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August 1996/$10.00

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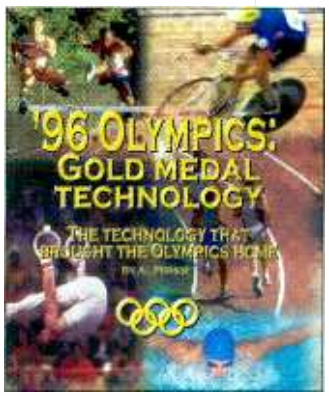

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ON THE COVER: Discreet Logic's Vapour Virtual Set in use at GTE mainStreet in LA. Other broadcast applications include the '96 Olympics, elections and interactive TV.

BROADCAST ENGINEERING (ISSN 0007-1994) is published monthly (except semi-monthly in June and December) and mailed free to qualified persons by Intertec Publishing, 9800 Metcalf, Overland Park, KS 66212-2215. Periodicals postage paid at Shawnee Mission, KS, and additional mailing offices. Canada Post International Publications Mail (Canadian Distribution) Sales Agreement No. 0956295. POSTMASTER: Send address changes to *Broadcast Engineering*, P.O. Box 12902, Overland Park, KS 66282-2902. CORRESPONDENCE: Editorial and Advertising: 9800 Metcalf, Overland Park, KS 66212-2215. Phone: 913-341-1300; Edit. fax: 913-967-1905. Advert. fax: 913-967-1904.

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Buy this baby, and it'll last you a lifetime

In a July *New York Times* story, five computer giants, Microsoft, Apple, Compaq, Dell and Intel describe the Grand Alliance HDTV standard as "already outdated." Outdated? Hell, it's not even been adopted!

If HDTV technology is outdated, I guess that means those of us in the broadcast industry are dinosaurs. Yep, we're out there chipping on stone tablets and beating on hollow logs. According to the computer industry, the proposed HDTV TV standard must be a Neanderthal's version of video.

In May, after more than five years of study, the Grand Alliance digital transmission standard was recommended for approval by the FCC. By all accounts, final approval by the commission was all but certain. But now, as we're in the final minutes of the fourth quarter, the whining computer weenies want to change the rules of the game. They don't want a mandated HDTV standard because then they couldn't obsolete your TV set every 18 months.

The cable industry isn't much better. After supporting HDTV standards development, they've jumped ship. Recently, National Cable TV president, Decker Anstrom said, "The drawbacks of government-mandated standards are well-established: they freeze technology, limit innovation and ultimately reduce consumer choice and competition."

Whoa, wait a minute. Did I hear the cable guy say standards would "limit competition?" Don't talk to me about competition Mr. Anstrom. You speak for an industry that when released from FCC rate regulation in January, immediately increased rates as much as 26%. Of course you don't like regulation, many in your industry have been ripping off consumers with high prices and lousy service since day one. Now you'd like to also freeze out the broadcaster from your systems.

TV stations depend on over-the-air and *compatible* wired delivery of their signals. If the cable and computer industries have their way, they'll develop their own standards, which may be incompatible with over-the-air broadcasting. The result could be noncarriage or inferior quality for TV station signals.

Consider also what standards have done for the entertainment and home electronics industries. How old is your TV set? Two, three, five, maybe 10 years old? It still gets the evening news, doesn't it? Did you watch some of the Olympics? Didn't have to buy a new picture tube, remote control or software upgrade to watch the programs did you? Compare that NTSC workhorse with your computer. Which has worked longer? Which do you expect to last longer, without needing software or hardware upgrades?

It's no secret that FCC chairman Reed Hundt would like to avoid the issue and let the "marketplace" decide the HDTV issue. Give me a break! Anyone remember AM stereo? While the FCC stood back and waited, Kahn and Motorola were busy beating each other to death trying for a "marketplace" decision. The result was that AM radio almost died, and AM stereo is about as popular as former Arkansas governor, Jim Guy Tucker.

It's not too late to make yourself heard. Stations need to contact their congressional representatives and tell them they'll support ATV. Let them know that you'll invest in broadcasting's future. Urge them to pressure the FCC to adopt the Grand Alliance standard now.

Heck, I'll even make it easy for you.

Send me your comments via E-mail, fax or letter. I'll duplicate each letter and send copies to every FCC commissioner and the chairman himself. Let them know that *BE* readers care about the future of broadcasting and that you are ready to take advantage of the opportunities that ATV technology affords.

Don't fall prey to Bill's shell game, "Buy this baby, it'll last you a lifetime." It won't and you know it.

Brad Dick

Brad Dick, editor

READER FEEDBACK
CompuServe: 74672,3124
Internet: be@intertec.com
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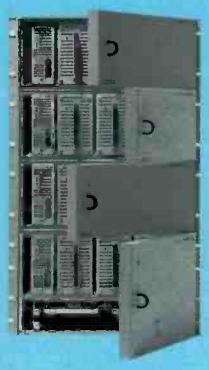
Don't get caught going down the wrong road. Some video servers will work for you today, but not in the future. Television technology is changing rapidly, with new compression standards, increased storage needs, additional multi-channel feeds, new distribution technologies will impact your facility. Which video server will take you into the future?



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Responding to ISDN

To BE:

At least you can get ISDN! Here in New England we have to deal with "Nyet-Next." Coverage is less than 10% and nobody at the company knows what it is. They refer you to a consultant in New Hampshire!

Best bet is to wait for cable modems. We're using them on our school system Ethernet and it's slick. We'll be offered it at home sooner than ISDN (within six months) and will have a 10MB/s pipeline for the ISDN prices you were quoted. Then the problem will be overloaded servers!

Jim Hayes
Fotec
jeh@fotec.com

Jim:

I tried your idea and called my winky dinky cable system. The service rep didn't know what a cable modem was. She thought I was trying to steal HBO or something and told me I'd better not mess with the cable. We're so backward out here in the Midwest that my ring number is still two longs and a short.

BD

WEIC vs. remote TV

Dear BE:

Once a month my husband receives a magazine that requires his immediate inspection. Often, I have wondered what information could be so tantalizing for him to stop mowing and hide behind this literature for an hour. When I notice the silence, I realize his issue of Broadcast Engineering *must have arrived. To anyone not in the business, this has got to be the most foreign language written in English. For my husband, engineer in charge (EIC) of a mobile production unit, you'd think he was reading a Dr. Seuss book. For me, well, even Dr. Seuss makes more sense.*

First, let's gain perspective on the characteristics of an EIC. He can get a meter reading on anything — the dishwasher, curling iron, VCR, even the dog has an output. Therefore, anything broken can be made to work again (sort of). He travels to exotic regions only to bring home souvenir hotel soaps and shampoo bottles. He has yet to take you on a vacation where there is no TV truck. He keeps business cards of others he has worked with in his front pocket and a wallet full of crumpled receipts and media passes in the back. He cares not for sports, only the truck in which the game is being broadcast from.

As the wife of an EIC (WEIC), I have yet to learn the importance of DBX and how it affects the RTS according to the FCC and SBE. Or why the DVE and Beta SP need a DA to transmit kb/s to the CCU. I have been instructed by my husband how a triax cable is metered and the Ohm's Theory (or is it a Law?). Nevertheless, I am the (WEIC) or better yet, the WICEIC (figure that one out). With that title I hold certain responsibilities that only those in my business understand.

I am referring to those of you who keep the home fires burning for our mobile production crew. We members of the PTA who use an ATM to run by the KFC for a PDQ meal while reciting the ABCs. My obligations as a WEIC require patience and understanding. I wait for his calls to assure me he has arrived safely. I am understanding when he is too tired or busy to hear my decorating woes. Providing a stable environment when EIC/dad goes away is tough. Keeping my sanity when EIC/husband comes home is tougher.

My EIC arrives home worn out and wrinkled with one clean pair of underwear. I receive a kiss and a Holiday Inn shower cap. My EIC is tired and hungry, ready for a home-cooked meal. Being in competition with restaurants puts a particular stress on the WEIC. Dinner must live up to the rib eye with wine sauce he had last night. This week, the kids enjoyed spaghetti and peanut butter on paper plates. Once again it is time to plan, prepare and Pfaltzgraf. The transition from the road to home must go smoothly for my EIC. He needs time to adjust and relax. He should not be burdened with overdue bills or household duties for at least 12 hours. He is physically and mentally drained, having had the pressure of a live TV shoot on his shoulders. As WEIC, I must handle this situation delicately because I know there is only 48 hours until he leaves again. Our time together is precious and should be spent wisely; with plenty of time to nag and nit-pick after he retires (this is something I remind myself of daily). I must manage his time accordingly, yet allow him to think he managed it. The EIC still needs to feel useful at home. He needs assurance that his family depends not only on his income, but his strength, his dexterity and his artistic maneuvers with the weed eater (it's that ego thing).

His evening is spent telling bedtime TV truck tales to the kids and tucking them in bed with their empty shampoo bottles. My EIC and I talk into the night, finishing stories we had started over the phone. I smile while he drones on about the event, nod in agreement as he details the difficulties with Camera 5. I "ooh and ahh" over the audio patching and monitor setup. I "oh really?" about the producer and "you're kidding?" about the A2. I rub his feet as he rambles on, drifting in and out of sleep.

My EIC awakes mid-morning refreshed and eager to tackle the bills, the yard, the kids and the garage. We fall into our family mode until he departs again. For the next 36 hours we devote our attention to him, praising his household accomplishments. He knows he is needed. He knows he is loved. He knows he is the only one that can mow the yard in that crisscross pattern.

I am the WEIC. I do my best to maintain him as he would his truck. Those of you in the business know the difference of a well-kept truck and one that is not. Everyone involved from the producer to the camera operator to the driver to the EIC bond together to create a masterpiece of fonts, sounds, pictures and graphics. But there are others of us behind the scenes. Pleased and proud no matter how the shoot goes, I wonder...any chance a WEIC could get on payroll?

Carrie S. Fain
Springfield, MO

Correction: In the July article, "A Review of IOT Performance," the article incorrectly stated the tube life of the EEV IOT-equipped sockets. The last sentence of the first paragraph under "Tube life" should have read: Included in this universe of all EEV IOTs are 28 tubes with more than 20,000 hours; of these, 20 tubes have more than 25,000 hours; and of these, five tubes have more than 30,000 hours.

Send your thoughts to the editor at CompuServe 74672,3124 or fax to 913-967-1905.

The longest journey ended with 70,305 steps

In my June editorial, I asked readers to guess how many steps I took in my trek to cover the 1996 NAB Convention. There were many responses, most of which were much higher than the actual number of steps that I took. There were times, however, when it seemed like I took 100,000 steps.

The correct answer was 70,305 steps.

The closest answer, 69,420, was from *BE* reader Larry Sues. For the closest guess, he wins a 1996 *Broadcast Engineering* magazine T-shirt.

