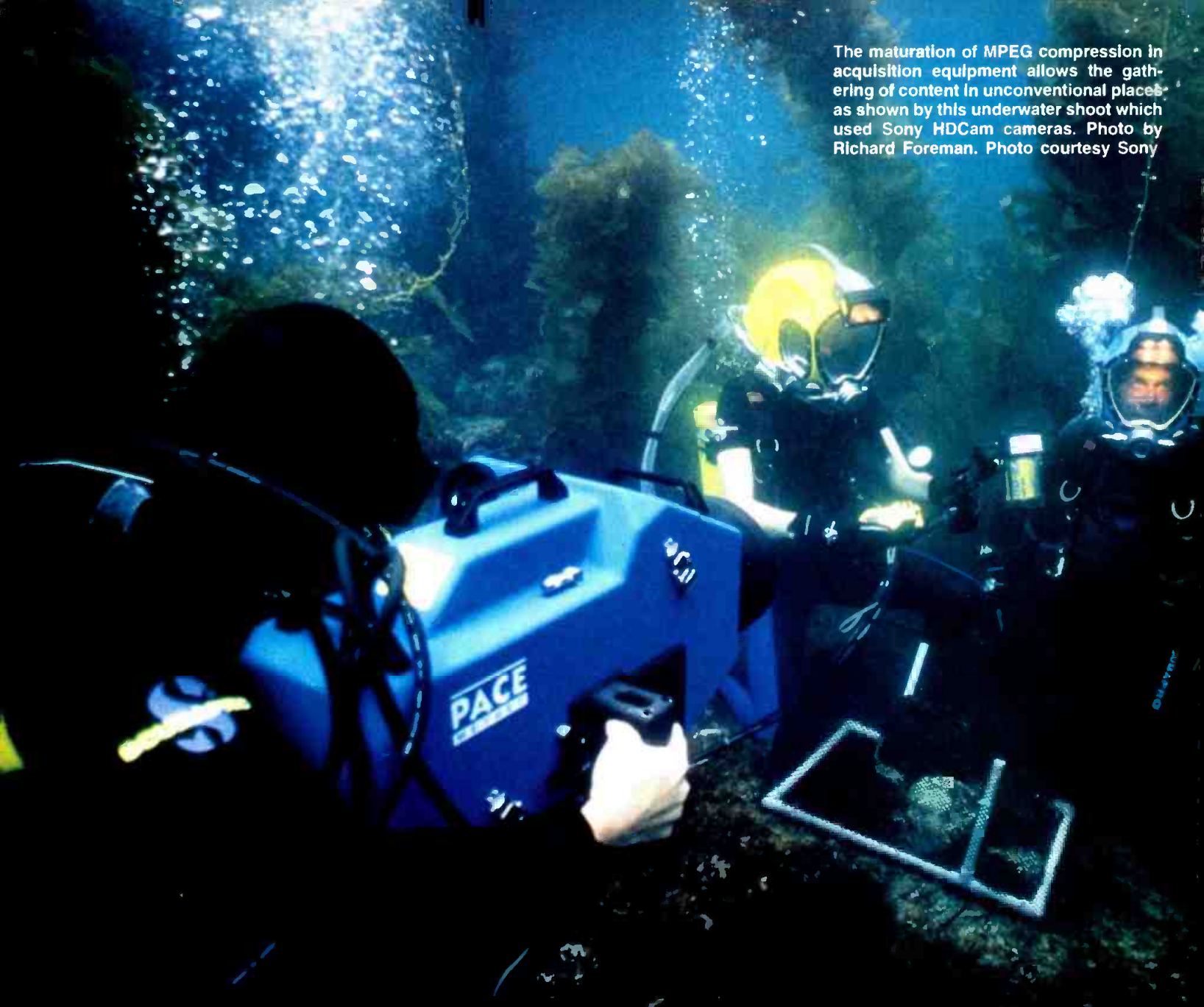
The focus of broadcasters may well expand to include the Internet as a primary form of communication as the penetration of digital video overtakes analog. Television and radio networks are well positioned to implement new services to follow the higher network speeds that will surely come. Internet delivery of HDTV and SDTV on demand and multicast, Web-based online archival storage of historical footage, multiple-market presence for major market stations, Internet-delivered contribution and live production feeds are some of the possibilities. Broadcasters could become narrowcasters — targeting specific content to those who wish it. Some of these services are being developed today by those institutions that are part of Internet2.

In the future, RF transmission could well be reserved for mobile applications (communication/computing devices in cars, trains, airplanes, hovercraft, spaceships, and pockets). Users in fixed locations will utilize a suite of connected pathways (both wired and wireless) to access data at speeds geared to the application. Our mail, video, news, music and personal communication will come into our lives via the least expensive and/or the fastest means. Hardware will seamlessly switch connection methods depending upon what is available. When we must leave the fiber jack in the wall and become mobile, we'll suffer through the slower RF forms of communication, never to be isolated from the information that drives our day.

What is the future of broadcasting? However it turns out, broadcasting and high-speed networking will certainly be linked. As it matures, data networking will become the giant of content delivery and acquisition. It is still not too late to become the first broadcast-quality, Internet-delivered TV station. ■

Terence E. Gray, PhD served as network data reference for this article.

Michael Wellings is the chief engineer for Video and Television Technologies at the University of Washington.



The maturation of MPEG compression in acquisition equipment allows the gathering of content in unconventional places as shown by this underwater shoot which used Sony HDCam cameras. Photo by Richard Foreman. Photo courtesy Sony

Testing MPEG compressed signals

By Michael Robin

Distribution and processing of composite analog video signals is characterized by less than ideal performance in terms of linear distortions, non-linear distortions and noise. These video-signal impairments result in reduced reproduced picture quality. One way to judge the reproduced picture quality is subjectively by observing the picture on a picture monitor. Various international bodies have developed subjective picture-quality grading criteria, resulting in the CCIR five-level video quality assessment method.

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Testing MPEG compressed signals

Signal impairments

Objective equipment performance measurements use standardized waveforms. These waveforms are tailored to contain frequency domain components that are best suited for measuring specific types of impairments. Traditional analog-video distribution architectures are fairly well understood and the test methodologies for these systems have been highly refined. CCIR Recommendation 567 is the source of video testing methodologies for composite analog television signals. Figure 1 details the three types of video signal impairments; linear distortions, non-linear distortions and noise, which affect the performance of analog composite systems. The analysis of signal quality using a set of test signals is an indirect measurement. This is because the test is outside the actual picture. There is, however, a known close relationship between the test signal distortions and the related picture impairments.

The analog signal impairments of different elements making up a video distribution system, such as video DAs, switchers, VTRs, the STL and the transmitter are additive. As a consequence, large systems, consisting of a number of elements connected in a typical operational or signal distribution configuration may result in less than satisfactory overall performance. Knowledge of the distortions introduced by each piece of equipment allows the calculation of overall system performance. Overall distortions in a large system can be kept under control by specifying and using high quality equipment with low signal distortions. Specifying equipment performance is, however, insufficient. The performance of each device in a system has to be verified prior to purchase to determine whether it meets its specifications. Following installation, a complete system test must be carried out to determine that the overall performance meets established performance targets. Periodic tests are also carried-out to confirm that the system behaves as installed. Over the years, two types of video-testing philosophies have evolved:

- Out-of-service tests: In-depth tests such as those done during equipment development and in system evaluation laboratories. These tests use full-field test signals.
- In-service tests: Operational tests that use vertical interval test signals (VITs).

These tests can be accomplished using specialized test signal generators and oscilloscopes or automated test equipment.

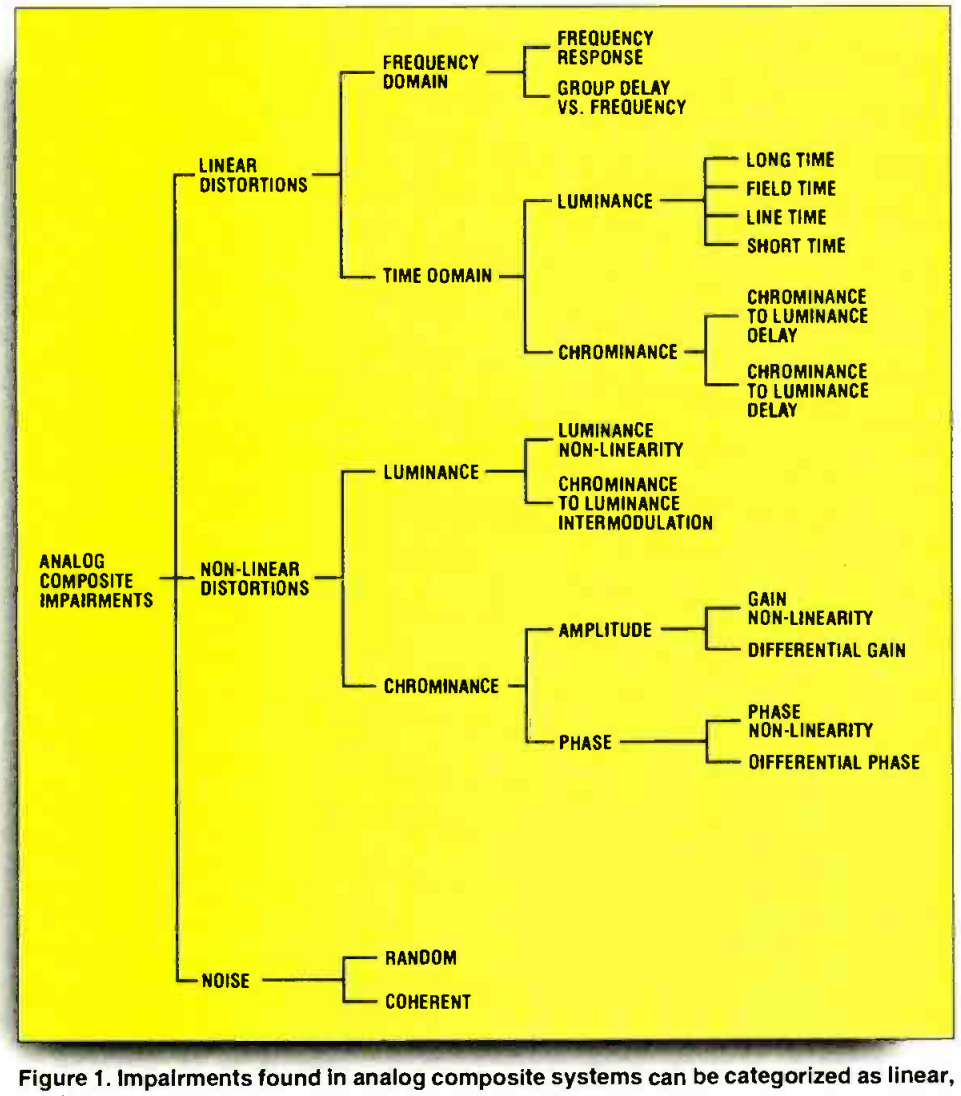

Figure 1. Impairments found in analog composite systems can be categorized as linear, nonlinear or noise.

Digital testing concepts

New digital architectures, such as MPEG compressed systems, pose a new set of problems and failure modes. Tools developed for the evaluation of analog video are inadequate for the compressed digital world. The multitude of independent factors which contribute to picture quality in the digital and analog domains are very different. Among the MPEG variables affecting picture quality are: data rate, use of I, P and B frames, number and types of frames between I frames, field/frame adaptive prediction, motion estimation and compensation methods, slice size, and buffer size.

The limitations of standard analog-type test methods when used to evaluate the performance of compressed systems dictate the use of different approaches. Most image-quality decisions are based on subjective evaluations of the displayed picture by trained and untrained individuals. To verify the performance of a compressed system, a group of experienced observers is assembled to watch the playback of a videotape and subjectively assess the picture quality using experience and intuition. One of the major issues in testing compression systems is that the type of program material determines the subjective performance. Images with a great deal of motion and spatial detail are difficult for the encoder to handle. Specific encoders have different buffer and motion estimation characteristics, which result in performance differences with the same material. The sequences recorded on tape must con-

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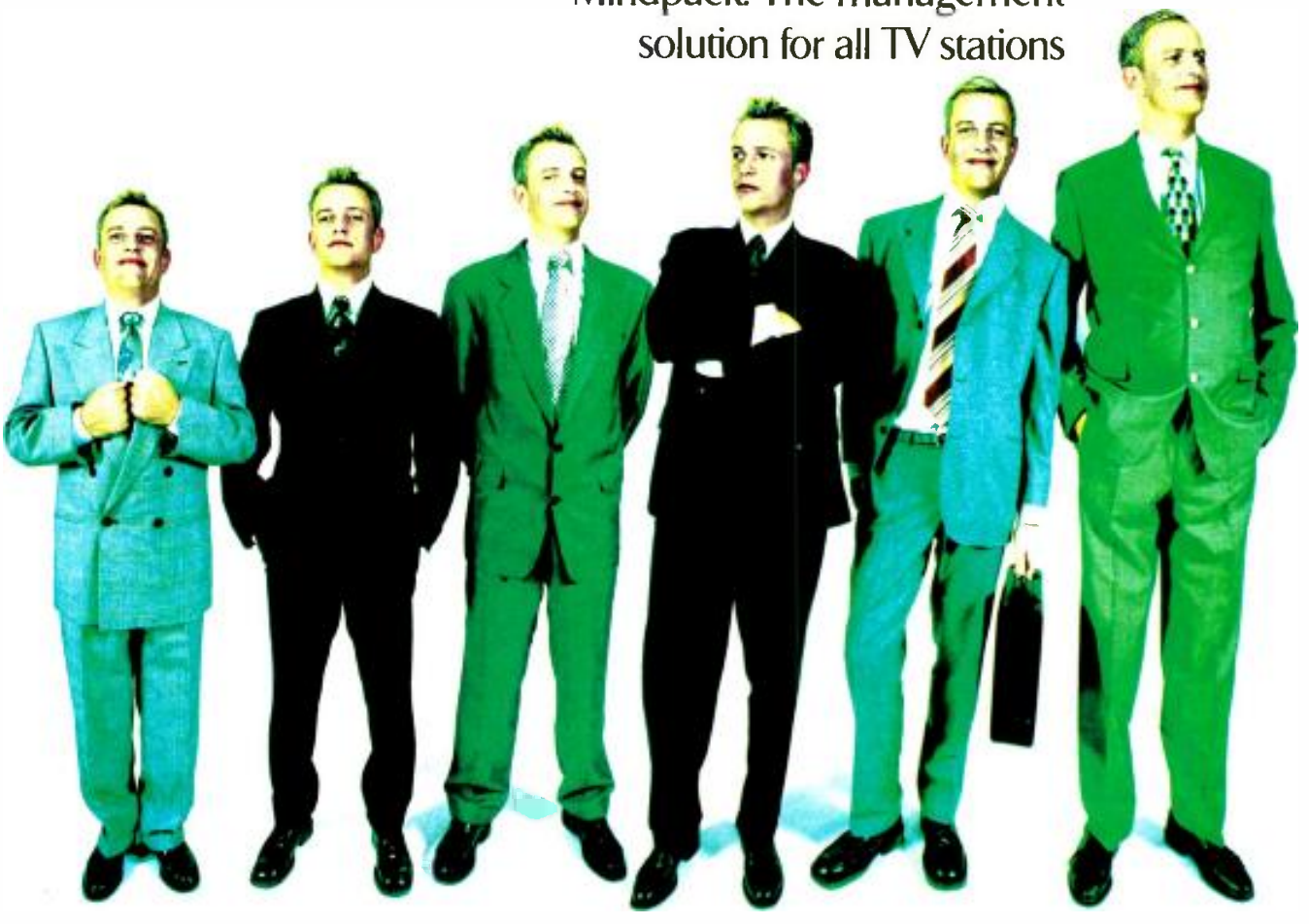