Congratulations Larry!

BD

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By Dawn Hightower, senior associate editor

WRAL-HD hits the air

WRAL-TV, now WRAL-HD, is the nation's first experimental HDTV station to go on the air. The new Channel 32 transmitted full-power digital test signals on July 23, and three days later, transmitted the first digital video and sound. The station operates at 100kW with a 1,750-foot antenna.

Full operation will follow a period of testing the HDTV system as recommended to the FCC by ACATS and as documented by the ATSC. Channel 32 will continue to make technical measurements of digital signal propagation and test coverage of the Raleigh-Durham-Fayetteville area. Signal testing will continue until next spring when broadcasts of regularly scheduled programming will begin.

Clarification of tower registration procedures

The FCC has issued a public notice that updates tower registration procedures concerning the filing windows for existing towers (those studied by the FAA and cleared by the FCC prior to July 1, 1996).

The update does not alter the procedures for proposed structures or existing structures that do not require a new FAA aeronautical study. Because the registration Form 854 wasn't available until June, many tower owners had difficulty in getting the form and securing surveyors to verify site data. The updated filing window gives tower owners more time to become informed of the requirements, obtain the form and verify their site data. See "FCC Tower Registration, Part 1" on p. 10 for more information.

If you have any questions contact the Wireless Telecommunications Bureau's Consumer Assistance Branch in Gettysburg, PA at (800) 322-1117. Copies of the fact sheet and Form 854 are available from the FCC's Forms Distribution Center at (800) 418-FORM (3676) or at its web site at www.fcc.gov/wtb/antstruc.html.

SBG tests high-speed wireless Internet system

Sinclair Broadcast Group (SBG) has completed extensive field testing of its SUPERCAST system in the Baltimore area using two UHF-TV stations. The system broadcasts Internet and Internet-type info to computers using the TV signal and can be delivered free to the public. The system can deliver digital data at speeds of 100kb/s.

With the SUPERCAST system the TV signal is received by standard computers equipped with a broadcast modem that plugs into one of the computer's expansion slots, and a TV antenna or cable connected to the computer carries the signal to the modem. A return path using a standard phone line is activated only when the user needs to send a response back to the station or to conduct secure commercial transactions.

Data received by the modem is stored on the computer's hard drive for real time or future viewing. This over-the-air delivered data is transmitted 24-hours a day and is continuously updated. The consumer can use a standard browser to view and interact with the received data that is stored on the hard drive. Because the data is delivered from the hard drive, the material is available almost instantaneously.

The TV data broadcasting system does not interfere with the delivery of TV pictures and sound. The high-speed digital data is carried on the TV signal using a portion of that signal that is reserved for data transmission. No new FCC regulation is required to implement the system.

Norpak supplied the equipment and software that was used in the test.

FCC approves WavePhore's data transmission system

WavePhore is ready to market its TVT 1/4 technology now that it has FCC approval. The high-speed digital datacasting technology will transmit digital data over existing TV signals. The FCC go-ahead marks a successful conclusion of WavePhore's three-year initiative to seek amendment of FCC rules to allow digital data transmission within the video portion of TV broadcasts without prior FCC approval.

The TVT 1/4 system enables broadcasters to transmit digital data with the analog broadcast signals without discernible degradation of the video signal and without modification to their existing transmitter system. Data is transmitted at a range of 384,000b/s.

For more information, access the Internet at www.wavephore.com or contact David Deeds, chairman and CEO at (602) 438-8700 or E-mail at ddeeds@wavephore.com.

CAI Wireless demos digital wireless network

CAI Wireless Systems, Inc. has transmitted digitally encoded programming to Thomson TV set-top converters using CAI's wireless delivery system. The digital wireless cable system is in the final stages of testing.

The programming transmission demonstrated the viability of digital wireless cable technology.

In July, the FCC adopted the Digital Declaratory Ruling. Now, the commission will routinely grant wireless cable and ITFS applications proposing to transmit digitally on a non-interfering basis. Wireless cable operators will be able to increase the carrying capacity of their wireless cable spectrum to more than 100 channels. This ruling makes wireless cable the first terrestrial video programming service to be authorized to go digital.

TV/COM receiver cheaper because of new chip

TV/COM's QPSK receiver is now half the cost of its previous design. The chip features patented variable rate technology that combines the functions of three chips into a single ASIC. The receiver includes a consumer-grade tuner that improves signal acquisition by up to 50%. The QPSK receiver can be used in consumer satellite set-top boxes and commercial digital satellite decoders.

TV/COM's patented Variable Rate Demodulator (VRD) technology has been combined with forward error correction functionality and integrated into a single chip. The chip incorporates VRD, Reed-Solomon and Viterbi functions, which previously required three chips.

The design allows performance from 2 to 90Mb/s. This will enable the satellite operator to vary the bandwidth dynamically to fill a 54MHz transponder completely or to transmit a SCPC signal with the same receiver with no hardware or software changes required.

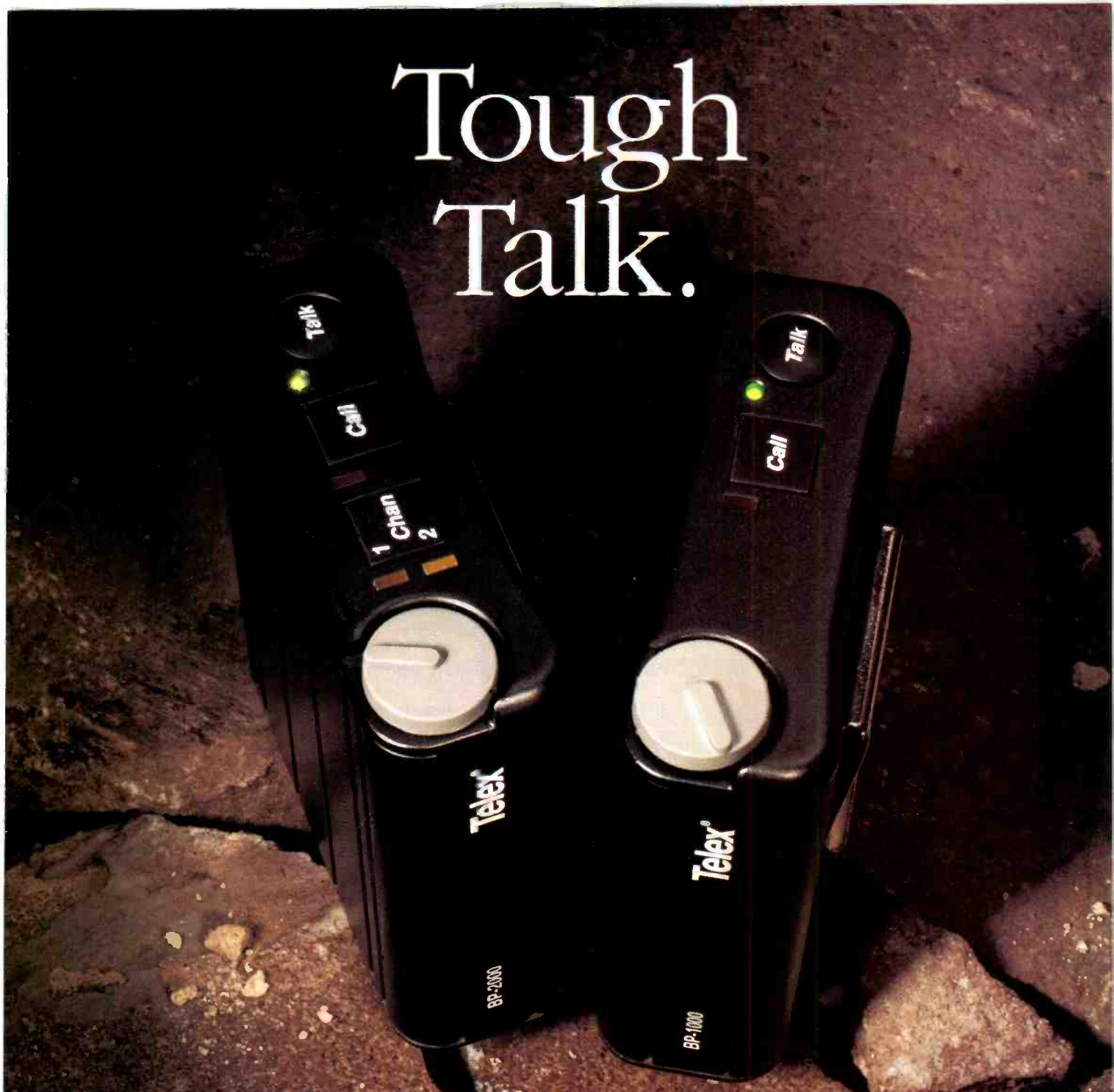
For more information contact Andrea La Vorgna at (619) 675-4714 or by fax at (617) 451-1505.

NAB offers new publications

The NAB Services Department has more than 100 publications available for purchase. Following are eight newly released publications: "The Antenna & Tower Regulation Handbook," "The NAB Guide to Unattended Station Operation," "NAB Spectrum Chart," "These Taxing Times: A Guide for Broadcasters," "The Broadcaster's Guide to the Internet and the World Wide Web," "Broadcasters' Law and Regulation Conference Papers 1996," "1996 Broadcast Engineering Conference Proceedings," and the " 1996 Multimedia World Journal."

To order a particular publication or to receive a NAB Publications Catalog, call (800) 368-5644 or access the NAB web site at www.nab.org and click on The NAB Store. ■

Tough Talk.



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Circle (12) on Action Card

By Robert D. Greenberg

FCC tower registration, part 1

Editor's note: A two-part special report on FCC Tower Registration by Robert Greenberg will run through September. Harry Martin will resume his FCC Update column in October.

On Nov. 28, 1995, the FCC adopted a Report & Order (R&O) in WT Docket No. 95-5, 61 Fed. Reg. 4359 (Feb. 6, 1996), which created rules that will streamline the antenna structure clearance process. These rules replace the current clearance procedures with a uniform registration process.

Part 17 entitled "Construction, Marking and Lighting of Antenna Structures" also has been updated to be consistent with FAA air-safety recommendations. Antenna owners are now primarily responsible for painting and/or lighting. These changes unify federal guidelines for painting and lighting antenna structures and designate a single point of contact for resolving lighting outages.

This proceeding was initiated by the FCC's Tower Standardization Team to explore ways to streamline the antenna clearance process, to reduce administrative burdens on the public and the commission and to ensure safety in air navigation.

For the purpose of this article, the terms antenna structure and tower are interchangeable and refer to any structure that is an antenna or has an antenna on it and is subject to FCC rules.

Highlights of the R&O

- Registration will reduce the number of entities responsible for antenna painting and lighting from 900,000 licensees to 75,000 owners. Approximately 75,000 of the 500,000 antennas require notification to the FAA.
- Registration will reduce the number of filings concerning minor changes to site data by a factor of 12. On average, there are 12 tenant licensees on each of these 75,000 antenna structures.
- Registration will reduce the time it takes to process tower-related applications and notifications requiring consideration of painting and lighting specifications.
- Electronic filing will decrease the possibility of processing backlogs by permitting owners to register immediately upon receipt of an FAA "no hazard" determination.
- Updating Part 17 to be consistent with the latest FAA air safety recommendations will unify federal guidelines concerning tower painting and lighting.
- The industry and the FCC will save millions of dollars each year.

Background

The FCC and the FAA have the statutory responsibility of ensuring that towers do not present an air safety hazard. Section 303(q) of the 1934 Communications Act, as amended, mandates that the commission "require the painting and/or illumination of radio towers" in cases where there is a "reasonable possibility" that an antenna may cause a hazard to air navigation. Similarly, Section 1501 of the FAA authorizes the FAA to require that persons proposing to erect a structure provide notice to the FAA, when such notice will promote air safety. In its efforts to promote safe air commerce, the FAA periodically publishes Advisory Circulars, two of which set forth its recommendations for painting and lighting of structures.

In 1992, at the request of the FCC, Congress amended Sections 303(q) and 503(b)(5) of the Communications Act to: 1) make antenna owners, as well as commission licensees (and permittees), responsible for tower painting and lighting, and 2) provide that non-licensee antenna owners may be subject to forfeiture for violations of painting or lighting requirements as specified by the commission.

WINDOW	STATES/TERRITORIES	APPROX. # OF FILINGS
JUL 1- OCT 31, 1996	MI, MT, AZ, HI, NC AK, NM, NY, MA, MO	12,835
NOV 1-30, 1996	IL, WY	3053
DEC 1-31, 1966	NV, OK, PR	3167
JAN 1 - FEB 28, 1997	CA, OH	6737
MAR 1-31, 1997	IA, VA	3273
APR 1-30, 1997	AS, GA, GM, GU, MP, VI	3141
MAY 1-31, 1997	LA, ME, RI	3077
JUN 1-31, 1997	CO, MN	2993
JUL 1-31, 1997	NE, PA	3022
AUG 1 - SEPT 30, 1997	FL, IN	6946
OCT 1-31, 1997	DE, KS, WA	2961
NOV 1-30, 1997	NH, OR, WI, WV	3096
DEC 1-31, 1997	AL, DC, MD	2953
JAN 1-31, 1998	AR, ND, UT	2943
FEB 1-28, 1998	ID, MS, SD, VT	2996
MAR 1-31, 1998	KY, TN	3149
APR 1-30, 1998	CT, NJ, SC	2930
MAY 1 - JUN 30, 1998	TX	8331

Table 1. Filing windows for existing structures constructed prior to July 1, 1996. (Revised as of July 19.)

Since the late 1950s, the FCC has worked in concert with the FAA to promote air safety through the antenna structure clearance process. Currently, each applicant proposing to construct or alter an antenna that is taller than 200 feet, or that may interfere with the approach or departure space of a nearby airport runway, must notify the FAA of proposed construction. The FAA determines whether the antenna constitutes a potential hazard and may recommend appropriate painting and lighting. The commission then uses the FAA's recommendation to impose specific painting and/or lighting requirements on licensees.

Who must register

The final rules require the owner of each antenna requiring FAA notification to register the structure with the commission. A single entity will be responsible for notifying the commission of changes, rather than each tenant licensee on the structure. The FCC sees little benefit in broadening the original proposal to include all antenna structures. The initial goal was to streamline the antenna clearance process that affects only 75,000 of the 500,000 antenna structures. Only those structures that meet FAA notification criteria have been identified as potential hazards to air navigation. The remaining structures are either less than 20 feet above existing terrain, shielded by nearby obstructions or otherwise well below established flight paths. The commission will not register structures that do not meet the FAA notification criteria.

The final rules also require registration for each antenna, including structures that make up AM directional arrays. In order to streamline the antenna clearance process, each structure must be individually registered. By registering each applicable structure within AM arrays, the FCC can easily identify the painting and lighting requirements for each structure. The commission noted that completing the one-page Form 854 by the structure owner and processing by the staff requires a modest amount of time and does not require a fee.

The commission will only require registration of antennas that require FAA notification. Furthermore, the registration number issued to structures within a given array would not be related numerically or otherwise. Notwithstanding registration requirements, the FCC will continue to solicit the coordinates for the center of the array when a licensee files for a construction permit using FCC Form 301, because the center coordinates are used for calculating signal coverage.

When to register

After July 1, 1996, all new antennas meeting the notification criteria must be registered with the commission. However, for existing antennas, the FCC agrees with the commenters that prescribing filing windows by region is the simplest method to register these structures. Therefore, the commission is requiring owners to register existing structures by state, in accordance with their filing windows. In this manner, existing structures will be registered over the two-year period between July 1, 1996 and June 30, 1998.

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Circle (73) on Action Card

(See Table 1.) Notwithstanding the filing windows, owners registering existing antennas that require re-notification to the FAA must register immediately upon receipt of the new FAA determination.

The commission also will require that each applicable structure be registered prior to construction. Proposed antennas that are determined by the FAA to present a potential hazard to air navigation must be lighted during construction. The registration process will be the government's only method of requiring such safety lighting, because the FAA does not have statutory authority to mandate the painting or lighting of antennas. The timely registration of all applicable structures is essential to the integrity of the new registration database. The commission intends to eliminate the possible processing delay by permitting owners to register electronically. In cases where a structure owner wishes to begin construction immediately upon receipt of the FAA determination, the electronic filing capability will enable the owner to register the structure with the commission and receive a registration number within minutes.

How to register

The commission will require antenna owners to file revised Form 854 "Application for Antenna Structure Registration." The FCC will permit owners, at their option, to register electronically. Not all owners will have similar needs when filing FCC Form 854, thus the commission intends to permit owners to file electronically or via mail. Using either method, the owner of a proposed structure could begin construction as soon as a registration number is obtained.

The FCC will not require owners to pay a registration fee. Although there may be significant start-up costs involved in implementing the registration process, a nominal fee could deter some owners from registering structures, and would reduce the speed of service in processing registrations, and would complicate electronic filing procedures. Instead, the commission will seek to recover administrative costs through the benefits of the streamlined system and by charging a nominal fee to those who wish to access the antenna registration database.

Therefore, after a majority of the existing structures are registered, the FCC may consider permitting on-line queries of the antenna registration database through a "900" telephone number on a fee-per-minute basis. Prior to providing a "900" service, the commission will initiate a notice and comment proceeding concerning applicable fees. Such fee-per-minute charges would only apply to value-added access to the database, such as on-line status reports for registration applications. Database searches and copies of the entire database, however, would continue to be available through the copy contractor or free of charge through the Internet.

Finally, the commission is not requiring owners to renew their registration periodically. Although it is important to maintain the validity of the site data contained in the database, there is little benefit in mandating a renewal process for tens of thousands of owners, when only a small percentage will need to update registration information in the next five or 10 years. Therefore, the FCC will not require owners to renew their antenna registrations on a periodic basis. Instead, owners must notify the commission, using FCC Form 854, of any change of structure height, ownership, owner's address or upon dismantling the structure. ■

Robert D. Greenberg is a senior supervisory engineer with the Federal Communications Commission, Washington, DC.

Author's note: I would like to thank the members of the Tower Standardization Team for their efforts and insights over a three-year period. The team members include Lisa Stover, Steve Markendorff and Roger Noel of the Wireless Telecommunications Bureau; Jim Voigt and George Dillon of the Compliance and Information Bureau; and Robert Greenberg, Robert Hayne and Sharon Bertelsen of the Mass Media Bureau.

Editor's note: The opinions expressed by the author are not necessarily those of the Federal Communications Commission.

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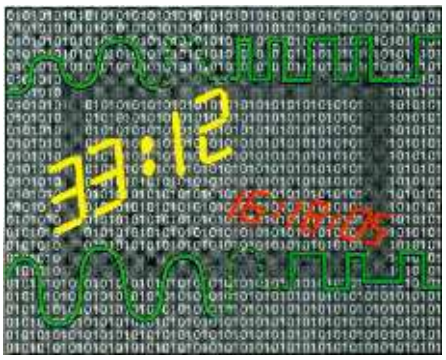
Circle (6) on Action Card

William Y. Zou



Designing for multichannel DTV

With the completion of technical development and regulatory proceedings, broadcasters finally get to the critical stage: the implementation of digital television (DTV). Implementing DTV will provide broadcasters not only the opportunity for improved services to their communities, but will present numerous system design and planning challenges.

The architecture of DTV systems will embrace digital technologies in the studio and the signal distribution chain. The incorporation of NTSC and new standard definition TV (SDTV) systems will require a gradual transformation to a digital infrastructure. The basic architecture will be dependent on a few significant practical factors, most notably costs and consumer demands.

Video compression

With the adoption of the U.S. DTV standards, MPEG-2 standards will be the compression choice for multichannel broadcast. MPEG-2 compression is defined by a set of parameters, among them are video resolution, bit rate, GOP structure, aspect ratio, motion prediction, refresh rate, etc. The selection of compression parameters depends on a variety of considerations, including picture quality, bandwidth, need for editing and random access. Due to the use of human visual characteristics within MPEG-2 algorithms, the only reliable way to determine picture quality at present is through subjective assessment. Careful consideration must be given to the selection of test material to ensure an accurate representation of on-air programming.

For multichannel SDTV operation, statistical multiplexing can further improve picture quality without increasing bit rates and/or bandwidth. However, the effectiveness of using statistical multiplexing depends on the contents of individual programs and the number of programs multiplexed. In general, the more channels that are multiplexed, along with the variety of program content involved, the more picture quality improvement can be achieved through statistical multiplexing.

Switching and insertion

Switching and insertion in a multichannel DTV environment is much more complex than in analog or uncompressed environments. Based on the MPEG-2 standards, video, audio and data are compressed through their encoders and then processed by the transport layer for packetizing and multiplexing. It is believed that the compressed/packetized signal will be one of many signal formats in DTV facilities. To switch compressed/packetized streams, switchers will need to detect the switching points and provide adjusted clock reference and time stamps for proper reconstruction of the bitstreams for display. New equipment and operational practices remain to be developed in these important areas.

Signal storage

Signal storage in DTV will have a new meaning. Certainly, traditional VTRs will still be used for baseband recording. However, for compressed/packetized video, audio and datastreams, all that is needed is a data recorder capable of recording at the required data rates. Existing digital VTRs can be modified using proper interfaces for DTV operation.