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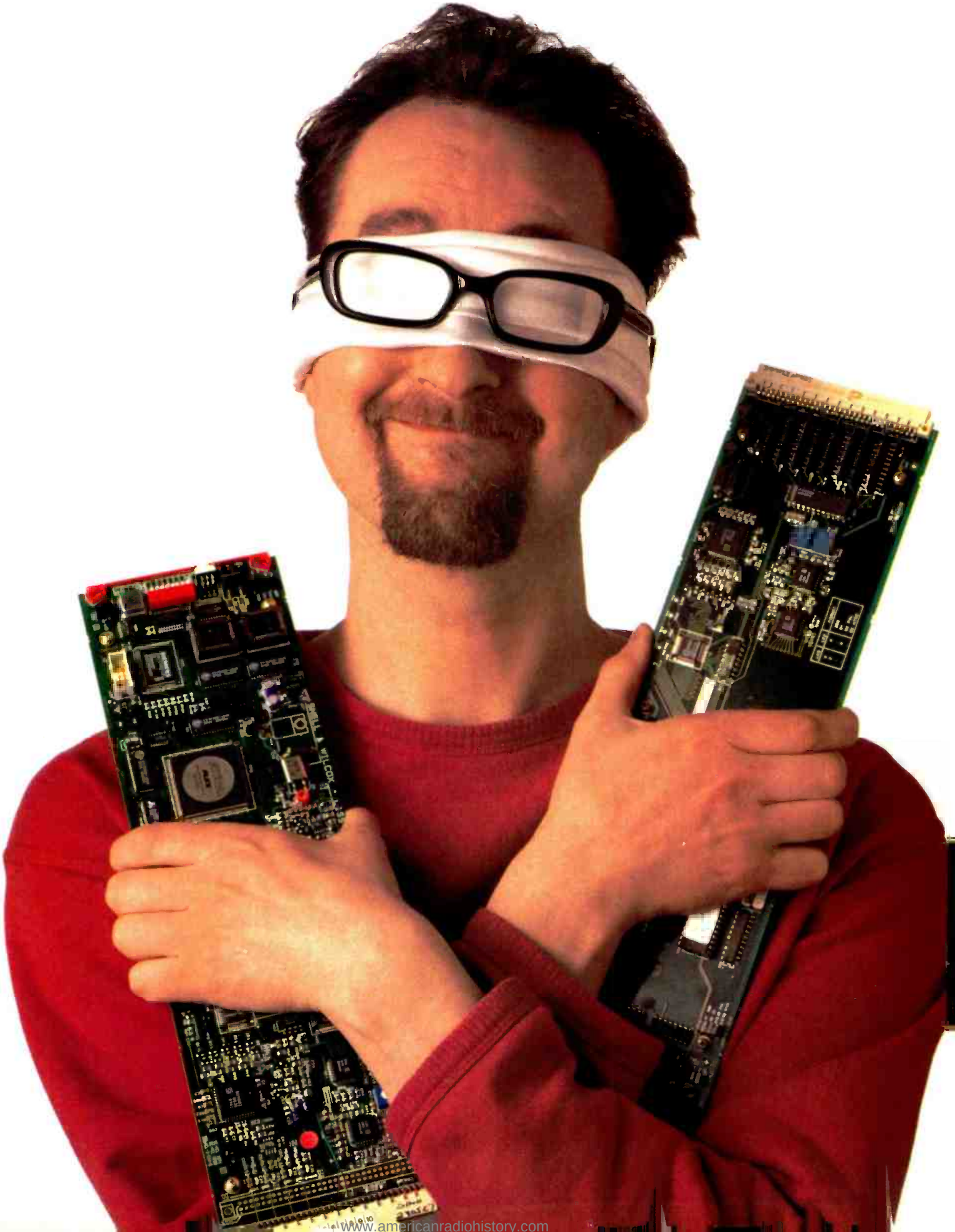

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Testing MPEG compressed signals

results of the video system and test sequences. Various organizations are in the process of developing objective picture quality analysis (PQA) methods and equipment. The available devices usually compare a signal before compression with the resulting signal after decompression and assign a quality rating similar to the five-level CCIR quality assessment method.

In line with ITU Draft Recommendations measurements there are three agreed-upon objective methods of picture quality measurements resulting in three levels of measurement accuracy.

- Picture comparison method: This approach compares the source video signal, for instance SDI 4:2:2 @ 270Mb/s, feeding the input of the system under test (MPEG codec) with the degraded signal obtained at the output of the MPEG codec. Figure 3a shows a block diagram of the test setup. The measuring system uses a matrix-based mathematical computation to process each picture or sequence of pictures. This method is very accurate because it has complete information about the original and the degraded signal. This obviously requires that the test equipment as well as the codec be available to the test personnel, a situation encountered in development laboratories. This test method could be extrapolated to a test situation where the MPEG encoder and the MPEG decoder are not side by side, and, indeed, not in the same geographical location. In this hypothetical case it is obvious that the source signal would have to be made available to the measuring equipment. This would require an additional, separate, signal path that would, by necessity, introduce its own impairments affecting the measurement reliability.
- Feature extraction method: This approach extracts a reduced amount of data from the input signal and compares it with a similarly reduced amount of data extracted from the degraded signal obtained at the output of the MPEG codec. Figure 3b shows a block diagram of the test setup. The test equipment compares the extracted features and generates an impairment measurement result. The input feature data, several hundred bytes, can be delivered from a remote location to the measurement site using a low bandwidth data channel, thus allowing the MPEG encoder and the MPEG decoder to be in separate geographical locations. This measurement setup would be adequate for monitoring purposes.
- Single-ended testing method: This approach analyzes the received signal for known artifacts and other defects resulting from transmission or the encoding process. Figure 3c shows a block diagram of the test setup. Among the impairments tested are blockyness resulting from the requantizing and variable length coding (VLC) of the discrete cosine transform (DCT) coefficients.

As more compressed digital systems are installed the need for fast, accurate and reliable subjective and objective test methods will increase. This need is and will continue to be met by ever more sophisticated objective test equipment relying on human vision models to evaluate the picture quality. In a hybrid analog/digital world all system elements need to be maintained to their original specifications to ensure a smoothly operating system. This means specific types of equipment, analog, digital and compressed digital, will have to be tested using different methods. A complete system will have to be subjectively tested and the subjective tests will have to be duplicated with objective tests. It is important to remember pictures with a great amount of noise, high frequencies and movement stress compressed systems. ■

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.

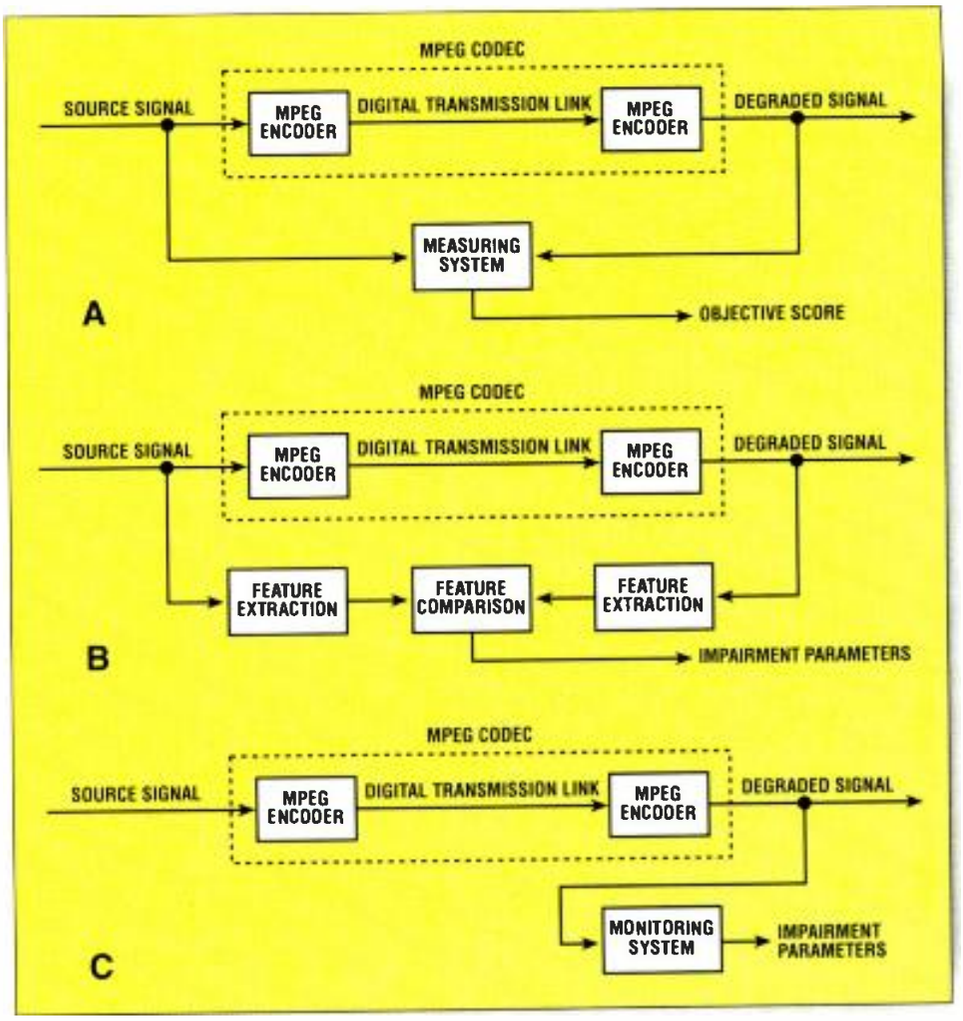

Figure 3. Currently there are three agreed-upon objective methods of picture quality measurements, picture comparison, feature extraction and single-ended. In picture comparison (a), the measuring system uses a matrix-based mathematical computation to process each picture or sequence of pictures. With feature-extraction (b), a reduced amount of data is extracted and compared. In the single-ended approach (c), the received signal is analyzed for known artifacts and defects.

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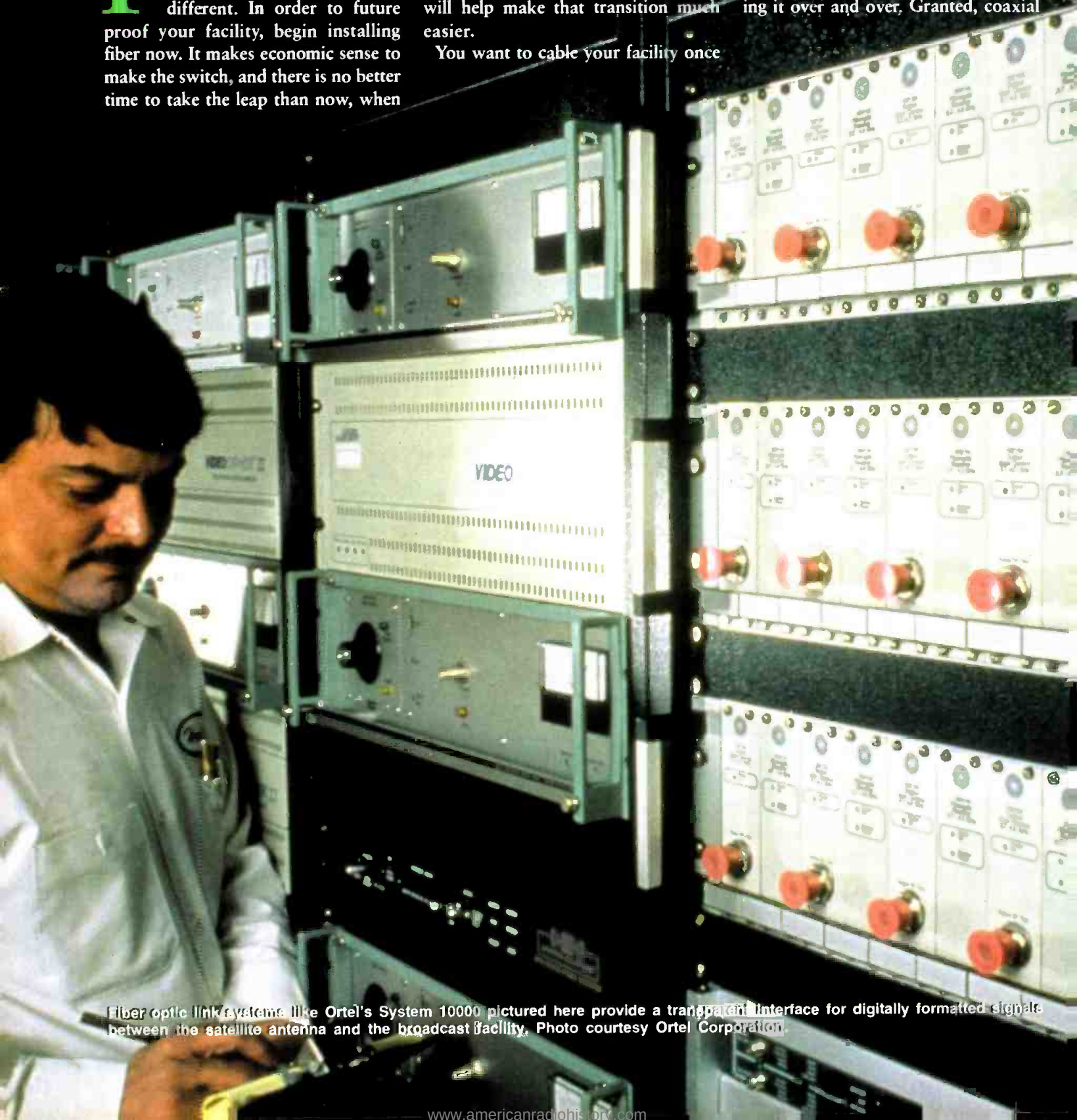
Working with fiber

By Richard A. Cerny

Fiber optics is a much simpler technology than most people believe. It's not difficult, just different. In order to future proof your facility, begin installing fiber now. It makes economic sense to make the switch, and there is no better time to take the leap than now, when digital technology is demanding the convenience and performance of fiber. A few guidelines and some tips will help make that transition much easier.