During the ATV field testing, modified D-3 VTRs were used for playing back compressed source material and recording demultiplexed bitstreams. The creation of standards for the D-6 digital cassette recorder and DVC will give broadcasters new formats for a range of HDTV/SDTV applications. By recording only low bit-rate signals, such as the 19Mb/s GA bitstream, the cost of the data recorder can be reduced, making the initial DTV conversion less costly.

Most recently, disk-based and laser disk recording technologies have begun to compete with traditional tape-based recording/playback equipment. Disk arrays have been widely used in video servers and have the advantage of large storage capacity and random access. In the future, these recording media will most likely co-exist.

Image capture

For HDTV and SDTV production, the decision to use progressive or interlaced cameras will have to be made by the station/network. Considerations include picture quality, required bandwidth and equipment cost. Recently, 525- and 720-line progressive cameras have been developed and impressive picture quality has been demonstrated. As indicated by the ATV subjective tests, progressive scan offers better quality in programs that have fast motion combined with detail, such as sporting events. On the other hand, interlaced scan can provide excellent quality for DTV service with the advantage of lower equipment cost. By using proper conversion equipment, interlaced source material can be deinterlaced for compression and transmission.

To facilitate operating in the 4:3 and 16:9 aspect ratios in the simulcasting environment, newly developed cameras can be operated in either mode. These cameras were introduced to serve HDTV and SDTV and were in part an answer to the high cost of HDTV cameras. These cameras could be operated as NTSC cameras or as 16:9 SDTV cameras with the mixed and switched signals upconverted for broadcast. However, now appearing on the market are lower-cost, medium-resolution cameras that operate at HDTV scanning rates.

Video servers are an emerging technology that may replace or supplement some traditional broadcasting equipment and will likely be incorporated in initial DTV multichannel broadcast. These units can support multiple channels, simultaneous read/write, random access and digital and analog I/O. Video servers will be used for source compression, program storage/library, nonlinear editing, spot/commercial insertion, animation and master control/management and will be implemented widely in the future.

As the transition to multichannel ATV nears, more and more equipment will become available. This "family" of HDTV equipment from JVC is among the first.

Signal conversion

Analog NTSC largely required that the signal be captured, stored and distributed in the same format, from origination to the end users. New digital systems will allow the

capture, transmission (including storage) and display formats to be different.

Digital technology has already been integrated within facilities where signals are captured, recorded and distributed in serial, parallel, composite, component and compressed formats. As part of the introduction of ATV, many more signal formats will need to be captured, stored and converted. The conversion of signals will be an important commonplace part of any new facility architecture.

Format conversion will be integral to new facility designs. In DTV facilities, conversion between NTSC and HDTV and conversions among HDTV formats will be necessary. For conversion between HDTV and NTSC, a downconverter is needed for simulcasting with the HDTV service. It also performs the frame rate conversion when NTSC programs are derived from 60Hz HDTV sources. An upconverter allows the use of NTSC materials for HDTV programming and is needed to take advantage of the industry's huge NTSC programming library, as well as to continue to employ existing NTSC production equipment, especially during the initial stage of DTV service.

As defined by the ATSC DTV standard, progressive and interlaced HDTV formats with various spatial and temporal resolutions are allowed. Therefore, the functions of a format converter should include deinterlacing, spatial up/down conversion and temporal up/down conversion.

Networking

Traditionally in broadcast environments, video and audio signals are routed through hard-wired routing switchers. The implementation of MPEG-2-based compression and packetization in HDTV and SDTV, plus the introduction of multimedia in production and related services, will bring forth new facility architectures. As discussed earlier, compressed/packetized bitstreams can be treated like computer files and distributed over computer networks.

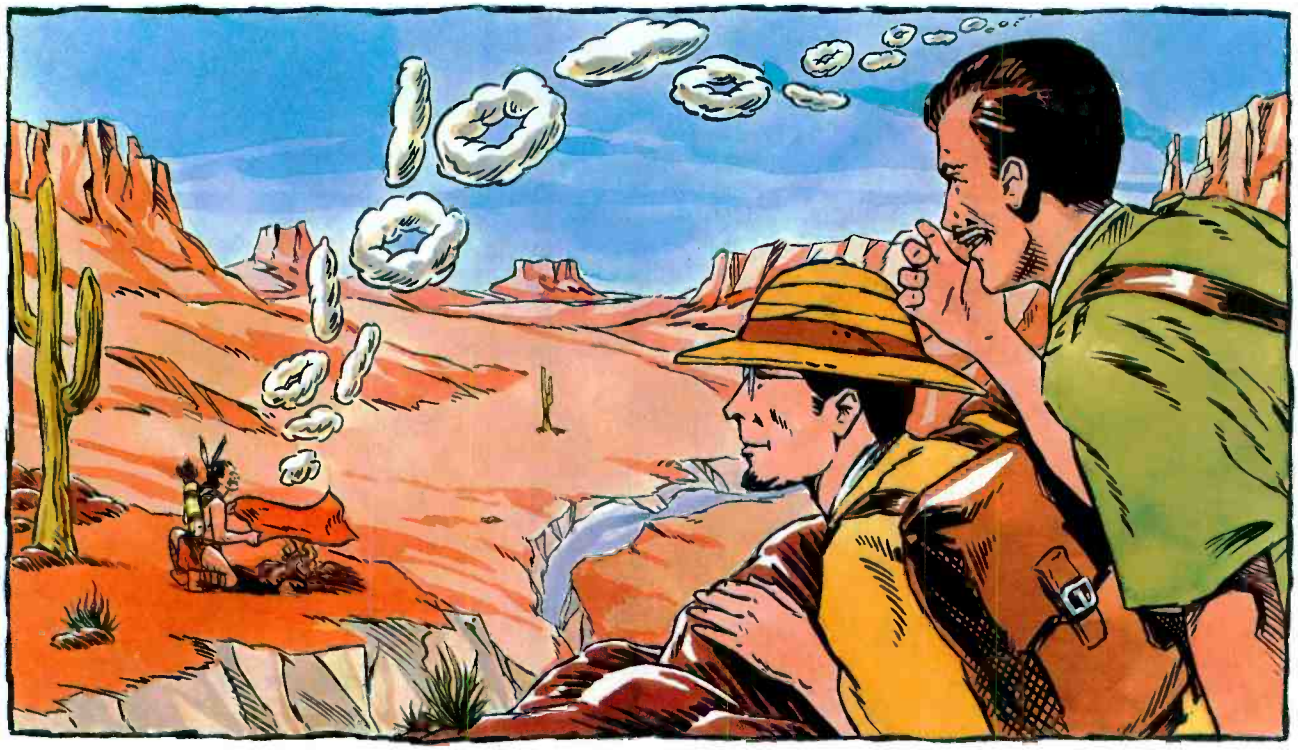
It is expected that future network architecture will transition from dedicated and fixed hard-wired facilities to virtually connected, cell-routed/addressed and rate- and media-independent, flexible and efficient systems. Currently, various networking technologies have been considered for digital studio applications. Some of these technologies, such as Asynchronous Transfer Mode (ATM), Fibre Channel (FC) and Serial Digital Data Interface (SDDI), are proposed for studio networking. It is hoped that the industry organizations will standardize studio networking technologies to facilitate the conversion of digital television.

To compete for better services, the future studio architectures will have to provide interfaces for various media, such as satellite, fiber and telco, terrestrial, cable, microwave, on-line and archives. For these different applications, signals need to be converted and channel-coded for robust transmission. Providing proper interface with industry standards can reduce equipment and operational costs.

Concatenation

With the introduction of more compression-based equipment into the production/distribution chain, the concerns due to concatenation of different compression schemes and post-compression signal processing will be raised. The selection of production compression and the design of the distribution chain have to take into account the impact of concatenation. In general, using high bit rate and identical compression algorithms within the signal chain will certainly mitigate if not visually eliminate a loss of video quality.

The goal of using compression for production is based on the cost of storing and switching programs within the studio and distributing/contributing signals between



"LOOK WILCOX, THE DIGITAL COMMUNICATIONS TREND IS CATCHING ON EVERYWHERE," WHISPERED SNELL.

network and affiliates. The compression ratios should be chosen so that the video quality meets requirements of the general applications of contribution vs. distribution, as well as specific applications, such as production mixing and editing. The selection of compression ratios is also influenced by the cost of storage and switching.

To achieve high compression ratios, the GA HDTV system uses 4:2:0 chroma resolution (half as many samples in the horizontal and vertical directions). However, for program contribution and downstream processing, higher chroma resolution is required by broadcasters. A new MPEG-2 profile called 4:2:2 (half as many samples in the horizontal direction) profile has been proposed and is expected to be widely used by broadcasters. Although it's not part of the original MPEG-2 hierarchy of profiles and levels, the 4:2:2 Profile@Main Level decoder is required to decode all the bitstreams decodable by MP@ML decoders.

The 4:2:2 profile can provide higher video quality, better chroma resolution and allows a higher bit rate (at main level, up to 50Mb/s) than MPEG-2 Main Profile@Main Level. With a higher bit rate and chroma resolution, this profile can be used for applications requiring multiple generations of encoding/decoding, picture manipulation and/or change in picture coding type between generations.

Distribution and interconnection

There are two approaches to distribute network feeds to affiliates/member stations in the digital compression domain. One is to send network feeds in the terrestrial emission signal formats, i.e., the 19Mb/s GA bitstream. This is the most efficient way to distribute programs in terms of saving transmission bandwidth and minimizing conversion costs at local stations. The shortcoming of this approach is that this is considered distribution quality and there is not much quality headroom in the compressed bitstream for downstream processing, such as local editing.

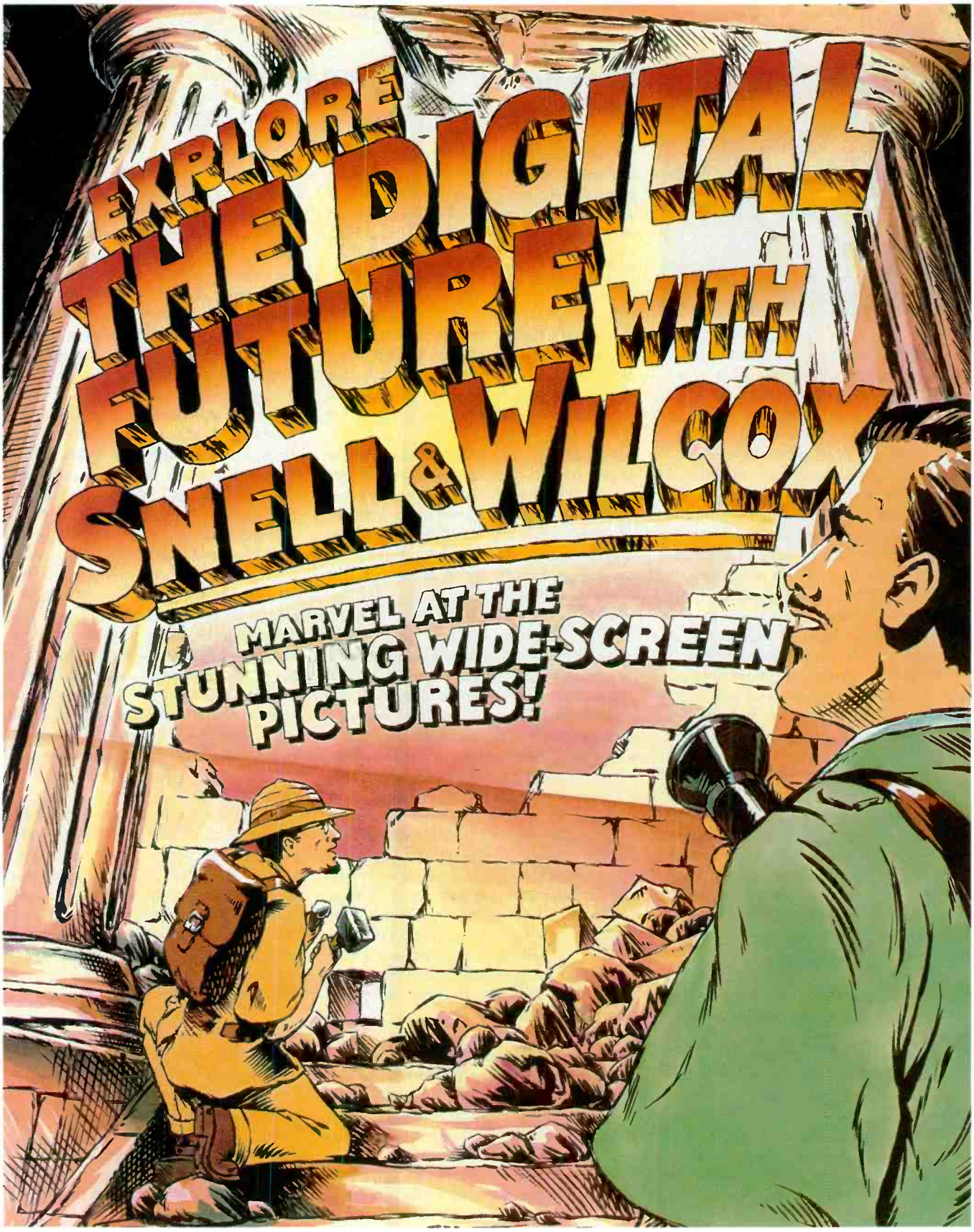
Another approach is to use less compressed network feeds so as to provide enough headroom for downstream processing at local stations. The constraints of selecting a compression ratio are determined by transmission bandwidth (satellite and microwave), interface with other media and standards (telcos, cable and DBS), studio equipment (switcher, VTR) and the resultant subjective quality. One approach could be to use the MPEG-2 4:2:2 profile or DS-3 codecs for network distribution and contribution.

Designing of multichannel DTV studio involves technical as well as operational planning. In the vast majority of facilities, there will be a continued strong dependence on existing analog and digital systems. Therefore, the integration of multichannel DTV into existing infrastructures must be a major area of consideration and effort.

In order to be positioned well in the coming DTV multichannel environment, broadcasters should begin a comprehensive conversion plan. In conjunction with DTV RF transmission planning, consider key issues of studio design. Through equipment replacement schedules and analog-to-digital upgrades, some key multichannel DTV equipment can be purchased and installed gradually. Design decisions can also be based on the network signals to be received and the various distribution requirements. This information can be used to determine how to record, route, format and multiplex network signals in a DTV facility. With forward thinking and careful system planning, broadcasters can be ready for DTV. ■

William Y. Zou is a communications systems engineer for the Public Broadcasting Service, Alexandria, VA.

"CLEARLY THE RESULT OF AN EARLY EXPERIMENT IN COMPRESSION..." MUSED WILCOX.



SNELL & WILCOX

Engineering with Vision

Circle (7) on Action Card

By Curtis Chan

Steps to take to increase your problem-solving abilities

Re-engineering in the broadcast engineering environment still exists. As a consequence, one of the unfortunate fallouts is the lack of "human bandwidth" for any one individual to perform all the necessary tasks of the job in any given day.

Aside from the one or two superhuman beings capable of keeping all the balls (human interface problems, technical problems, daily tasks, operational problems, etc.) in the air, odds are that most of us are bound to drop one or two balls. In most cases, the cumulative effect of compounding problems can be minimized by breaking away from traditional thinking and discovering new ways to approach problem solving.

Following are nine creative ways to help in your problem-solving process, which will make you more productive and give you some extra valuable time to contemplate.

Step 1.

The first step is to gain a clear understanding of the situation. That is, in order to create change, you must first understand what the current conditions are that led up to the event in question. Remember Aristotle's Law of Identity that states, "Something is what it is. A is A." So this first action provides a foundation on which all subsequent questions rise.

Step 2.

The second step is to avoid distorting the facts or creating unnecessary embellishments. Distortion of the facts is claiming that A is B. An environment of bluffing or seeking to add your own bias toward the facts will not only smear reality, but will result in flawed conclusions that ultimately will come back to haunt you. Part of being realistic is being informal — that is the freedom to say what you need to say to whomever you need to say it whenever you want without the fear of reprisal or politics. Free and unbridled individuals will outproduce restrained thinkers every time.

Step 3.

The third step in the process is to see the overall vision that will culminate in the solving of the problem or the attainment of an envisioned opportunity. In this light, you must envision your goals or objectives and set realistic milestones that are attainable.

Step 4.

The fourth step is to ask why are things the way they are? What are the causes and effects and what are the motivations behind current conditions? You can't start to think creatively without first asking why is that so. That is, the fundamental question will always relate to an effect you're observing and the cause behind it.

Socrates' Law of Causality addresses the ability to ask a question about an observed effect and then to give the answer by uncovering and understanding the cause. Realistic thinking and asking "why" questions identify the cause to a problem, which will enable you to create a plan of action or the vision to resolve it.

Step 5.

The fifth step is to become a change-oriented person and to not resist change.

Remember the late Frank Zappa's words of wisdom: "Change is not only necessary, it's inevitable." After ascertaining the cause, a change agent will seek to alter the effect.

For the people that resist change, maybe it's because they're really disappointed by previously unfulfilled promises of change; so what seems to be resistance is really the fear of another disappointment. Take the leap-of-faith in yourself and use your creative attributes to help solve some of those "resistance paths to progress" and leave behind a legacy that will make a difference in your environment. Improvement comes through altering, modifying and transforming. Solutions shouldn't be bound by only traditional ways of thinking.

Step 6.

The sixth step is to tap into your hidden abilities. Ability is the capacity to get things done. The capacity to accomplish is further defined by coming to closure on the issues and offering solutions. Getting things accomplished requires the skilled use of resources. You can accurately assess the way things are and envision new ideas, but without the ability to successfully act on these ideas, nothing really changes.

A recommendation for engineering environments is to foster a learning environment for your personnel where training and skills development are a continual process.

Step 7.

The seventh step in helping with your ability to think more creatively is to ask how? In other words, give yourself some autonomy in asking "how" about events and circumstances that led up to the problem. In many cases, team participation yields far better results than if done individually. This is something of an oxymoron because many corporate entities stifle creativity with too much red tape; a malady created in many cases to enhance job security.

Step 8.

The eighth step toward developing a clearer vision is to not sanction incompetence. One of the reasons why there's so much incompetence is that we ignore it and walk away from it rather then attacking it head on.

Incompetence is often rationalized as inevitable, inescapable or merely "the way it is." The reality is that you cannot attain a perfect vision of the solution if you keep avoiding the issue of incompetence and taking appropriate measures to correct it. For a manager, that means committing the time and resources to help your people develop the skills they need to be more productive. As part of the corporate culture, training and development of your most prized asset, human culture is everyone's concern.

Step 9.

The last step in the process toward better problem solving is implementation. The leadership characteristic of implementation or carrying through to closure is based on your ability to produce deliverables. The ability to rally people and resources to put an idea into practice is an essential leadership attribute. Remember that there is a big difference between being a manager of people and a leader of people.

If you don't want to become the lone ranger, plan on rallying the troops and get the emotional buy-in from your superiors, peers and subordinates. Delivering the deliverables is based on the successful execution of the fundamentals that precede implementation. Implementation and the subsequent actions taken are accomplished most effectively when each of the preceding nine steps are completed. ■

Curtis Chan is president of Chan & Associates, a marketing consulting service for audio, broadcast and post-production, Fullerton, CA.

Editor's note: Author's interpretation pulled from "Think Out of the Box," Career Press, 1995, by Mike Vance and Diane Dean.

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Other additions include software that allows the user to turn on the Skin Tone Detail feature from the menu functions of the RCU-240A, MRU-240 or OCP-40. A new viewfinder with a large eyepiece comes standard on the HL-43A.

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Circle (8) on Action Card

By Jim Starzynski

Widgets and wires

Of all the widgets and miscellany that a broadcast facility requires, none seem as inconsequential as the lowly connector and wire. In fact, smart connectorization and wiring practices for the control room, studio and facility infrastructure are the cement in a broadcast system's foundation.

When planning the wiring of a new facility, start by considering the following important factors: 1) the goal of the system; 2) the budget available to work with; 3) the time frame to completion; 4) who'll be wiring the job; 5) and most important, what kind of a plan you will need to satisfy these conditions.

First, talk to operations staff to learn the operational requirements of the proposed system. Then talk to maintenance engineers responsible for upkeep of the new facility to find out their preferred techniques or systems. With this information at hand, money, time and manpower will likely make the rest of your choices for you.

Choosing connectors

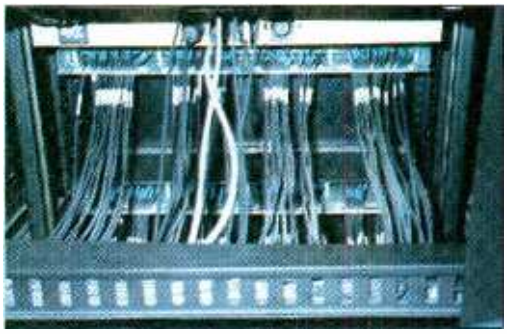
Intensive in-house connectorization for an analog broadcast facility's infrastructure is inescapable. When wiring a master distribution frame (MDF) for the building or an intermediate frame (IDF) for a studio or edit room, the wiring points must be reliable, accessible and well-documented. There simply is no way to cut corners. These systems are the plumbing that you're going to be relying on show after show, session after session, year after year.