You want to cable your facility once and have it be capable of serving your communications needs for the long term. Cabling with copper means doing it over and over. Granted, coaxial



Fiber optic link systems like Ortel's System 10000 pictured here provide a transparent interface for digitally formatted signals between the satellite antenna and the broadcast facility. Photo courtesy Ortel Corporation.

Working with fiber

ilar in concept to the distributed star-hub configuration that airlines and data networks use. Start with a main hub location, ideally one in a central location and in the main control area for convenient access. This is where simple fiber jumper patching allows you to reconfigure and make moves, adds and changes without recabling. Call this the main distribution frame, or MDF. From this point cables radiate out to secondary locations where intermediate distribution frames, or IDFs, further distribute to local patch panels in telecommunication closets, equipment rooms, or user nodes. This topology allows you to flexibly reconfigure devices in one segment without disrupting the entire network. The star-hub is the most efficient, flexible topology for structured cabling networks.

Cabling with copper means doing it over and over.

This closet-to-closet network of cables and patch panels is called the backbone. Your objective in planning is to create a backbone that connects any two nodes in the facility by traversing the fewest number of patch panels in series. You will want to perform a link budget analysis to ensure that the total cable and connector loss, or *attenuation*, stays within the optical budget set by the transmitter and receiver electronics.

The link budget analysis is simply a calculation that subtracts the total attenuation of your path from the available link power of your

Camera accessories: Keep a mixed bag

by Bennett Liles

Planning for EFP and ENG shoots has always been a what-if game. Maximizing the number of multipurpose tools that you carry can keep you in demand and out of traction. While cameras and accessories are lighter, the list of things that single shooters must know and do is longer.

Batteries are still indispensable and heavy, but the two main tricks here are being able to keep them charged and limiting the number of battery types your equipment needs. In addition to the usual AC charger, a DC power cable with a cigarette lighter connector is good to have. Keep extra fuses for the car's lighter circuit. If any of your equipment is other than 12V, avoid cheap, linear regulators and stay with the microprocessor-controlled variety. Most new batt-belt systems have seven-step, multicolor "fuel gauge" voltage indicators. If yours doesn't, external, in-line types are available.

A good shooter is prepared for any situation. The setup above features a wireless receiver, shotgun mic, cam-mounted light and fluid-filled camera head on tripod.

It's tempting to save on tripods and camera mounts because the cheap ones are usually lighter. It's wise to take a light one for shoots with little or no camera movement, but if smooth pans and tilts are anticipated, take along a solid, cast aluminum tripod and a fluid-filled head. Infinitely adjustable and independent pan/tilt friction is a must.

Multitask lighting gear can save a lot of trips to the truck and back. Start with a good camera multimount that fits into the accessory shoe and mounts up to three lights, mics or other gadgets on it. To change light intensity, the usual scrims and barndoors can be augmented with small power control units that can dim camera-mounted lights to 10 percent intensity with minimal color temperature change. At the very least, two small lights with adjustable focus should accompany two larger instruments with longer throw capability.

Filters should include at least the basics for lights and lens. For lights, the most common problem is a need to use artificial fill light on a daylight shoot. Dichroic-coated optical glass grids will raise an instrument's temperature from 3200° K to the required 5600° K for smooth color between these sources. Special effects and light diffusion can also be accomplished with these grids. Lens filters can provide similar effects like fog, day-for-night and neutral density for bright and glaring locations with snow. Protection and correction should be the key words on lens filters. These are the two basic functions you will always need to have handy.

Remember that for most TV formats, the picture is only window dressing for the sound, which carries at least 90 percent of the usable information recorded. Don't scrimp on it in effort or gear. The basic microphone package should include at least three omnidirectional lapel mics, one camera-mountable shotgun and fishpole and a couple of directional handheld mics with stand clips. The more directional a mic is, the more it will need a windscreen. Wireless mics have become standard, so have at least two. Each receiver can pair with a handheld and lapel wireless mic. Frequency agile systems are expensive but worth the cost for the mobile shooter. Diversity reception is also a must. The most useless thing in the world is an ultra-cheap wireless mic. Stands and cable should be kept in presentable condition without gobs of old tape on the connectors. Use high fidelity, padded and tight-fitting headphones. A good, belt-mountable field mixer with internal tone oscillator and VU meter fill out the package. Now all that's left is creatively compressing most of this onto one of the many rolling carts available for this gear.

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

light and will probably remain that way as fiber doesn't corrode or degrade with age.

You no longer have to be concerned with your video and audio capacity planning, meaning the guesswork in how many video cables to run, how many analog, 601 digital, how many HDTV, etc. is largely removed. You don't have to predict how many analog audio lines are needed or when they will become digital. Your focus becomes geographical and most capacity issues disappear. This is because any type of signal can travel on fiber: NTSC or PAL analog video, serial digital video from 19.4Mb/s up to uncompressed 1.5Gb/s and beyond, analog audio, digital AES/EBU, control data, intercom, triaxial RF camera links, Ethernet or what have you. The fiber is just a fat pipe the size of a human hair; a cable contains a few or many of these strands.

The capacity or function of each fiber conductor is determined by the terminal electronics, whether integral or outboard, including fiber transmitters, receivers, multiplexers, etc. For instance, with a simple low-cost fiber transmitter/receiver set, each video circuit, whether digital or analog, typically uses one fiber. Using a multiplexer, one fiber can support up to 64 channels of audio plus several data and intercom circuits. This type of multiplexer uses digital time division multiplexing with a laser output. The fiber capacity could be further enhanced by optically multiplexing two or more light signals, say one HDTV laser transmitter operating at a wavelength of 1310nm and an audio multiplexer signal at 1550nm, on one fiber. This optical sharing of a fiber is referred to as wavelength division multiplexing, or WDM. Wavelength multiplexing is often used where the number of fibers is limited, for instance, when leasing an unused "dark" fiber from a local carrier to transmit over longer distances for studio-to-transmitter links or across town between facilities. It is normally not necessary where fibers are plentiful.

No matter how fast or far you want to go, a well-planned fiber network will continue to accommodate your facility and your operation.

Cleaning up the mesh

The way you route your cable will have an impact on its cost and utility. Think of your fiber infrastructure as your fourth building utility, much the same way as you think of water, power, and HVAC. Instead of running cables in a point-to-point manner and adding cables to ultimately form an unmanaged mesh, your first objective is to plan the fiber backbone. You will want to form a hierarchical topology composed of fiber optic cables and patch panels, often called distribution frames, sim-

Working with fiber

cable has improved somewhat, and it does a reasonable job with serial digital video over limited distances if environmental conditions are ideal. Increase the distance, hike up the bit rate and throw in some noise or grounding problems and you face some major reworking or the possibility of starting over completely. Currently, the maximum coaxial cable transmission distance for uncompressed HDTV is approximately 100m minus a 10 to 15 percent safety margin to allow for cable aging, connector losses, physical compression and excessive bending. To go longer distances without losing the signal, expensive reclocking distribution amplifiers with auto equalization are required at the far end of the cable.

The capacity of fiber is virtually unlimited. No matter how fast or far you want to go, a well-planned fiber network will continue to accommodate your facility and your operation. Plus, you have the intrinsic benefits of glass for free. It eliminates grounding problems, is impervious to induced noise or RF pickup in increasingly hostile environments, immune to cross talk between cables at any frequency and is electromagnetically secure, so there is no eavesdropping on your cables. There is no video loss or high-frequency roll-off. It is only a fraction of the size and weight of copper cables, so you can eliminate the need for most of your conduits, trays and other pathways. Troubleshooting consists mainly of continuity checks with a flash-

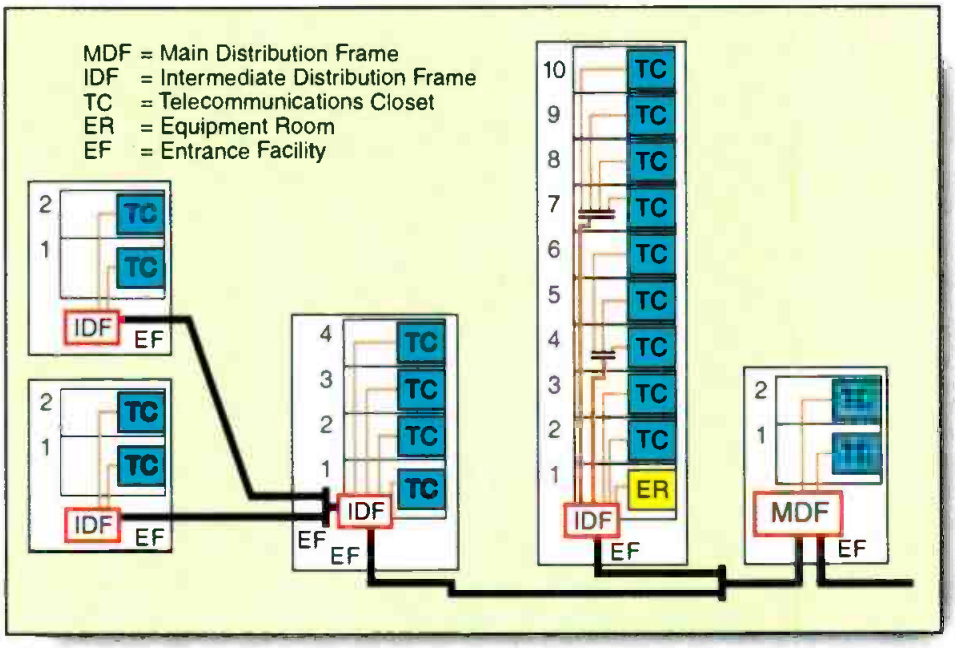


Figure 1. Example of structured cabling system. The standard star-hub configuration assures predictable fiber optic link budgets between any two nodes in a network. Figure courtesy Telecast Fiber Systems.

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fiber optic electronics. Fortunately decibels are additive, and this is an easy exercise. This allowable link margin, which is dictated by your transmitter and receiver, will depend on many parameters, including the type of signal, the data rate or frequency, the operating wavelength, and the types of optical source and detector used.

What materials do you specify? There are generally three types of fiber to choose from. All three have the same outer diameter of 125 micrometers, also stated as µm or microns, but they differ as to core size. Single-mode fiber has a core size of 9µm. The two multimode core sizes are 50µm and 62.5µm. While multimode fiber cables have been the most popular, primarily based on ease of coupling and the lower cost of terminal devices, new Gigabit technologies are driving the trend toward single-mode cables. Multimode fiber is future resistant. Single mode is future proof.

Fiber cheap is fiber poor

How many fibers do you install? Think in terms of dozens. Patch panels are typically manufactured in multiples of 12 fibers. Experience has taught us to overbuild — at least twice as many fibers as you could conceivably use. It is better to have the fibers and not need them than it is to need them and not have them. The cost of excess fibers is low. The cost of recabling, as it is with coax, is high. Since the most economical systems use one fiber per video circuit, you will want to plan to install more fibers than the average LAN requires. It is not uncommon to see video-intensive campuses and large network facilities running 144-fiber cables between buildings, and perhaps 24 to 36 fibers to each floor. You may not need that much, but the point is that you should install plenty of excess fibers.

There has been a trend toward the push-pull SC optical connector, especially in single mode installations, primarily because of the reduced back reflections that the angle polished versions exhibit. However, the ST is still the prevalent connector in facilities of all types because of its ease of installation and reliability. Adapting from SC to ST is trivial; buy a short jumper cable with SC on one end, ST on the other.

Multimode fiber is future resistant.
Single mode is future proof.

Think about how much easier it will be to make equipment moves, adds and changes with a structured cabling system of fiber, and how nicely you can sleep knowing your facility is future proof. Consider installing fiber, even if coax and wire look cheaper and less scary. When you start to plan, think starhub with patch panels at key locations. Bring fiber as close as possible to your HDTV devices and eliminate coax as much as possible. Keep coax for the short local runs within a node or group. Plan to install excess fibers. It's cheaper than the alternative. Use single mode cable to be ready for all of tomorrow's technologies. It is your choice as to ST versus SC connectors. They both work well and are readily available. Be prepared to faithfully label all your patch panel ports and jumpers, and keep good documentation on the backbone. Finally, buy yourself a basic optical powermeter. It only costs a few hundred dollars, and it is essential to maintaining a reliable, well-managed network.

Fiber is inevitable. It continues to displace copper and microwave in more and more installations. You now have the reason to embrace it. It makes economic sense to do it. It is not difficult, just different. ■

Richard Cerny is president of Telecast Fiber Systems Inc. Worcester, MA.

While installing fiber cable, strict adherence to guidelines regarding its flexibility must be observed. Raceways, such as those being installed here, help to organize and protect cable, as well as ensure the integrity of its location and minimum bend radius over time. Photo courtesy ADC Communications.

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Harris Corp.'s Real-Time Adaptive Correction: Unleashing the full potential of DTV Transmitters

BY JOSEPH L. SECCIA AND MICHAEL SIMON

Digital television has sparked many developments that have the potential to improve transmitter reliability, functionality and performance. One of the most exciting developments is Real-Time Adaptive Correction (RTAC TM).

Using advanced digital signal processing (DSP) techniques, RTAC provides continuous adaptive correction in the transmission system automatically, without the use of training signals.

Harris' first generation of RTAC is more than a security blanket that helps stations ensure the signal is reaching its entire intended coverage area. It is also a springboard for new transmitter capabilities such as a fully integrated software-based transmission test system that is already available and eventually will provide a foundation that links the DTV transmitter to a complete network management system.