For audio, you'll need to choose between connecting your trunks up with reliable, but somewhat scarce solder-type blocks ("Christmas trees") or more contemporary punch blocks. Solder-block connections offer undeniable reliability, longevity and density, but this comes at a price. Though inexpensive to buy, they're extremely labor-intensive to install. Remember your time frame and crew considerations. On the other hand, punch blocks will connect quickly by punching down non-stripped individual pairs. They've become common in the audio/broadcast industry, as they have been for some time in the telephone industry. They're available in many different configurations, but they require a larger footprint for installation and cost quite a bit more then solder-block types. The connections are solid and can be remade or changed a number of times as specified by the manufacturer. Your individual situation will dictate the proper choice.

Don't overlook good grounding. Connect the shields of line-level cables to a solid system ground on one end. Have a solid point for this reference available in your frame. Make a sturdy mechanical and electrical connection by busing individual insulated shields to a single point and bolting them down. This will reduce noise and facilitate subsequent troubleshooting.

Signs of the times

For control-room installations, custom wiring on site used to be the only way to go. The need for custom panels and the pulling of cable for long distances through crowded trenches or ceilings made this so. Today the exigencies of staffing dictate otherwise; it simply isn't practical to dedicate a person to wire every cable pin by pin or stamp out custom panels. Although there may still be a certain circuit that requires a custom hookup, it is now more sensible to buy connectorized cable assemblies from a growing number of reliable suppliers. To do this you'll need to standardize and plan your connection points carefully.



The neat and well-labeled wiring of these Neutrik NPP-TT-14-PT patchbays is a good example of proper control-room infrastructure.

If your raceways are jammed, specify your cables with one end blunt to facilitate the pull. For panels, you can design them using off-the-shelf building block, mini, prepunched frames. Order them from a catalog at the same time you order your chassis connectors. Have your crew assemble the panel, install the connectors and wire the circuits. Or better yet, order the entire panel as a complete wired and tested assembly.

Microphone input boxes are available in many configurations and can bolt right up to the wall or be ordered rack-mountable. Jack panels can also be purchased in this fashion. Many of these items require long lead time, however. Plan accordingly and order these parts early. There will be plenty of other work that your crew can do while waiting for delivery.

For studio floor systems (such as musicians foldback or front-of-house PA) take some tips from the touring sound community: standard, portable, rugged and simple. Many types of cable assemblies can be purchased to suit the job. Fully wired and tested mic splitters can be ordered in a rolling rack, for example. If your speaker clusters are going to be flown, purchase your speakers and cabling as a package. A competent, full-service supplier or sound company will make this easy and cost-effective. If your installation requires multiple audience-mounted speakers with cables cut to various lengths, prefab your assemblies in the wiring or maintenance shop. Use contemporary speaker connectors that turn and lock. This will facilitate breakdown for your stage crew and minimize failures for the maintenance folks.

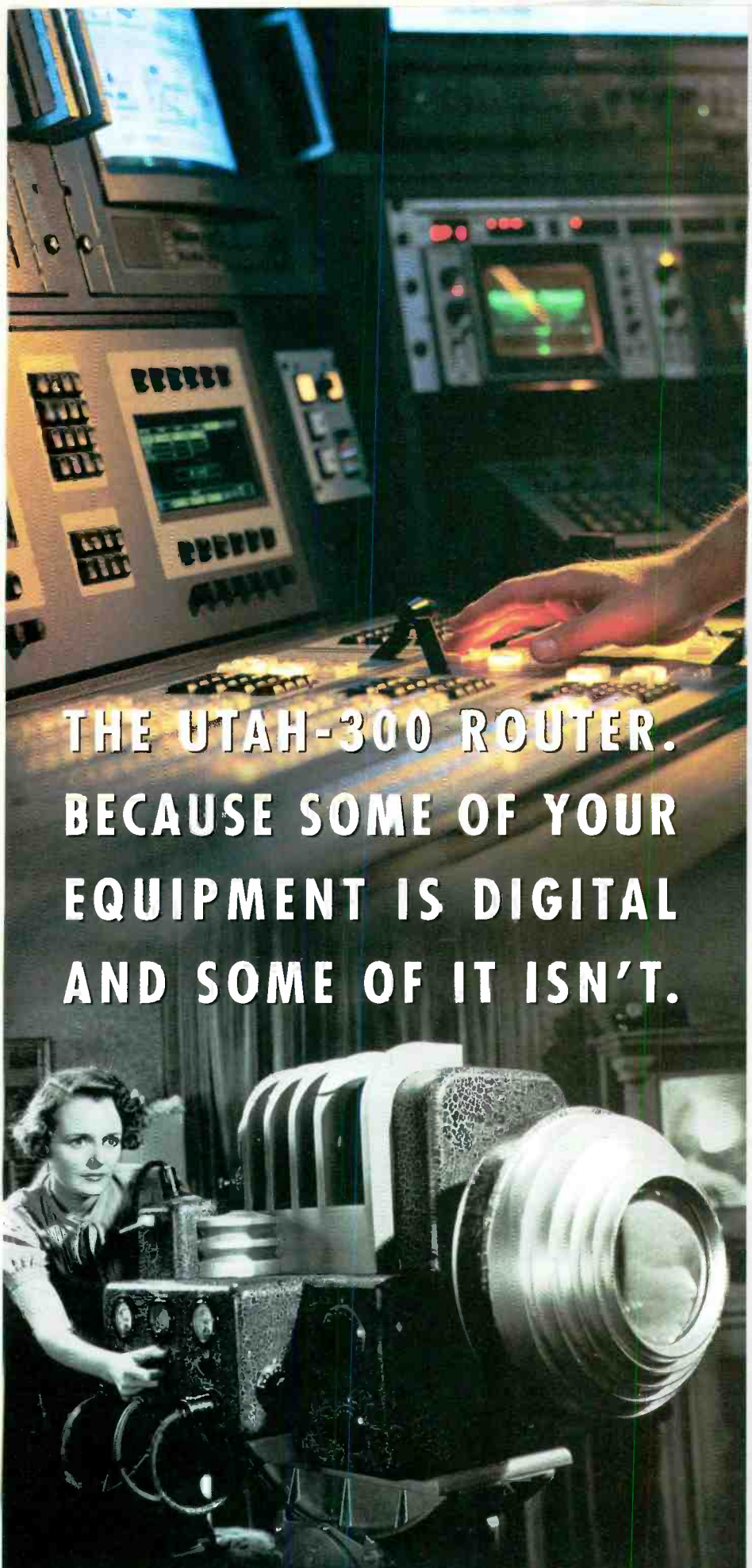
Digital paths

The digital transition in the broadcast world hasn't made system installation simple yet. However, consider this: 16 channels of CD-quality sound and digital picture riding on one piece of cable and two connectors. Too good to be true? It's right here, right now, in broadcast facilities using serial digital (component) distribution with embedded audio. Muxes and demuxes are used to interface to individual digital and analog I/Os. Although digital signals are complex in nature, their wiring and connectorization practices are simpler than their analog predecessors.

Nevertheless, budgets and schedules will be the most critical components you'll face during any installation. Until the broadcast world migrates to a fully "plug-and-play" philosophy, the foundation of your system will rely on technical designers' ability to make savvy decisions that satisfy a program's production needs and get it on the air. ■

Jim Starzynski is a project engineer at NBC headquarters in New York.

For more information on wire and connectors, circle (200) on Action Card. See also "Connectors, All Types" p. 88, and "Wire, Cable, FO materials," p. 90 of the BE Buyers Guide.



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Circle (14) on Action Card

By Steven Blumenfeld and Mark Dillon

Information gadgets

Last month we discussed the venues in the home in which interactivity takes place. We started with the living room and ended up in the bedroom — kind of a normal progression don't you think?

Well, this month we will discuss information appliances that are mass-produced consumer hardware devices that allow you to gain access and use data. This data can be located and generated anywhere, anytime and received by a variety of means. These days a lot of useful information is available. Let's start with "personal information devices."

Is that a fax machine in your pocket?

First on the list are the new sports pagers that Motorola has come out with. These dedicated pagers look more like a Nintendo Gameboy. The display is of a baseball diamond and it shows play by play — who's on first, what's on second and I don't know's on third. Pretty amazing especially if you are a big time baseball fan and can't watch all the games. No more wondering if the Padres or the Dodgers are falling apart in the ninth. Just look down at your pager and your expression will let everyone in the room know what's going on.

The next gadget on the list is one that has been around for quite awhile. As a matter of fact, a lot has been written about it — the venerable PDA. You should know this article is being written on my Apple Newton 130 on a plane high over GTE's headquarters in Dallas. June 1996 was a big month for the PDA. On Friday, June 21, 1996, Apple released Newton Internet Enabler (NIE) for the Newton. This TCP/IP stack allows you to access an Internet service provider and connect over PPP or SLIP protocols. You can also connect directly in your office so your Newton can become a desk terminal.

With the beta version of Eudora Pro for the Newton, you can send and receive E-mail, with LandWare's Net- Hopper 2.0, you can browse the web, and with a pager PCM card, you can receive pager messages and generally open a whole new world of connectivity for the PDAs.

Add a PCM modem, cable and a cellular phone and you can connect wirelessly anytime, anywhere. This compact system is small enough to fit in your pants pockets. You can also use it to send and receive faxes. Imagine sitting in a meeting and when the boss asks some technical question, you access your favorite technical web site and up comes the answer. Be careful because all this connectivity surely won't be comforting to your significant other.

There are devices to strap on your wrist, put in your pocket, and of course, put on your head. Virtual I/O glasses actually allow you to see a 10-foot screen floating in front of your face from an NTSC input and stereo audio. We have ours hooked up to a portable Hi-8/tuner for use during demos or on long trips with the kids — what better way to test your channels' reception than to be watching all the time.

Like any black sheep, CD-I has returned to right past wrongs; this time in the guise of a consumer TV Internet terminal.

Put your television to work

OK, now it's time to leave the personal gadget world and talk about two last interactive items. StarSight, a TV electronic program guide (EPG) that makes your television smarter and CD-I Online, software that makes your television connected.

StarSight is a $4.99-a-month service that gives you the ability to know what is on, when and preprogram your VCR to record it. It works by sending program-specific information — show title, channel, theme (type of show), time, etc. — in a continuous revolving datastream (carousel). This carousel data is sent over the VBI of your local PBS TV station to your StarSight STB (set- top box).

Believe it or not — especially if you only watch a little television — this is a useful device. One of the coolest features is its ability to browse channels. This is different than the traditional surfing that most people are used to. With the browse function, your tuner remains on your viewing channel and the data about each show is overlaid on the picture. If you find a show that sounds more interesting than the one you are watching, just hit the tune button and you are there. It makes watching television, and especially surfing, more efficient. The best part is that you will always have an exact clock and it will never blink 12:00.