This article takes a closer look at RTAC in DTV transmitters as well as its first spin-off capability — built-in test equipment.

Review of types of distortion and their impact on transmission

Broadcasters have typically had to be concerned about two types of distortion that occur during transmission — linear and nonlinear.

Linear distortions are caused by changes in amplitude and phase relative to frequency during transmission. These distortions are of particular concern because they may affect signal coverage.

Obviously, the more the signal is obscured by noise, the more the coverage is compromised. With an analog signal, if SNR is too low, the picture on a TV set will develop an abnormal sparkle, become snowy and then roll. With a digital signal however, as the signal nears the digital "cliff," the picture on a TV set will freeze, pixelate, then go away altogether.

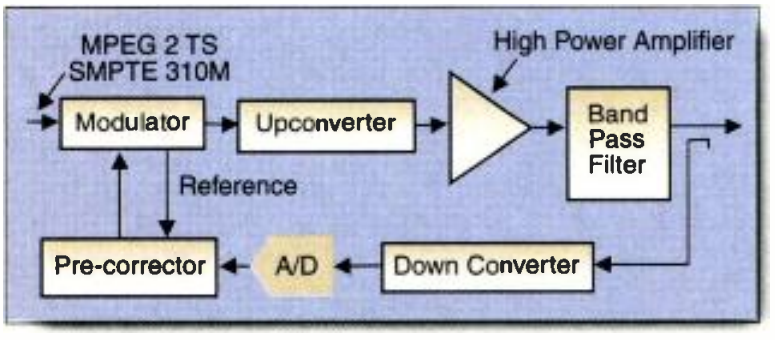

Figure 1 shows the basic block diagram of a digital television system using adaptive correction. A sample is taken at the output of the band pass filter, downconverted to the IF frequency and then converted to digital. This digital sample is then compared with a reference signal and used to determine the type of predistortion that is applied during the modulation process.

To ensure signal coverage, the ATSC recommends that DTV transmitters maintain a S/N of 27dB or better. While an S/N greater than 27dB will not materially increase DTV coverage, an S/N under 27dB will begin to impair coverage.

Nonlinear distortions are caused by changes in gain relative to input amplitude (AM-AM) and in phase relative to input amplitude (AM-PM). Both of these conditions create new in-band and out-of-band frequency components that can interfere with other TV channels and services, resulting in noncompliant and illegal operation.

Harris' first-generation RTAC system provides adaptive correction for linear distortions. Its second-generation RTAC system, which is well into development and will be introduced after field-testing, will provide nonlinear adaptive correction as well.

A closer look at RTAC

Introduced in February 1999, Harris' RTAC system is based on tried-and-true feedback-loop technology that has been used in telecommunications equipment for many years.

A block diagram of the RTAC system is shown in Figure 1. A feedback loop at the output of the RF mask filter continuously samples the transmitted signal. Signal samples are analyzed and necessary adjustments are automatically made, ensuring a S/N of 27dB or better at all times.

RTAC operates without test signals, and can be told to hold when the station operator does not want real-time adaptation on line. Figures 2 compares eye patterns of a signal with RTAC off and with RTAC on.

The launch pad for other new services

RTAC's benefits extend beyond ensuring linear operation. By creating a feedback loop that continuously analyzes differences between the input signal and the actual output signal, RTAC provides a great deal of test information that allows broadcasters to fully understand what is happening inside the transmitter during operation over time.

While error analysis is inherent in any feedback loop scheme, the challenge has been to extract this information and display it in a manner that is

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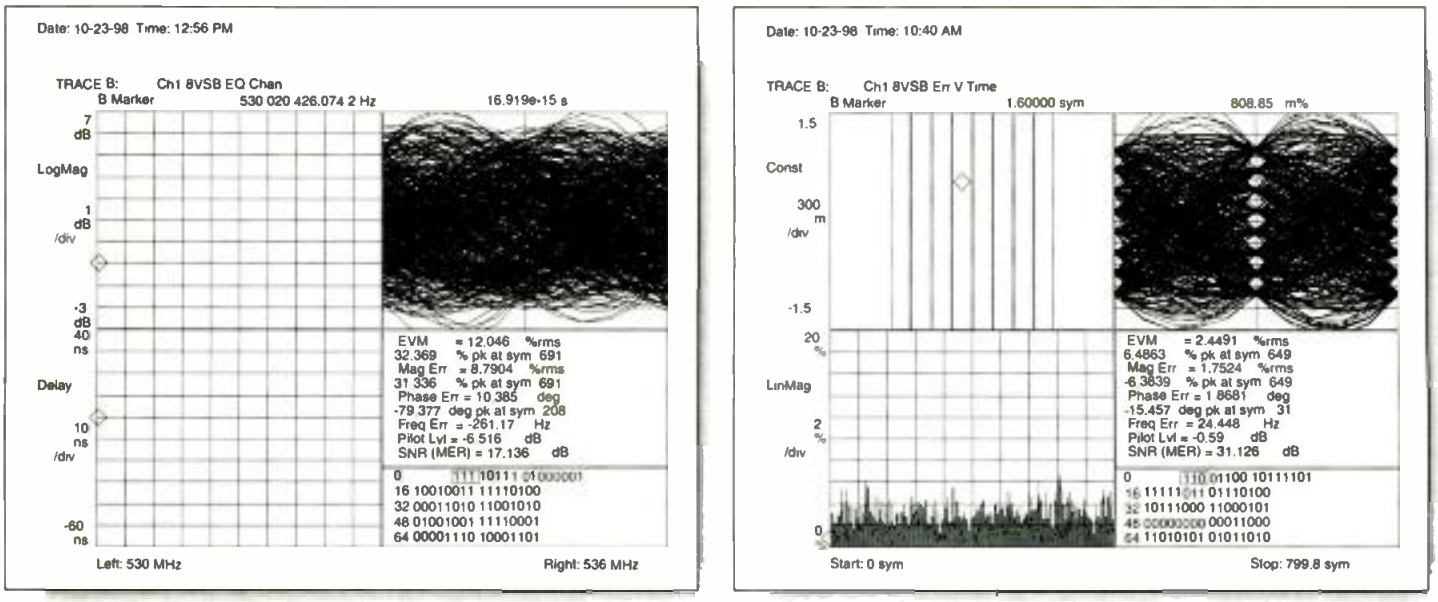

Figure 2: RTAC off vs. RTAC on. The first picture shows the eye diagram presentation of the RF envelope with significant linear distortions present. The second picture is the same presentation, only now with the RTAC system on. The RTAC system pre-equalizes for the linear distortions in the system, yielding a nice looking eye diagram and more importantly a S/N of greater than 27dB, the ATSC recommended minimum.

user-friendly and meaningful to broadcasters. Harris has recently developed a new system called CD EYE to overcome this challenge (see Figure 3).

A plug-in software option that is integrated into Harris' RTAC-equipped CD 1A 8-VSB exciter, CD EYE streams data packets (the input signal, the system output signal and the pre-correction metrics being generated by RTAC) from the exciter's serial port to a Win 95/98 NT PC. (PC requirements for CD EYE: 133MHz Pentium (or compatible) CPU; Windows 95/98 or NT; 1024x768 x16 bit color VGA video card; RAM - minimum as recommended for operating system; Hard Disk — minimum as recommended for operating system. If connecting the computer directly to exciter: Serial port (16550 compatible UART recommended). If connecting the computer via modem to exciter; Windows compatible V.34 modem. To use the help system, a Web Browser such as Internet Explorer or Netscape Navigator is recommended. The browser only needs to be installed — you do not have to have an Internet account.)

CD EYE's client software processes streamed data and presents time, frequency and modulation domain analysis on a directly connected PC at the transmitter site. Data can also be accessed via modem.

CD EYE provides measurements for spectrum, out of channel mask, eye diagram, constellation, S/N and EVM, pilot level, and RTAC metrics. Information is displayed both graphically and numerically and can be logged for trend analysis and troubleshooting purposes. The system also provides control and status monitoring of RTAC and the CD-1A exciter.

Going forward

The good news in this industry is that the new television standard, with its digital cornerstone, offers unlimited potential not only for new consumer services, but also for tools that will significantly simplify transmission system operation while improving reliability and efficiency and reducing cost. Real-Time Adaptive Correction and capabilities such as CD EYE are only the beginning. ■

For more information on Harris' RTAC, circle 451 on the Free Info Card.

Joseph L. Seccia, P.E., is product manager and Michael Simon is lead DTV applications engineer at Harris' broadcast communications division.

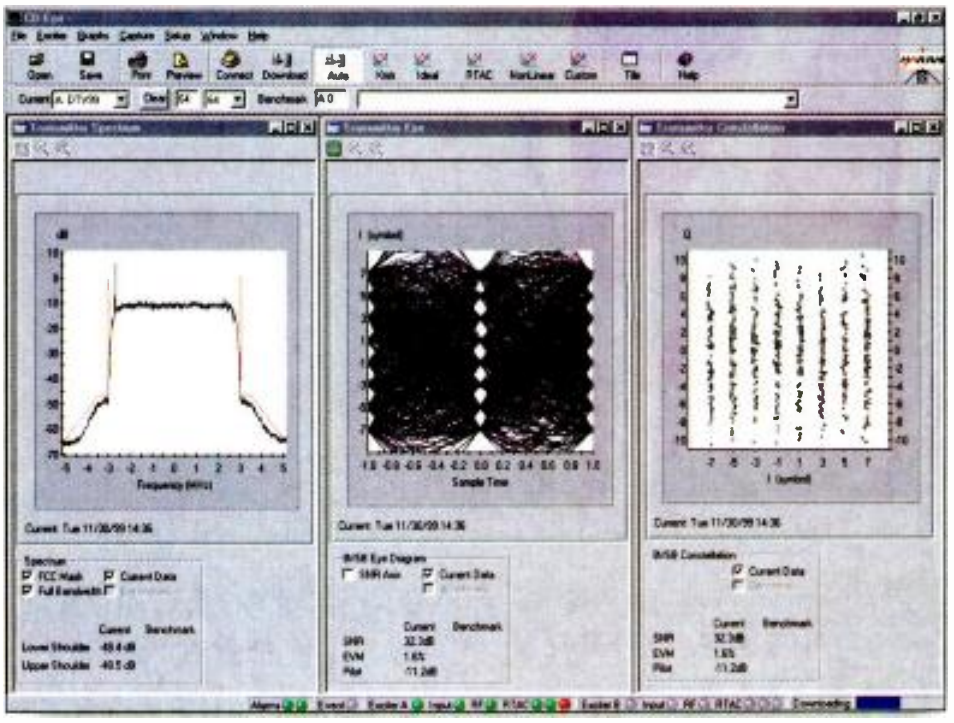

Figure 3: This screen represents information that is provided with CD EYE built-in test equipment.The Transmitter Spectrum displays shows spectral energy vs. frequency, similar to a common spectrum analyzer. The Transmitter EYE diagram offers a graphic diplay of uncorrected linear distortions in an sampled transmitters output signal. The display also reports S/N and EVM metrics. The Transmitter constellation diagram offers a rough estimate of the presence of non-linear distortion present.

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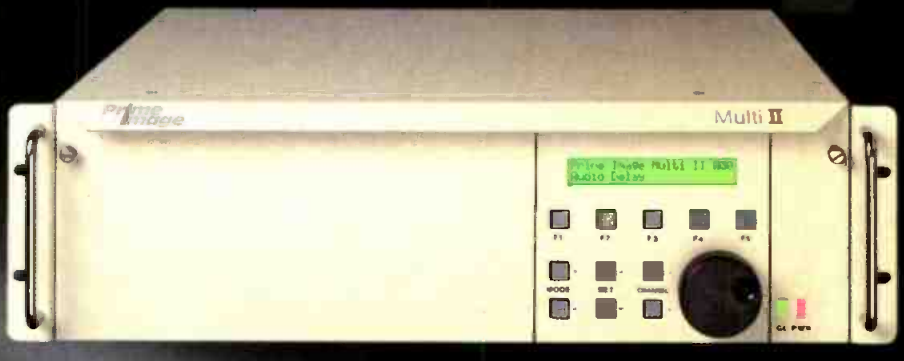

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Field Report

The Godfather of Soul meets Sony's Oxford

BY BOB MANAHAN

Sometimes a dream job just falls into your lap. That was my recent experience when I was asked to man Sony's Oxford audio console to capture a live performance by "The Godfather of Soul" — James Brown — at the House of Blues in Las Vegas.

The project employed the advanced HDTV and digital audio capabilities of National Mobile Television's HD-2 production truck. With an eye towards a future 5.1-channel DVD release, Brown quickly saw the potential and agreed to the performance. The location recording was to be done with NMT's truck.

Capturing James Brown live proved to be quite a challenge, due to his extraordinarily large band that included half a dozen horns, a full double rhythm section, six backup singers and two keyboard players. Guessing that set-up time might be limited, I went into the NMT facility in Torrance, CA, the day before the show and set up my basic console "road map." One of Oxford's big advantages is that any fader can be assigned to any channel, so I placed all of the faders that I knew I'd be riding in the center.

Gary Rosen and James Brown sit in front of Sony's Oxford console, an all-digital 5.1 audio console. (Photo courtesy of Sony)

My task included both recording the audio to the truck's two 48-track PCM3348HR DASH machines and providing two stereo mixes — one to the HD video tape machines and another intended to act as a scratch mix for post-production use. The Oxford can mix in 5.1 channel, stereo and mono all at the same time. You can also do separate mixes of the multitrack buses, as well as separate complete cue and monitor mixes (there are 24 cue sends from each channel).

We arrived about 9:00am the day of the show. We took 48 microphone feeds from the house — these were all standard PA mics, although their performance was enhanced greatly by the Oxford's preamps and converters. We placed another six microphones at various positions in the audience for surround tracks.

All 54 mics ran directly to the Oxford's mic preamps and onboard 20-bit A/D converters. No outboard mic pres or converters were used. I also used the Oxford's internal compression, filters, gating and equalization; there was never a need for any outboard processing.

Another advantage of Sony's Oxford (OXF-R3) is that its faders are virtual. That is, they can perform a variety of different tasks, from controlling channel outputs to multitrack bus outputs to line trim inputs; you can even set up cue feeds with the faders, as opposed to using the rotary knobs one would find on an inline console.