Lastly, we have CD-I Online. Oh, I can hear the moans and groans from the audience already — "not that thing again, I thought CD-I was dead." Well, just like any black sheep, it has returned to right past wrongs; this time in the guise of a consumer TV Internet terminal. With the addition of a modem and software from Philips, you can be surfing on your 37-inch color long board from your favorite leather recliner.

As a matter of fact, with the proper setup (we know all you engineers have wired your televisions properly), you can switch between the Internet, your VCR and television without ever having to move your muscles.

The CD-I Online software — available in Europe and in beta testing in the United States — connects to a local Internet service provider and downloads web information to the CD-I player. The software then decodes the data transferring the data into NTSC text and graphics. Philips has spent a lot of time making sure that the text is legible on TV screens, and they have done a great job. The text is readable from 10 feet away on every television we tested starting at 13 inches. Entering URLs is a little clumsy with the virtual (on-screen) keyboard, but I am expecting my remote keyboard any day.

Watch out Larry Ellison, Philips may have beaten Oracle to market with the first $500 Internet terminal and you now can watch MPEG movies, listen to CDs and collect your E-mail on the same appliance. ■

Steven Blumenfeld is vice president of technology and studio operations, and Mark Dillon is vice president, on-line services, with GTE, Carlsbad, CA.

READER FEEDBACK

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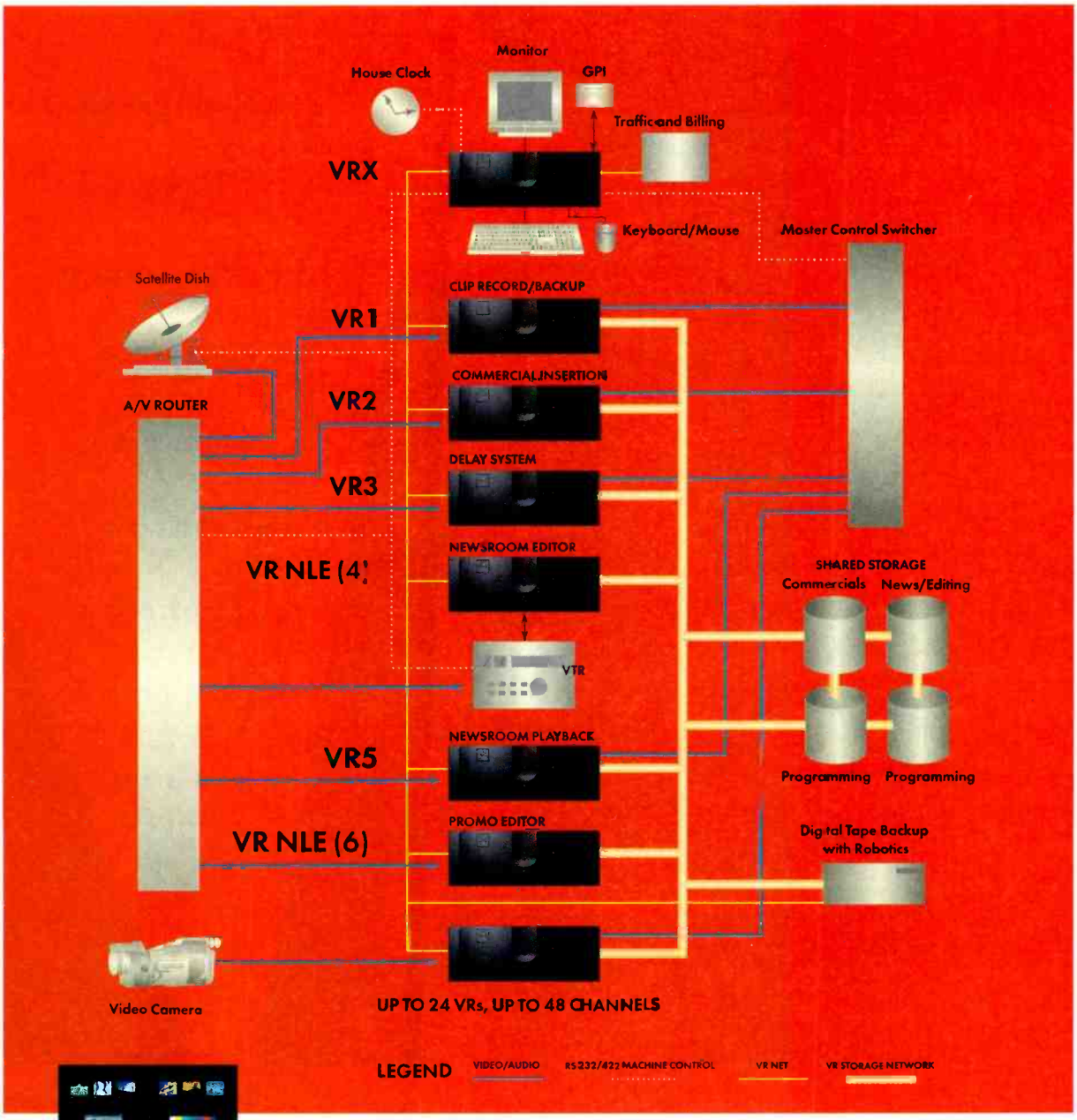
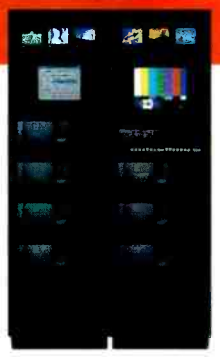
WHY TOTAL REDUNDANCY?
WHY TOTAL REDUNDANCY?





Because you can never be too safe. The VR disk-based broadcast system incorporates multiple redundancy strategies – including RAID fault tolerance technology – which eliminate any single point of failure. And that means an integrated digital solution with total redundancy and absolute reliability. Is it possible to have too much of a good thing? Choose a VR system and you won't ask twice.

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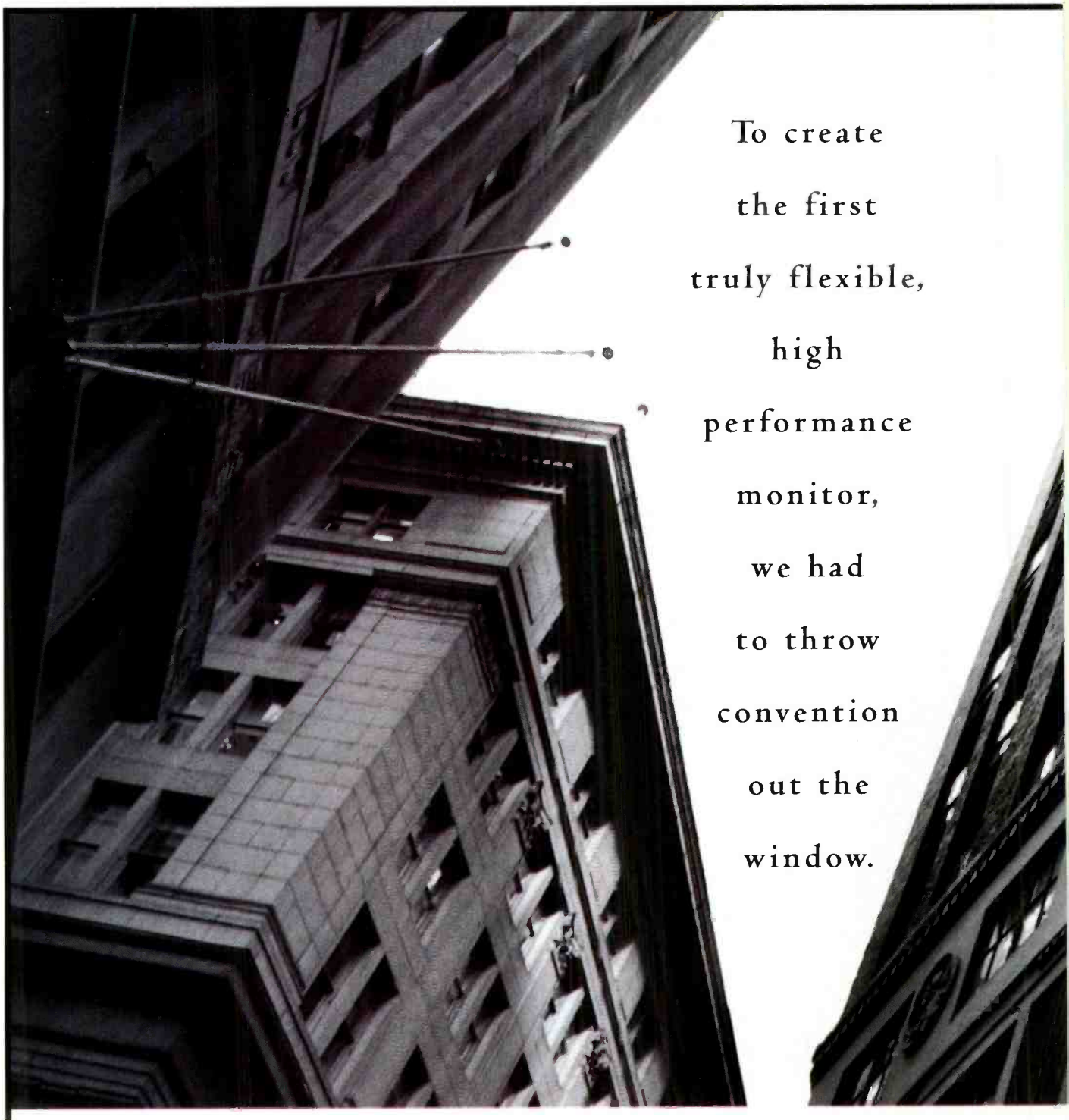

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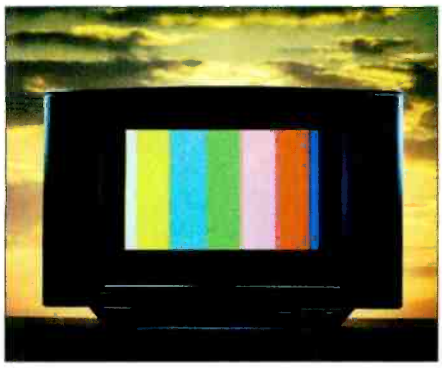
composite to component. The new and improved CRT delivers performance that's even superior to our own previous high resolution monitors. New standard features include: auto white balance compatibility using industry standard color analyzers, VITC reader, safe area display, closed caption, an internal test pattern generator and on-screen EDH for the display of digital signal error codes. New options include an IC memory card which can store and transfer monitor set-up and configuration information. Call 1-800-472-SONY, ext. BVM for information on the new standard in monitor technology, and get ready to throw convention out the window. **SONY**

By Louis Libin



Broadcast technical standards: Why are they necessary?