The ultimate arbiter, of course, is the performer. Right after the show, we invited James back to the truck for a quick playback. Brown told us that the scratch stereo mix was as good and as clean as anything he'd heard. He was impressed with both the sound and picture quality.

This is the first time Sony's Oxford was used to do a live concert recording on such a large scale. Something tells me this is just the beginning of opportunities that the Oxford will be part of in the years ahead. ■

For more information on Sony's Oxford, circle (452) on the Free Info Card.

The HD video control room in the NMT HD-2 production truck, installed by Sony Systems Integration Group. (Photo courtesy of Sony)

Bob Manahan is a two-time Emmy Award-winning mixer. He has 20 years of experience in the audio field as both a dialog mixer and in the post production of numerous television and music specials.

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Circle (146) on Free Info Card

The benefits of new technology allow multiple remote cameras to be used to cover a larger multicamera event and maintain a consistent look.

Features important to these types of cameras are preset and user-selectable white balance settings, multiple audio inputs (and controls) and an uncluttered but informative viewfinder display. Separate video outputs and genlock inputs are desired when integrating these cameras into a multicamera show. Flexible power options are also important.

Widescreen aspect ratios are being used in HDTV productions, and SDTV material that will be upconverted for use in HDTV programs must also be shot with that aspect ratio in mind. However, if your news department will not be converting to widescreen production in the near future, you may be able to use a 4:3-only camera for the expected lifetime of your news cameras.

Hitachi SP-3000P

The miniaturization of technology has made the combined camera and VTR (also known as the camcorder) almost universal for news use. The introduction of the new compressed digital videotape formats has contributed to an increase in the number of models of camcorders from many manufacturers. The benefits of digital recording are being explored in these new formats.

With their improving video quality and already-accepted VTR quality formats, the new range of consumer DV equipment is also receiving consideration as an accepted format for low-budget or high-risk acquisition. If a thousand-dollar camcorder is stolen or dropped it will not be as traumatic (budget-wise) as it would be if one of the station's flagship ENG camcorders were to be lost.

Some versions of studio and ENG cameras are being used for electronic field production (EFP) or remote work. Typically the lower-priced end of the studio camera line or the higher-priced end of the camcorder line are used for these applications, and the differences between each type is not readily apparent. Often, multicamera magazine shows are shot with ENG-style cameras, and shopping center remotes, fairs or parades are done with scaled-down (smaller) studio cameras. Hand-held

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Circle (151) on Free Info Card

Philips LDK100

cameras for magazine shows take advantage of the "smart card" approach to download the same settings to multiple cameras, and studio cameras that are smaller and lighter than their studio brethren are often used in mall shoots. An exception to this is the special event unit, or sports remote vehicle, where top performance is required in addition to the ability to operate the camera on a long-distance cable link from the truck.

In addition to traditional SD cameras, new formats such as 480p scan cameras and HD cameras of 1080- and 720-line formats (1080i and 720p) are being developed. Soon there will be 1080p cameras

Digital technology has improved the stability of the cameras to the point where the individual settings of many of the parameters of the camera can be stored and transferred between cameras.

that will record 1080 lines at 24fps. These camera technologies represent the future of video cameras.

Digital technology and DSP have worked to create systems with capabilities that would have been just a dream only a few short years ago. The capability of cameras throughout the product lines has increased dramatically. In the camcorder area the camera is being even more closely integrated with the recording medium. These integrated functions range from the largely tape-based solutions of today to future linear and random-access recording media of the future. Depending on your needs and desires (and your budget) there are solutions available at almost every price point. ■

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

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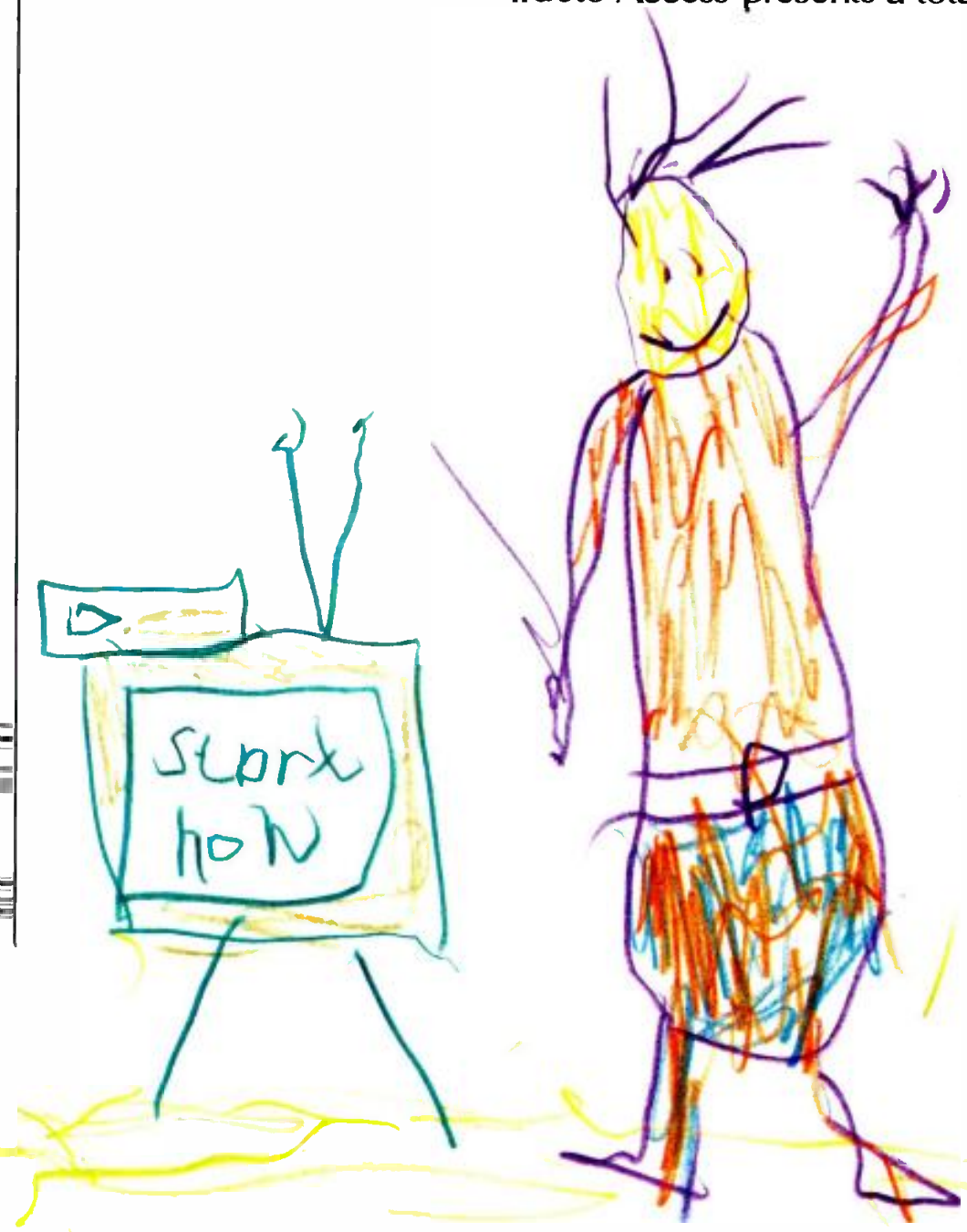

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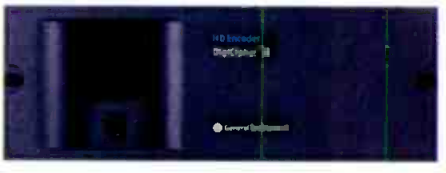

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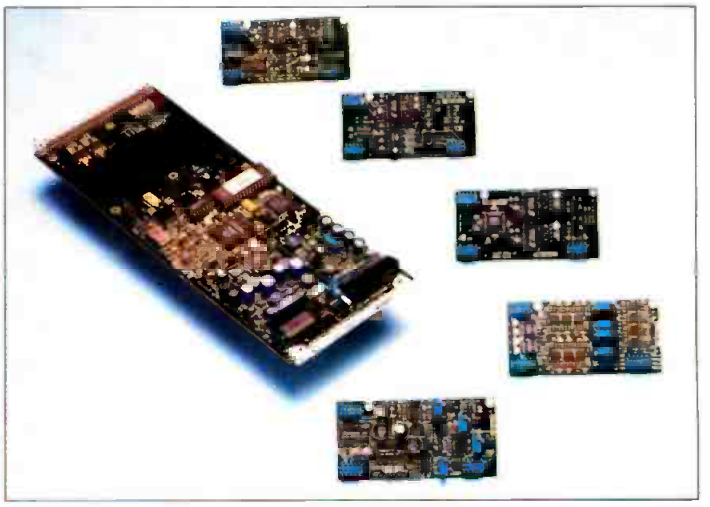

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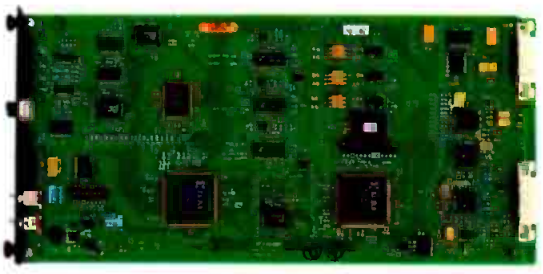

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Component SDI video has always offered the ability to embed up to 16 channels of audio in a video stream. There are, however, associated problems. When a switch is made between two video sources that contain embedded audio data, it is difficult to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

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

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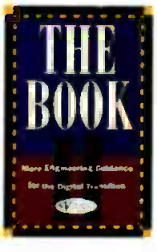

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Business Wire

Business highlights from broadcast and production

BY SANDRA FERGUSON, EDITORIAL ASSISTANT

NEP Supershooters recently purchased a second Grass Valley Group Kalypso system.

Howard Schwartz recording in New York installed two Soundtracs DPC-II digital consoles — one in its new post production room, Studio 13, and the other in the existing Studio West. The Peabody Conservatory of Music in Boston recently upgraded its recording facility with a full renovation that included a Soundtracs DPC-II digital console.

Omnibus Systems provided a $1 million station-wide automation package for KOMO-TV in Seattle.

Acrodyne signed an agreement for construction of a 60,000-square-foot facility that will house its corporate headquarters, sales/marketing, engineering, financial and operations teams, plus a manufacturing facility.

Walters-Storyk Design Group recently completed Argentina's first DVD authoring suite — The Fingers Art Group — in Buenos Aires.

Monterey Post Sound in North Hollywood announced that it purchased Euphonix's System 5.

DirecTV selected DiviCom to provide the entire digital TV compression system to its Castle Rock, CA, Broadcast Center.

Sony recently installed a full digital infrastructure at ABC's New York Times Square facility. The installation included a Sony JumboTron JTS-L15 LED display on the exterior of the studio that faces Times Square.

Switchcraft announced the acquisition of Conxall Corporation in Villa Park, IL. Switchcraft also added Bi-Tronics of Hawthorne, NY, to its roster of distributors.

The Associated Press and www.washingtonpost.com introduced Virage's Campaign 2000 Video Search Engine. Cable News Network, Informix and Virage announced that CNN plans to begin live operation of an application to collect, share and distribute live news feeds among three of CNN's major news netowrks (CNN, CNN Headline News and CNN International).

ROHN Industries received a contract to build a tower for Central Missouri State University's KMOS radio station that will be used for the HDTV market. The tower will be among the tallest in the U.S., measuring approximately 2,000ft. Donald Markley, of D.L. Markley and Associates Inc. of Peoria, IL, is the consulting engineer.

The University of Cincinnati's College-Conservatory of Music recently installed two Yamaha 02R digital consoles and an EX-5 synthesizer in its newly renovated electronic media facilities.

The Whitlock Group recently opened an expanded broadcast engineering services division office in Tampa, FL.

CBS News and Princeton Video Image announced a multi-year agreement under which CBS News will use Princeton's virtual imaging technology to provide branding for *The Early Show* in various New York City scenes shown during the program.

Electronic Arts Canada outfitted Studio A's new facility with five Westlake Audio BBSM-12 monitors.

IMMAD ECVS announced an agreement with Turner Entertainment Networks for pre-functional design and engineering services.

AZCAR announced an agreement with Turner Entertainment Networks for pre-functional design and engineering services.

Harris has entered into a definitive agreement to acquire Louth Automation. The cash acquisition is expected to be completed in January 2000. Harris was selected to provide a Diamond-CD DTV transmitter and other digital equipment to KCET in Hollywood.

Maine Public Broadcasting Corp. signed with Dielectric for DTV and NTSC TV station equipment. Dielectric recently acquired the complete Mark Products line of cable pressurization and leak-locating products.

20th Century Fox ordered 14 addi-

8VSB PROVEN

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THE CHOICE OF POWER

tional TASCAM MMR-8 modular multitrack recorders and 14 MMP-16 modular players to dub major motion picture releases in 24-bit digital. Universal Studios installed several TASCAM MMR-8s and MMP-16s in its motion picture and TV dubbing facilities.

Belden signed a contract with the Olympic Games' Sydney Organizing Committee to supply the vast majority of backbone and horizontal cables to be used in voice, video and data transmission for the 2000 Games.

WCNC-TV in Charlotte purchased Pluto's AirSPACE for on-air interstitial playback. Avid, Avstar and Pluto announced a new digital newsroom solution that will combine the three companies' broadcast news solutions.

Quantegy and Xytech entered into an agreement in which Xytech's software will be the standard inventory application for Quantegy products.

Spin Physics acquired Prodex LLC and formed a new corporation named Prodex, A Spin Physics Company. The new corporation is headquartered in San Diego.

Viewgraphics selected Medea's VideoRaid RT storage subsystem for its Windows NT-based HDTV workstation and I/O server, HDStore.

GTE purchased Artel's Vista 270 customer-controlled switching system.

People

John A. MacDonald

Leitch announced the appointment of John A. MacDonald as president and chief executive officer. Thomas M. Jordan and Michael Poulin were elevated to Fellow status in the Society for Motion Picture and Television Engineers.

Gunnar Rieger was named engineering/IT manager for WLVI-TV in Boston.

James Popowytsch was appointed chief engineer for National Video Center.

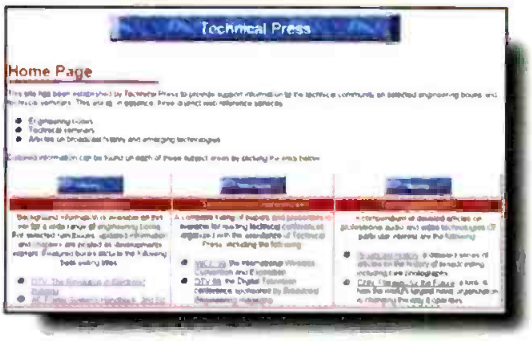
Pinnacle Systems elected Jim Dunn, vice president of marketing and sales, as an officer of the company.

Panasonic appointed Doug Leighton to the new position of product marketing manager for DVCPRO production products. ■

Windows to the Web

www.commscope.com

CommScope, Inc. is the world's leading manufacturer of coaxial cable and specializes in precision twisted pair and optical transmission cables. CommScope provides the Audio/Video professional with over 30 years of experience in the manufacture of high performance transmission media.



www.technicalpress.com

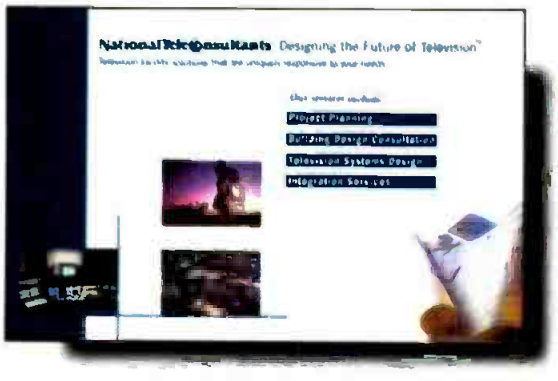
Technical Press is a web-based reference site that supports more than a dozen video engineering books, including *DTV: The Revolution in Electronic Imaging*. Also available are articles on digital video technologies and applications, and a detailed series on the history of broadcast engineering.

www.sennheiserusa.com

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

www.pinnaclesys.com

Pinnacle Systems: Pinnacle Systems' broadcast products give professionals the cutting edge tools needed to create dazzling productions faster and more affordably than ever before. These innovative digital video manipulation tools perform a variety of on-air, production, and post-production functions such as the addition of special effects, image management, capture, storage, and play-out, as well as graphics and title creation.



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Praise what you want to flourish

BY KARE ANDERSON

When the Catholic priest who was moved to a new parish approached his superior to ask, "Would you mind if I smoked while praying?" he was, not too surprisingly, turned down.

You can change the meaning and the outcome of what you say by how you say it. One way to influence another's perceptions is in how you set the stage or provide the context in which the listener might hear your words. For example, the priest might have been more successful if he'd made his request another way, "Would you mind if I prayed while I am smoking?"

Setting the context with your initial comments is akin to dressing in a fashion that the people you are going to be around will approve or even admire, while still being true to yourself. Why? Because, like all other animals, we are most comfortable with those who look right — like us. In fact, the more familiar you look, the earlier in the conversation I will accept what you are saying, absorb its meaning and be more able to accept your ideas. Our vital signs shut down when we are first around a person, setting or situation that is different (thus more dangerous) until we decide how we feel about our situation. This time I'm going to describe how you can pull people closer, bring out their better side and cultivate genuine, enduring relationships by how you choose to describe situations to others.

There are two ways to praise and both are positively powerful. The first is to praise someone directly. Whatever you praise, you will encourage to flourish. The second and perhaps even more powerful way to praise is to compliment the person to the person or people who are very important to them. For example, wireless portal equipment manufacturer Punjabi, had a rugged but quite successful third year of operation in which everyone worked long hours. Instead of handing out awards at a company event, the CEO took the time to find a significant group related to each of the winners. For those winners the groups included a place of worship, a rugby club, a college alumni organization and an antique car association. With the permission of these organizations, the CEO arranged to give the award and an eight-minute speech, describing both the winner's accomplishments at Punjabi and a specific incident in which the winner exemplified the heroic character of a true team player. Thus each surprised winner got to bask in the spotlight in front of valued people in her or his own world. The CEO's greater effort also put his company in a genuinely positive light in many new places. Although it did not appear that any of the people who saw their friends receive the award were immediate, potential customers of Punjabi, they were sufficiently inspired to stir some positive word-of-mouth buzz about the awards ceremonies. A month after the ceremonies, a feature writer for the local paper heard the story through a friend-of-a-friend-of-a-friend who was a rugby player. Not one to be interested in business stories, she was nevertheless touched by the way the ceremonies had rippled out to surround the winners' lives. She tracked down the CEO and interviewed him, thus affording him another chance to speak glowingly about some of the specific examples of his winners' dedication and ingenuity. As he praised each person, the glow of the values he admired reflected back on him and his company.

You can change the meaning and the outcome of what you say by how you say it.

The reporter also interviewed the winners and several of the people at the organizations where the awards events occurred and then wrote a human-interest story that appeared, with photos, in a Sunday edition. The article generated several glowing letters to the editor by people who witnessed the ceremonies, the winners and others who were also moved by the story.

How can you give a lasting gift to 10 people you admire? For each person, think of the specific incident where that person has exemplified the quality that you most admire or cherish. Practice saying the story, then how you feel about the person. Then for each person, envision what group (family, religious organization, hobby or other interest or professional group) would be most significant for that person if you were to praise them among the members.

You have several ways to pass along your praise about the person you love or admire: simply call, e-mail or write to someone in their valued affinity group and share your story of praise. ■

Kare Anderson is a speaker and author.

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

SMPTE

The 34th SMPTE Advanced Motion Imaging Conference

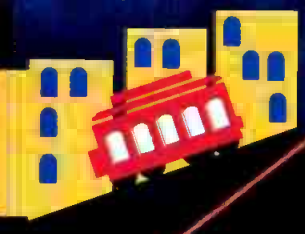
The Fairmont Hotel
San Francisco, California
February 3-5, 2000
"Bandwidth, Bitrate, and Resolution"

SMPTE features the following sessions:

- Audio Tutorial
- Video Tutorial
- Video, Video Compression, and MPEG
- Acquisition
- Compression/Transmission
- Switching/Storage
- Exhibition

Thursday, February 3 will feature an all-day seminar consisting of Audio and Video Tutorials. Friday, February 4 and Saturday, February 5 will consist of a technical program, including the Acquisition, Compression/Transmission, Switching/Storage, and Exhibition sessions.

Conference registration is available on the SMPTE web site at www.smpte.org, on site at the conference, or by contacting Ilisha Stier at (914) 761-1100 ext. 114.



San Francisco Convention & Visitors Bureau Photos

Further information is available at **www.smpte.org**

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QUICK DIAL 74

SONY

DSR-200A 3-CCD Digital (DVCAM) Camcorder

Combining a compact and lightweight body with the superior picture quality of DSP (Digital Signal Processing) and the DVCAM format, the DSR-200A is the ideal acquisition tool for video journalists, event and wedding videographers, stringers and production houses. 500 lines of horizontal resolution, 48kHz or 32kHz digital audio, three hour record time, and minimum illumination of 3 lux is only the beginning. Other features include 16:9/4:3 capability, Steady Shot, high resolution 1-inch viewfinder, time code operation, time/date superimposition and an IEEE-1394 interface for direct digital output. Offers full automatic as well as manual 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 continuously 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 balance. 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-20/40 DVCAM Player/Recorders

The DSR-20 and DSR-40 are versatile DVCAM VCRs with compact chassis and a variety of convenient functions for recording, playback and simple editing. They feature Auto Repeat Playback, Power-On Recording/Playback, multiple machine control interfaces and i.Link (IEEE1394) input and output. And, of course, they offer the stunning image and sound quality inherent to the DVCAM format.

i.LINK

- They both offer i.LINK ((IEEE1394) input and output. 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.

Inputs and Outputs

- They provide a full range of analog video inputs and outputs for integration into current analog-based systems. They both offer composite and S-Video input/output, while the DSR-40 (only) offers a component output as well. The DSR-20 is equipped with analog audio inputs and outputs (RCA), the DSR-40 with RCA inputs and XLR-balanced output. These connections in combination with their i.LINK interface allow a smooth transition to an all digital system in the future.

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-20/40 automatically rewinds the tape, then starts playing back the segment again.
- They are capable of searching for Index Points, which are recorded on the tape as "in-point" marks every time a recording starts. They can also search for photo data recorded on a DVCAM cassette by the DSR-200A/300/PD-100, or where the recording date has been changed.

Reference Input

- External sync input enables synchronized playback with other VCRs. Especially important in A/B Roll configurations. In addition, the DSR-40 only allows adjustment of H-sync and SC phase via the menu.

Control S Interface

- The DSR-20/DSR-40 have a Control S input allowing control via the optional DSRM-20 Remote Control.
- The DSR-20 adds a Control S output connector allowing two or more (up to 50) DSR-20s to be daisy-chained and controlled from one DSRM-20.

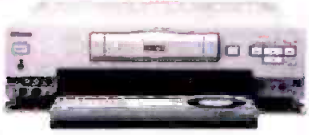
DSR-20 Only

- The DSR-20 can be powered by AC or DC.
- Equipped with Control L interface, the DSR-20 can perform simple Time Code-based editing when connected to another DSR-20 or other similarly equipped VCRs/cameras.
- In addition to Control L, the DSR-20 also incorporates an RS-232 interface for remote control of basic VCR functions from a PC.
- Supplied with the RMT-DS20 Wireless Remote for control of basic VCR functions.

DSR-40 Only

- Equipped with an RS-422A interface, the DSR-40 can perform as the editing player in A/B roll or cut editing system.
- It also has a simple recording function which can be controlled either manually or via its RS-422A interface.
- The DSR-40 is not equipped with a synchronization capability, the editing accuracy is performed by pre-roll and play.

DSR-30 DVCAM Digital VCR



The DSR-30 is an industrial grade DVCAM VCR that can be used for recording, playback and editing. DV standard 4:1:1 sampling digital component recording with a 5:1 compression ratio provides spectacular picture quality and multi-generation performance. It has a Control L interface for editing with other Control L based recorders such as the DSR-200A DVCAM Camcorder or another DSR-30. It also has a continuous auto repeat playback function making it ideal for kiosks and other point of information displays. Other features include high quality digital audio. IEEE-1394 Digital interface and external timer recording. The DSR-30 can accept both Mini and Standard DVCAM cassettes for up to 184 minutes of recording time, and can playback consumer DV tapes as well.

- Records PCM digital audio at either 48kHz (16-bit 2 channel) or at 32kHz (12-bit 4 channel).
- Equipped with Control L, capable of SMPTE Time Code based accurate editing even without an edit controller. Built in editing functions include assemble and separate video and audio insert.
- By searching for either an Index point or Photo Data recorded by the DSR-200A camcorder, the DSR-30 drastically cuts the time usually required for editing. The DSR-30 can record up to 135 Index points on the Cassette Memory thanks to its 16K bits capability.
- Audio lock ensures audio is fully synchronized with the video for absolute precision when doing an insert edit.
- Built-in control tray has a jog/shuttle dial, VCR and edit function buttons. The jog/shuttle dial allows picture search at ±1/5 to 15X normal speed and controls not only the DSR-30 but also a player hooked up through its LANC interface.
- DV In/Out (IEEE 1394) for digital dubbing of video, audio and data ID with no loss in quality.
- Analog audio and video input/outputs make it fully compatible with non-digital equipment. Playback compatibility with consumer DV tapes allows you to work with footage recorded on consumer-grade equipment. Tapes recorded in the DSR-30 are also compatible with Sony's high-end DVCAM VCR's.

QUICK DIAL 74

Panasonic

Broadcast & Television Systems

AG-EZ1 3-CCD Digital Video Camcorder

- Digital recording delivers 500 lines of horizontal resolution with no noise. (S/N ratio is 54dB).
- 10:1 power and 20:1 digital zoom lens. Both zooms are adjustable in four speeds (3.5-15 sec.) For extreme close-ups the lens can focus up to 1/4" from the subject.
- Audio is also digital, using PCM (Pulse Code Modulation) for quality that rivals CDs. Choose between two-channel 16-bit recording or two sets of 12-bit stereo, with the second set reserved for uses such as narration.
- Huge 1.5" 180,000 pixel color viewfinder provides 400 lines of resolution and displays all automatic and manual functions on demand.
- Variable speed shutter from 1/60-1/8000 of a second.
- Built-in SMPTE time code generator.
- Digital Electronic Image Stabilizer (DEIS) compensates for jittery videoespecially when the digital zoom is employed.
- Digital Photo-Shot lets you record a still-frame for six seconds, while audio continues as normal. 290 still pictures can be recorded on a single 30-minute tape.
- Three ways to easily find prev ously recorded scenes:
- TopScan plays back the first few seconds of each segment, providing a handy way to review an entire tape.
- Record/Review rewinds the camcorder and plays the last 10 seconds of the last recorded scene.
- Indexing encodes the first scene shot on a given day, to quickly find the starting point of each day's shooting.

$1695

NEW!

JVC

GY-DV500 1/2-inch 3-CCD Professional DV Camcorder

The world's first DV camcorder designed from the ground up for professional ENG work, the GY-DV500 combines the convenience and cost-effectiveness of Mini DV with the performance and features you need. It incorporate three 1/2-inch CCDs for superior picture performance (equivalent to 750 lines of resolution) superb sensitivity of F11 at 2000 lux and minimum illumination of 0.75 lux (LoLux mode). Ruggedly constructed with a rigid diecast magnesium housing providing the durability professionals crave, the GY-DV500's compact design and light weight (less than 11 lbs. fully loaded) makes it extremely portable. Additional features like the menu dial and Super Scene Finder assure ease-of-use and shooting flexibility, while the IEEE1394 and RS-232 interface allow integration into various non-linear and post-production systems. A professional camcorder in every sense, the compact, lightweight GY-DV500 redefines acquisition for corporate, educational, cable and broadcast production, as well as wedding videography and multimedia applications.

Professional Specifications

- Applies JVC's DSP with advanced 14-bit video processing to bring out more natural details, eliminate spot noise, accurately reproduce dark areas, and restore color information in dark areas.
- Three high-density 1/2" 380,000 pixel IT CCDs ensure the best possible image quality.
- CCDs are equipped with advanced circuitry to virtually eliminate vertical smear when shooting bright lights in a dark room. Ensures efficient light conversion with a sensitivity of F11 at 2000 lux.
- CCD Defect Correction function evaluates white defects with the lens closed and then stores their addresses in memory. When the camera is turned on, the data is sent to the DSP for storage and real-time correction.
- Black Stretch/Compress function ensures accurate reproduction of black areas on the screen. Advanced color matrix circuits give even difficult images a very natural appearance.
- Multi-stream parallel digital pipeline processing at 40 MHz creates an ultra-smooth gamma curve, calculated using a true log scale algorithm. The result is a dynamic range of 600% to accurately reproduce fine details and colors in shadows or highlights.

Professional Performance

- When activated, the Lolux mode increases sensitivity with almost no increase in noise. Lolux lets you capture high-quality video footage with excellent color balance at just 0.75 lux minimum illumination.
- Multi-zone iris weighting system gives priority to objects at the central and lower portions of the picture for accurate auto exposure under any condition, even if a bright subject moves into the picture.
- Adjustable gamma for adjusting the "feel" of the picture according to taste. Adjustable detail frequency for setting picture sharpness for a bolder or finer look.
- Viewfinder status display uses characters and menus to diplay selected information, including audio indicator, tape and battery remaining time, VCR operation and warning indicators. Camera settings and setup parameters can also be checked at a glance. A built-in menu dial lets you quickly navigate through the viewfinder menu.
- Highlight Chroma Processing maintains color saturation in highlights. The result is natural color reproduction, even in bright highlight portions of the picture.
- Smooth Transition mode ensures a smooth transition with no jump in color or light level taking place when manually changing gain or white balance settings.

Professional Audio

- To complement its superior video performance, the GY-DV500 offers outstanding digital PCM sound. You can choose between two 16-bit 48-kHz channels or two 12-bit 32-kHz channels with a dynamic range of 85 dB.
- In addition to camera mounted mic, has two XLR-balanced audio inputs with 48v phantom power and manual audio control. Phantom power can be switched off when not in use.
- Side-mounted speaker lets you monitor audio in playback and recording modes without headphones. The speaker also delivers audible warnings.

Compact and Lightweight

- Measuring 10-7/8 x 9-11/16 x 5-1/8 the GY-DV500 amazingly enough is almost half the size of the GY-X2B. Weight is carefully balanced for ease of use in an ENG environment and extended shooting.
- Consumes less than 20W of power, eliminating the need for cumbersome & heavy, large-capacity battery packs.

Automatic Functions

- Full Auto Shooting (FAS) mode for point-and-shoot ease of operation. You simply zoom and focus. Activating the Full Auto Shooting sets the camera to the Auto Iris Mode, even if the lens is set to manual. Automatic video level control (ALC) is also activated, along with Extended Electronic Iris (EEI) and Full Auto White, which provide both variable gain and variable shutter. Shoot continuously from a dark area to a bright area without changing Gain, Iris or ND filter.
- ALC (Automatic Level Control) with EEI (Extended Electronic Iris) for continuous shooting in all light levels — no need to switch gain settings or ND filter.
- Continuous Auto Black (CAB) circuit assures perfect Black Balance in a changing environment without having to interrupt shooting.
- Accu-Focus activates the electronic shutter for approximately ten seconds, forcing open the Iris. As a result, the depth of focus is minimized, and the lens can be focused quickly and precisely.

Conveniences

- Time code and index IDs allow frame accurate non-linear editing and mastering on standard formats with quick easy access to any target point.
- LCD display system let you switch or set functions, while referring to the counter or the on-screen display. Mode selection and initialization are also available via the menu display. Back-lit display supports shooting in dark areas.
- Back tally lamp lights to let you know that the camera is entering the Record mode. It flashes during the transition to the Record mode and when an error is detected in the camera.
- Variable Scan function allows flicker-free shooting of computer monitors. Shutter speeds can be set from 1/60.5 to 1/196.7 of a second in 255 increments to precisely match the scan rate of the monitor.
- Tape/Battery Remaining indicator means you always know exactly how much tape and battery power remains.

anton bauer

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)
5-3/4" x 3-1/2" x 2-1/4", 1.9 lbs (88kg)
Typical runtime: 2 hours @ 25 Watts 3 hours @ 17 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.

STEADICAM VIDEO SK

Steadicam Video SK2

Incorporating the same design principles as its larger Oscar and Emmy winning Steadicam cousins, the Video SK 2 is designed for cameras weighing from 9-19 lbs. Far more compact and less complex, the complete SK2 system –sled, stabilizer arm and vest- weighs a mere 21 lbs. and fits neatly into the trunk of a car.

Balancing is easier than ever and a single battery operates both camera and Steadicam. In fact, the SK2 is the only Steadicam simple enough to be operated without workshop training. A comprehensive instructional video will have you up and running in hours. But make no mistake, the lightweight Video SK2 performs like a true heavyweight.

Shoot on the move effortlessly, without cranes, booms or dollies. The sled-mounted monitor offers a crystal-clear picture, so your eyes are no longer glued to your camera's eyepiece. And with the weight spread comfortably over your torso you can shoot on the run, climbing stairs or even from a moving vehicle. With one smooth tracking shot capture what used to require five or six setups. An optional low-mode bracket can further enhance your creativity. Whether you shoot commercials, industrials or documentaries, the SK2 lets you offer more flexibility that ever before. If you can imagine a shot, you can shoot it more efficiently, more economically and more creatively than with any other other equipment.

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 and 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

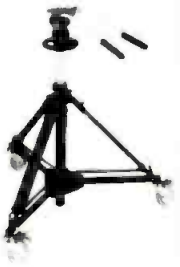
- The smallest head of the Sachtler's line.
- Sachtler Touch and Go quick release with automatic camera lock and safety lever/drop protection
- One step of dynamic counterbalance
- Frictionless leak proof fluid damping with one levels of drag
- Vibrationless vertical /horizontal brakes
- Built in bubble 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)



DV4XD System

Same as the DV4 PLUS —

- Five step of dynamic counterbalance
- Five step of vertical and horizontal drag

DV4XD System (0610) consists of:
Fluid Head (DV-6), Long Tripod (DA 75), floor spreader (SP 75)

DV8 System

Same as DV6 PLUS — • Greater load capacity

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

QTV

15" and 17" On Camera Prompters

The 15" and 17" On Camera prompter is the industry standard and designed for use with any camera, for any application. The high contrast, high resolution monitor, created by QTV, is the result of state of the art components and design. The monitor permits a much greater degree of tilt because of its cutaway feature. Its VPS Eyeline feature superimposes copy over the camera lens, enabling the reader to maintain maximum eye-to-eye contact. It's easy and comfortable to read. QTV's On Camera prompter will make sure the talent has clear access to the prompter. The 17" model has a viewing area of 123 sq. inches, 39% more than the 15" model. The 15" On Camera prompter is also available in a free standing pedestal model, which can be utilized both in the studio and in remote situations.

MVP-12

The MVP-12 incorporates QTV's latest design technology for studio and EFP prompting. The MVP-12 features the most advanced circuitry for a prompter of this size. Fully self-contained, it offers high brightness and high resolution that ensures unmatched ease of readability for the speaker. The MVP-12 is powered by AC or DC current utilizing the Sony type NP-1 or Anton Bauer 13-14 volt batteries, allowing on-location as well as studio prompting. It weighs only 19 lbs including the quick release roller plate for fast mounting and balancing. Below the lens mounting is utilized resulting ideal counter balancing for ease of operation.

MVP-9 Mini Videoprompter

The MVP-9 mini videoprompter is designed for use with smaller cameras and small spaces. The same level of performance is achieved as the larger CRT based units but in a smaller configuration that is powered by AC or DC current (as above). Created for the new generation of smaller, lighter cameras, the MVP-9 weighs only 17 1/2lbs and both the monitor and camera mount set up quickly and easily. As with the other units the VPS Eyeline feature assures maximum eye contact with lens while easily reading the script. It packs up very tightly, making it easy to take anywhere.

SONY

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 serial 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 consistent 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 outstanding wireless mic system for professional applications. Operating in the 800 MHz band range, they are barely affected 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 frequencies, 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 features, 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.

PROFESSIONAL VIDEO TAPES

QUICK DIAL 71

fuji

Professional Grade VHS

PG-30	2.39	PG-60	2.39	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	6.69	ST-60	7.49	ST-120	7.69

M221 Hi 8 Double Coated

Metal Particles			Metal Evaporated		
P630HMP	4.99		E630HME		7.69
P660HMP	6.29		E660HME		10.19
P6120HMP	8.29		E6120HME		13.59

M321SP Metal Betacam (Box)

05S	11.99	10S	12.49	20S	12.99
30S	14.99	60L	24.95	90L	39.95

DP121 DVC PRO

12M (Med.)	7.49	23M	8.79	33M	10.99
63M		19.99	64L (Lg.)		22.50
94L		30.99	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	1.69	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	3.89	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	7.45	ST-182 BQ	13.99

Betacam SP

B30MSP	13.49	B60MLSP	19.99	B90MLSP	29.95

Panasonic

Mini DV Tape

AY DVM-30	6.49	AY DVM-30 (10 Pack)	ea. 5.99
AY DVM-60	7.99	AY DVM-60 (10 Pack)	ea. 7.49
AY-DVM80	12.99	AY-DVM120	20.95

DVCPRO

AJ-P12M (Medium)	6.99	AJ-P24M	9.99
AJ-P33M	11.19	AJ-P66M	19.49
AJ-P66L (Large)	20.99	AJ-P94L	29.99
AJ-P126L			38.95

SONY

Hi-8 Professional Metal Video Cassettes

P6-30 HMPX	4.59	P6-30 HMEX	7.99
P6-60 HMPX	6.49	P6-60 HMEX	10.99
P6-120HMPX	8.49	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	3.59	T-60BA	3.99	T-120BA	4.79

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)	8.99
KCA-10 BRS	8.19	KCA-20 BRS	8.69
KCA-30 BRS	9.60	KCA-60 BRS	13.39

XBR 3/4" U-matic Broadcast Master (In Box)

KCS-10 XBR (mini)	8.79	KCS-20 XBR (mini)	10.59
KCA-10 XBR	9.29	KCA-20 XBR	10.69
KCA-30 XBR	11.99	KCA-60 XBR	15.69

KSP 3/4" U-matic SP Broadcast (In Box)

KSP-S10 (mini)	9.59	KSP-S20 (mini)	11.09
KSP-10	10.09	KSP-20	11.59
KSP-30	12.99	KSP-60	16.99

BCT Metal Betacam SP Broadcast Master (Box)

BCT-5M (small)	12.29	BCT-10M (small)	13.09
BCT-20M (small)	13.29	BCT-30M (small)	13.99
BCT-30M (small) (50 Pack)			ea. 13.49
BCT-30ML	18.99	BCT-60ML	21.99
BCT-90ML			27.95

Mini DV Tape

DVM-30EXM w/Chip	12.99	DVM-60EXM w/Chip	17.99
DVM-30EX "No Chip"	11.99	DVM 60EX "No Chip"	13.99
DVM-30PR "No Chip"	7.99	DVM-60PR "No Chip"	9.99

Full Size DV Tape with Memory Chip

DV-120MEM	24.99	DV 180MEM	26.99

PDV Series Professional DVCAM Tape

PDVM-12ME (Mini)	15.25	PDVM-22ME (Mini)	16.25
PDVM-32ME (Mini)	16.99	PDVM-40ME (Mini)	15.99
PDV-94ME (Standard)	33.49	PDV-124ME (Standard)	37.99
PDV-184ME (Standard)	44.95	PDVN 64N	24.95
PDVN-124N	31.95	PDVN 184N	39.95

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B&H
PHOTO - VIDEO - PRO AUDIO

FUJINON ENG LENSES

While ENG camera technology evolves faster and faster, delivering ever higher performance in ever small bodies, it has been increasingly difficult for lens manufacturers to improve quality while keeping size and weight to a minimum until recently. With Aspheric Technology (AT2) Fujinon has succeeded in manufacturing superior quality lenses that are both smaller and lighter than lenses of conventional spherical design. From the widest angle to the highest telephoto, Fujinon's broadcast hand-held style lenses offer unparalleled features and performance. In fact, they are so advanced and so optically superb they will reshape your thinking about how well a lens can perform.

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

A15X8EVM Standard Zoom Lens

A versatile performer in a compact package, offers AT2 inner focus, Quick Zoom and the "V-Grip" 7495.95

A20X8EVM Standard /Telephoto Zoom Lens

Combines additional focal length with AT2 inner focus, Quick Zoom and the "V-Grip" 11.499.95

CHYRON PC-CODI & PC Scribe

Text and Graphics Generator and Video Titling Software

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

PC-CODI Hardware:

- Fully-antialiased displays • Display and non-display buffers
- Less than 10 nanosecond effective pixel resolution
- 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

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 III- 450 MHz Processor
- Matrox Millenium II AGP 4MB WRAM display card
- 128MB 10ns 168-Pin (DIMM) S-DRAM
- IBM 10GB IDE System Drive
- Seagate Barracuda External 9.1GB SCSI-3 ultra-wide capture drive
- Adaptec AHA-2940U2W Ultra Wide SCSI-3 controller card
- Teac CD-532e 32X EIDE internal CD-ROM drive • 3.5" floppy drive
- Altec-Lansing ACS-48 3-piece deluxe speaker system
- Viewsonic G771 17" (1280 x 1024) monitor (0.27mm dot pitch)
- Microsoft MS Mouse • Focus 2001A keyboard
- Avid MCXpress for Windows NT • Windows NT 4.0 operating system
- 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 chassis they accept and route (on the vertical interval) virtually any video signal, including off-the-air and non-timebase corrected video. They also route balanced or unbalanced stereo audio. The audio follows the video or you can route the audio separately (breakaway audio). Each of the switchers offers manual control via front panel operation. They can also be controlled remotely by a PC, a Knox RS Remote Controller, or by a Knox Remote Keypad via their RS-232 port. Front panel LEDs indicate the current routed pattern at all times. Knox switchers are ideal for applicaflons 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-se ect, 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 abiflty 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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The GALLERY

Professional Services

Classifieds Help Wanted

It is the intent of **Queens Public Communication Corporation "QPTV"** to hire a television systems consultant to oversee the conversion of its current Sony based U-Matic format to Sony DVCam. Currently QPTV maintains two public access studio locations, including production, postproduction and transmission facilities in Queens, New York. The scope of work is as follows: • **Work together with QPTV and write the RFP • Evaluate and recommend a responsive bidder. • Work together with QPTV in the implementation of vendor's activities.** If you're interested, please contact QPTV to arrange for a meeting and site inspection. NYC metro-area applicants are preferred. Contact: Nancy Littlefield, Executive Director. Dan Leone, Director of Engineering. Phone-718-886-8160, Email-Nancy@qptv.org<mailto:Nancy@qptv.org>, Dan@qptv.org<mailto:Dan@qptv.org> Or write QPTV@ 41-61 Kissena Blvd. Flushing, New York 11355

OVER-NIGHT MASTER CONTROL OPERATOR: KNVA-TV, an Austin Television Station seeks Master-Control Operator to fill over-night position. Some experience in Television preferred. Computer experience is a must. Applications will be accepted until November 25, 1999. Please send resumes to Operations Supervisor, P.O. Box 490, Austin, Texas, 78767. EOE

SUPPORT ENGINEER: WHPN-TV UPN-57, Janesville / Madison, WI is seeking hands on support engineer. Transmitter, studio, computer, LAN, system planning & installation experience a plus. SBE certification and or FCC General Class License preferred. Send Resume to Dick Madouse, Chief Engineer, WHPN-TV, 2814 Syene Road, Madison, WI 53713 or FAX 608-270-5717. E.O.E.

Classifieds Help Wanted

Major Westcoast production/distribution company seeks a **NETWORK AFFILIATE ENGINEER.** Responsibilities include working directly with affiliates pertaining to resolution of problems both site related and transmisstion related, develop operational procedures as required, and implement changes in technology as required. Must be experienced in operation and installation of VideoCipher II+IRDs and stand alone descramblers, Affiliate Management System and Channel Control Computers for the VideoCipher II+ encryption system, PowerVu IRDs and PowerVu Authorization Computer system. Must have knowledge of RF. transmission systems and application of satellite link budgets in analog and digital domains. Candidate must have an intermediate level of experience regarding baseband analog video and audio signals, as well as, operations in both analog and digital playout facilites. Must also have knowledge of operational reference levels and subcarrier deviation. Please fax resumes to 310-235-5898.

CHIEF ENGINEER-Rare opportunity to build new VHF ABC network affiliate in Marquette, MI. You will oversee construction of new 1,200 foot tower, transmitter and studio facilities. You'll also perform hands-on preventive maintenance, operations, and diagnosis/repair of co-owned WBKP facilities in Calumet, including VHF transmitter, satellite equipment, STL/TSL/Intercity microwave and maintenance of studio and production facilities. Must be familiar with and able to troubleshoot, reprogram and maintain computer based broadcast systems. Knowledge of pertinent FCC rules and ability to ensure stations' compliance is mandatory. Ability to successfully deal professionally with other staff members, clients and the public is required, together with absolute honesty, integrity, strong work ethic and sincere desire to help other team members achieve group goals. Job is open immediately. Detailed resume and cover letter to WBKP ABC TV 5&10, 1122 Calumet Avenue #5, Calumet, MI 49913. Email: toms@wbkp.com

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CHIEF ENGINEER needed. Rare opportunity in beautiful Santa Barbara Ca. Seeking hands-on professional responsible for technical support of our young and growing Fox television station. Understanding of digital technology a must. The install is complete now we need a capable Chief to maintain the effort. All applicants must be team players with positive attitudes and good communication skills. Fax resume to 805-685-0998 attention General Manager. EOE.

Cosmos Technology Opportunities

We are updating our contact files
when openings occur for technology positions such as
Chief Engineer; Assist. Chief Engineers; Maintenance Technicians; LAN Network Administrators. If you have a short or long term interest in working for a leading broadcast group who is rapidly implementing digital technology, send your resume to:

Steve Smith, VP Engineering Cosmos Broadcasting Corporation
P.O. Box 19023 Greenville, SC 29602-9023; Fax: (864) 609-4420

WALB-TV Albany, GA	**WSFA** Montgomery, AL	**WLOX-TV** Biloxi, MS
WAVE Louisville, KY	**WTOL-TV** Toledo, OH	**KAIT-TV** Jonesboro, AR
KPLC-TV Lake Charles, LA	**WIS** Columbia, SC	**KCBD-TV** Lubbock, TX

We will consider all **qualified respondents.** Indicate you preference of station(s) and position(s): *Chief Engineer* openings available in:

Harlingen, TX; Wilmington, NC; Lubbock, TX; Biloxi, MS

Cosmos Broadcasting Corporation is an Equal Opportunity Employer.

BROADCAST MAINTENANCE ENGINEER: Major NYC TV News facility has an opening for 2 Broadcast Maintenance Engineers. Our plant is a unique blend of analog and digital equipment. The person we're looking for will have a minimum of 3 years experience troubleshooting Broadcast ENG / EFP & Studio equipment down to component level. Must be able to work independently as well as part of a team in a high pressure, deadline oriented atmosphere. Board swappers need not apply. Ability to work all shifts including nights and weekends is an absolute must. NO CALLS PLEASE. Attn. Steven Soep, Potomac Television Services, c/o CNN 5 Penn Plaza, New York, NY 10001. Fax: (212) 714-7920

ASSISTANT CHIEF ENGINEER: KARD TV FOX 14 in West Monroe, LA has an immediate opening for an Assistant Chief Engineer. Requirements for applicants are: Minimum of 5 years training in electronics maintenance or technical engineering; studio video and audio wiring; IBM-PC compatible computer hardware repairs and software maintenance; TV experience in VTR formats including 1", 3/4" and 1/2" (MII & DVCPRO) a major plus; UHF transmitter maintenance a plus. Salary based on experience. Send resumes' to KARD-TV, Attn: R. Logan, 102 Thomas Rd. Suite 400, West Monroe, LA 71291. KARD-TV FOX 14 is an Equal Opportunity Employer.

CHIEF ENGINEER: The Oklahoma Network (PBS) seeks an experienced hands-on technical manager to assist the Director of Engineering in overseeing day-to-day engineering operations of the Oklahoma City production facilities and in the transition to DTV. Qualified candidates should have experience as Chief or Assistant Chief Engineer in broadcasting including a strong maintenance background, operation design, capital planning and implementation, knowledge of physical plant systems, and technical construction. Supervisory, organizational and communication skills will be essential in guiding our technical team in planning and implementing projects. Excellent benefit package. Please send your resume to the Personnel Department, The Oklahoma Network, P.O. Box 14190, Oklahoma City, Oklahoma 73113. AA/EEO

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EOM

Best of the century

BY PAUL MCGOLDRICK

Now that we have survived this century — and millennium in some people's opinion — we have to face the brutal onslaught of the "Best of" lists, an activity that may have occupied the research hours of hundreds of journalists for the last twelve months. So I thought I would do my bit.

Seeing as how broadcasting only started this century, we don't have to go back very far to watch the changes. These are slow changes, really, considering we're in a consumer-driven market for entertainment. But my perspective is a little different than most, wondering — as I have sometimes done — whether getting into broadcasting was a sensible career path in the first place.

I could not have better planned the conditions for my first interview at the BBC. At 18, there was no previous work experience to fall back on, no family history, no old-school tie. Here was a young man who repaired TV receivers in his parents' dining room, held the third amateur TV license in the UK (G6AAC/T), and was already a published author (albeit in "Practical Wireless" known locally as Camm's Comic after the original editor). I went into the interview with absolutely no doubts about what I wanted to do. I was an employer's dream, but I didn't know that then.

The main BBC offices in London were in the Langham, a converted hotel directly across the road from Broadcasting House and connected to BH by a pedestrian crossing that was affectionately known as "Promotion Crossing" for the wonderful number of staff accidents that happened there. The Langham has since been converted back to a hotel as a Hilton, but I would have problems staying there with the number of wartime ghosts that are allegedly in residence.

The five-member interview team didn't give me the job I wanted. Instead, they offered me a Technical Traineeship, which unlike the old apprenticeships included sending me to college on their nickel, paying me a salary and on-the-job training in all areas of radio and television broadcasting. This sandwich training was popular for a while and it was ideal for me. Besides getting decent engineering qualifications I was taken through hands-on operations and maintenance in radio studios, recording, control, remotes and transmission, and a similar path through television. By the time I had finished, I had worked in just about every area in the business and — most particularly — I had worked on transmitters at Long Wave, Medium Wave, HF, VHF, UHF and SHF.

I saw and felt the start of the digital revolution when I played with one of the earliest tri-core cabled cameras from Philips.

Live television, black-and-white, 405-lines, tubes, image orthicons, for-real cameras and vidicons for newsrooms were the devices of the day. That was my world. In those days I could commute to Television Centre from South London in 30 minutes. I could park right behind TC with no problem; there were no security passes, no security issues.

But two-inch tape, color, 625-lines, plumbicons, klystrons and transistors came to the industry in rapid succession. I saw and felt the start of the digital revolution when I played with one of the earliest tri-core cabled cameras from Philips, a truly amazing jump from the nightmare of 90+ different conductor sizes and types in a standard (of the time) cable.

In broadcast operations there were also long periods of terrible boredom. Waiting for things to break can be a vicious way to spend a day, and when they do, your adrenaline rush lasts hours beyond the event. Changing a camera tube on the studio floor during a live broadcast has to be akin to working in the bomb squad. But at least in those days, when the show was over, it was over. There were post-mortems, of course, but the days didn't drag on and on as directors made them do later with the general availability of tape. With live television, you knew when you would make it to the BBC Club for that well-earned pint.

In a career that has spanned the last third of this century, did I make the right choice by entering broadcasting? Not if I had wanted to be a millionaire ... but I have certainly fulfilled the dreams I had when I started, and haven't run short of them yet. I'll continue to feel closer to transmitters than anything else because they are so demanding of engineers and engineering. The transmitter engineer can, I have always felt, do anything that the others can as well. Perhaps this will be the year to begin building the perfect transmitter, as I've long dreamt of doing, in my garage.

Ignore the politics, the lobbyists and the bean counters and broadcasting is still a great place to be. The industry will change in the next century but there will always be a need to get content from a source to a user, ensuring there will always need to be some form of a broadcast engineer. Happy New Year and welcome to the "Zeros" or the "Aughts" or whatever we are going to call the next 10 years. ■

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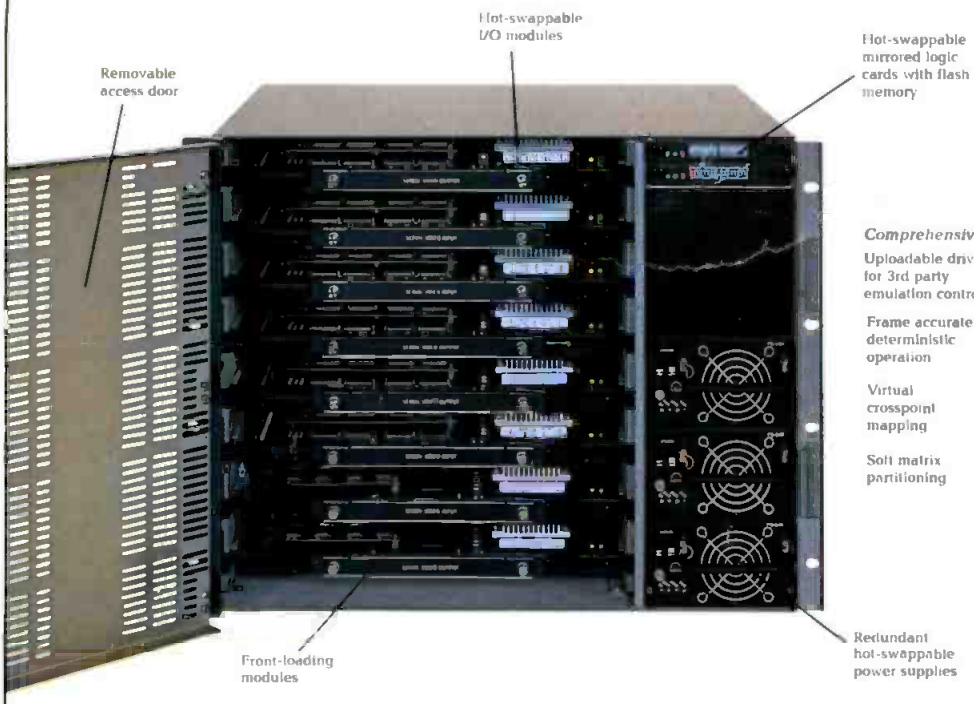

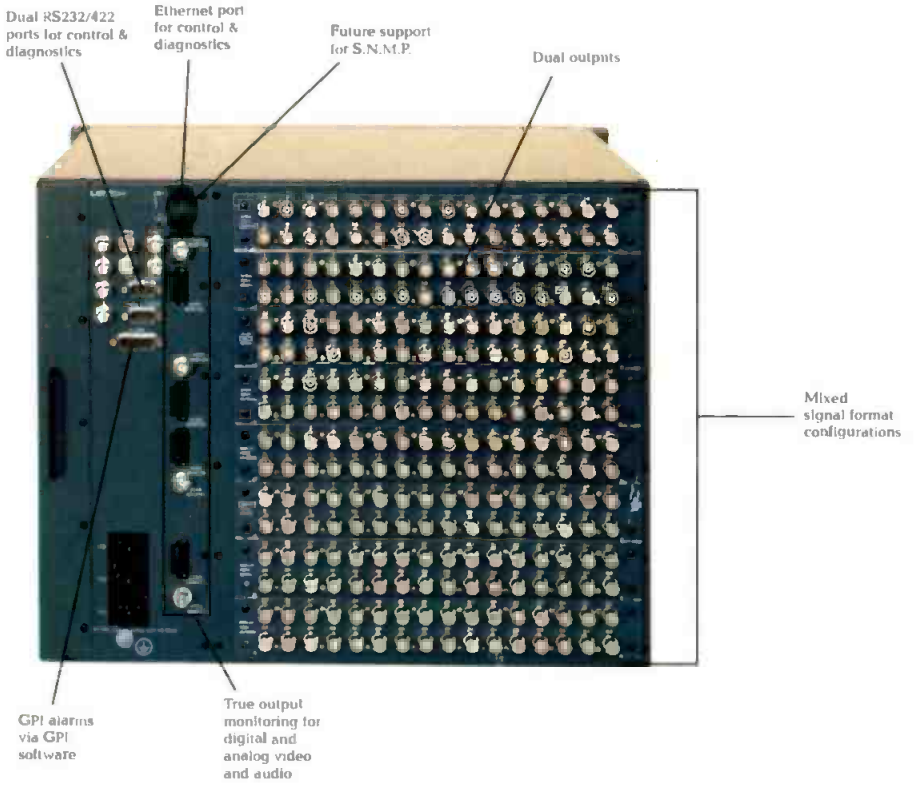

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