In a short time, the FCC will set a standard for an advanced TV broadcast service (ATV). The commission will also assign each of the approximately 1,700 TV stations a channel for ATV. The channel will be paired with the current NTSC channel. Most of the ATV assignments will be in the UHF band. Each NTSC station will be assigned an ATV channel with a specific numeric value.

Recent legislative actions have focused on whether broadcast technical standards are necessary. Broadcast organizations should be working hard to educate those who do not understand the importance of a broadcast technical standard. For example, "The Electromagnetic Spectrum Management Policy Reform and Privatization Act," a 42-page draft bill, purports to reform U.S. spectrum management policy "by replacing the government-run, centrally managed system that is the primary obstacle to the exploitation of the information revolution with a privatized, flexible system whose overarching goal is to maximize the electromagnetic spectrum's value to the American people by relying on market forces and consumer choices."

The standard

The proposed Grand Alliance ATV standard is based on precisely defined packetized data with headers and meets complex interoperability, flexibility and extensibility requirements. The system will interface cleanly with wired NII media, particularly with a switched network environment. The ATV standard will be the broadcast part of the NII.

No technical broadcast standard?

Without a technical broadcast standard, there will be technical and market chaos. For a broadcaster, there will be no guarantee of any service area or quality of service. For a TV set manufacturer, there will be no guarantee that the receiver or display tooled up for today will be acceptable when it gets to market. For the public, there will be no guarantee that the investment made in a TV appliance will have any long-term value. Set-top boxes with the attendant subscription fees will be predominant and free service will be denied to current NTSC viewers in ever-increasing numbers.

Spectrum policy and reality

Spectrum policy decision must be based on the fundamental laws of physics and the practical realities of engineering cost-effective business solutions. The laws of physics impose compromises among spectrum efficiencies, power, coverage area, interference into/from other services, quality of the service provided and the technical requirements and cost imposed on transmitters and receivers. New electronics technology generally makes new trade-offs and options possible, but balanced judgments of the costs and benefits must still be made.

On one hand, spectrum policy must strive to make the most efficient use of the spectrum. On the other hand, the technical requirements of cost-effective transmitters and receivers are vital to the economic viability of businesses that make use of the spectrum. Competition in an open standards-setting process among industry proponents of various approaches is the best way to draw out new technology and to assess the pros and

The Electromagnetic Spectrum Management Policy Reform and Privatization Act

Some of the key features of the "Electromagnetic Spectrum Management Policy Reform and Privatization Act" affecting broadcasters are:

- **Broadcasters to make payment for the new channel**
  The deposit for the new channel would be equal to the full value of the channels calculated on the basis of overlay auctions and is payable in equal installments over 15 years. The "overlay" proposal is a disguised up-front auction proposal that has surface appeal because it offers a little something for everyone, but under close scrutiny will undermine the implementation of a viable digital ATV service. The government collects all interest on the payments, which would be dedicated to tax or deficit reduction. Fifteen years after an ATV license has been assigned, a broadcaster may relinquish its NTSC license. If the NTSC license is given up at that point, then the total payments, but no interest, would be returned to the broadcaster. For every year beyond 15 years that a broadcaster holds the NTSC channel, the principal to be repaid to it is reduced by 20%.

- **Directs the FCC to auction "overlay" licenses**
  The bill directs the FCC to use auctions to sell spectrum that is made available because a broadcaster decides not to apply for the new ATV channel or because more digital channels can be made available in a market than there are existing stations (only remote areas). The auction price then determines the amount of the required "deposit" payment.

- **Prohibits the FCC from establishing ATV standards**
  As with any new technology, the ATV system needs to be fully implemented before all of its characteristics can be fully documented and the set of rules finalized. Until the industry has developed experience in dealing with the parameters of the system under different environmental conditions, the system cannot be fully characterized and spectrum use cannot be fully optimized. Further delay in embracing the ATV standard will only confuse the marketplace, delay the reassignment of spectrum made available for other uses, severely damage many interests who have already made major investments leading to ATV, and is neither warranted or desirable. ■

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cons of different approaches. New technology is not a panacea — a technical solution that is ideally suited for one application may be impractical for a different application. Therefore, spectrum policy decisions of "how much" spectrum to allocate, "where" is it located and "what restrictions" are placed on its use must be informed decisions made on a case-by-case basis.

Who should set the standard?

The FCC must set technical standards for spectrum use. Technical standards that are associated with a license are essential to proper spectrum management because they enable the FCC to ensure that new frequency allocations provide reliable service that is not disrupted by interference, and similarly, that new allocations do not disrupt existing services.

Technical standards allow precise measurement of service area, interference and spectrum efficiency that allow the FCC to make spectrum policy determinations. Without a precise characterization of these factors, it would be impossible for opposing viewpoints and their relative merits to be effectively presented and debated. Unambiguous standards enable competition among manufacturers, establish a level playing field and accelerate consumer adoption.

VHF and UHF spectrum efficiency

The UHF and VHF bands are used for TV broadcasting. Differing broadcast transmissions have differing interference characteristics. If differing mechanisms are permitted in the same broadcast bands, such as the VHF and UHF bands used for TV services, then the guard bands in the channels cannot be optimized. Guard bands are unused portions of each channel at the channel edges that are used to protect against interference.

When the characteristics of the systems differ or worse, are unknown, then wider guard bands must be created leading to inefficient use of the spectrum and less channels being available for assignment to services.

Compared to the digital TV system, analog NTSC TV is inefficient in its use of the UHF spectrum. Each UHF station places restrictions on the use of 16 other UHF channels in the surrounding geographic area. These "taboo" channels are a wasted spectrum — because of the resulting interference to existing TV service. The FCC stimulated private industry to develop a technical approach wherein the taboo channels serve a useful purpose — the introduction of ATV.

To auction or not to auction

The temptation to realize a short-term gain by immediately auctioning or assigning the UHF taboo channels is unattractive for three reasons: 1) since the analog TV broadcasting must be protected from interfering signals, the taboo spectrum would not be useful for applications other than point-to-multipoint low-power digital broadcasts like the ATV standard; 2) since the taboo channels are a spider web of frequencies with no contiguous geographical coverage, the taboo spectrum would not be as valuable nor can it be as effectively used; and 3) the public and broadcasters would be denied an upgrade of free over-the-air TV service to digital ATV.

More than pretty pictures

The ATV system provides a superior digital service with a 19.3Mb/s payload in a 6MHz channel that is not restricted to TV services. The system transport level is based on fixed-length packets with packet headers that describe the contents of the packets. In addition to TV services, these packet headers can be used to define a myriad of data services that can be carried in the channel limited only by the channel capacity. ■

Louis Libin is director of technology for NBC, New York.

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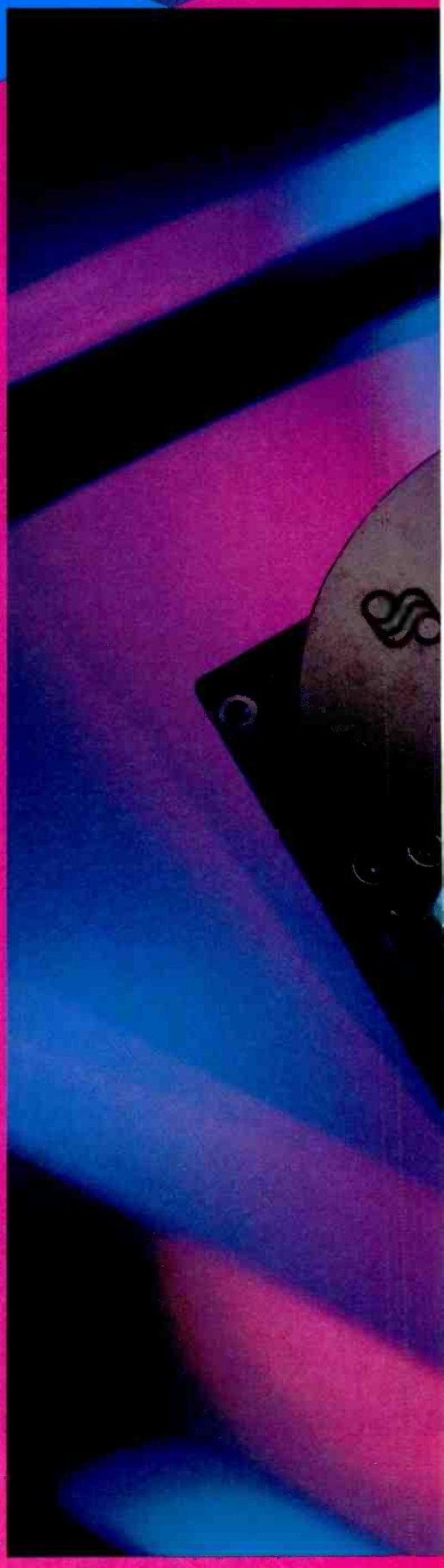
Flashback

NEC America:
Digital Video Recorder Pick Hit

The NEC model SR-10, the world's first all-solid-state digital video recorder. Using 1,000 1Mb chips, the SR-10 records 34 seconds of video for instant frame-by-frame random access and real-time slow-motion recording and playback. Up to 136 seconds of storage expansion is optional. (Taken from the June 1987 issue of *Broadcast Engineering* magazine, 1987 "Pick Hits.")

While the same product could be produced today with far fewer than 1,000 chips and for a lot less money, other non-tape recording technology has matured. Newer, hard-disk and optical disk recording is reliable, affordable and widely available. The problem for the user isn't what technology to select, but which of the multitude of products available to pick. Here is where *BE* can help.



Making the selection

While several companies lay claim to being the first with disk recording technology, what really matters is what the product does today. With the increasing demand for non-linear editing, animation and the need to manage large databases of stills, the disk-based recorder has become a solution with wide application.

Two general labels are used for these devices; video disk recorders (VDRs) or digital disk recorders (DDRs). Both do about the same thing, although technically, a VDR needn't use a digital recording format.

The basics

What should you look for in a VDR? It depends on your application. In general the following general features are provided:

- The VDR must provide high-quality recording/playback;
- The VDR should emulate VTR operator features, adding flexibility where the technology allows;
- The VDR should be self-sufficient, able to operate as a stand-alone device and still be able to integrate into standard production environments;
- The VDR must be frame accurate;
- The VDR should provide full editing features including previews of edits.

Through the maze

To help you understand the players (products), this article looks at 16 disk-based recorders. The manufacturers of each recorder was invited to provide a technical synopsis of their product, focusing on features and technology. Their edited presentations are contained here.

At the end of each product description is a company phone number and reader service number. Readers can obtain more information by calling the company or submitting a reader service card with the desired product numbers circled. We'll forward the information to the selected companies for their follow-up with you.

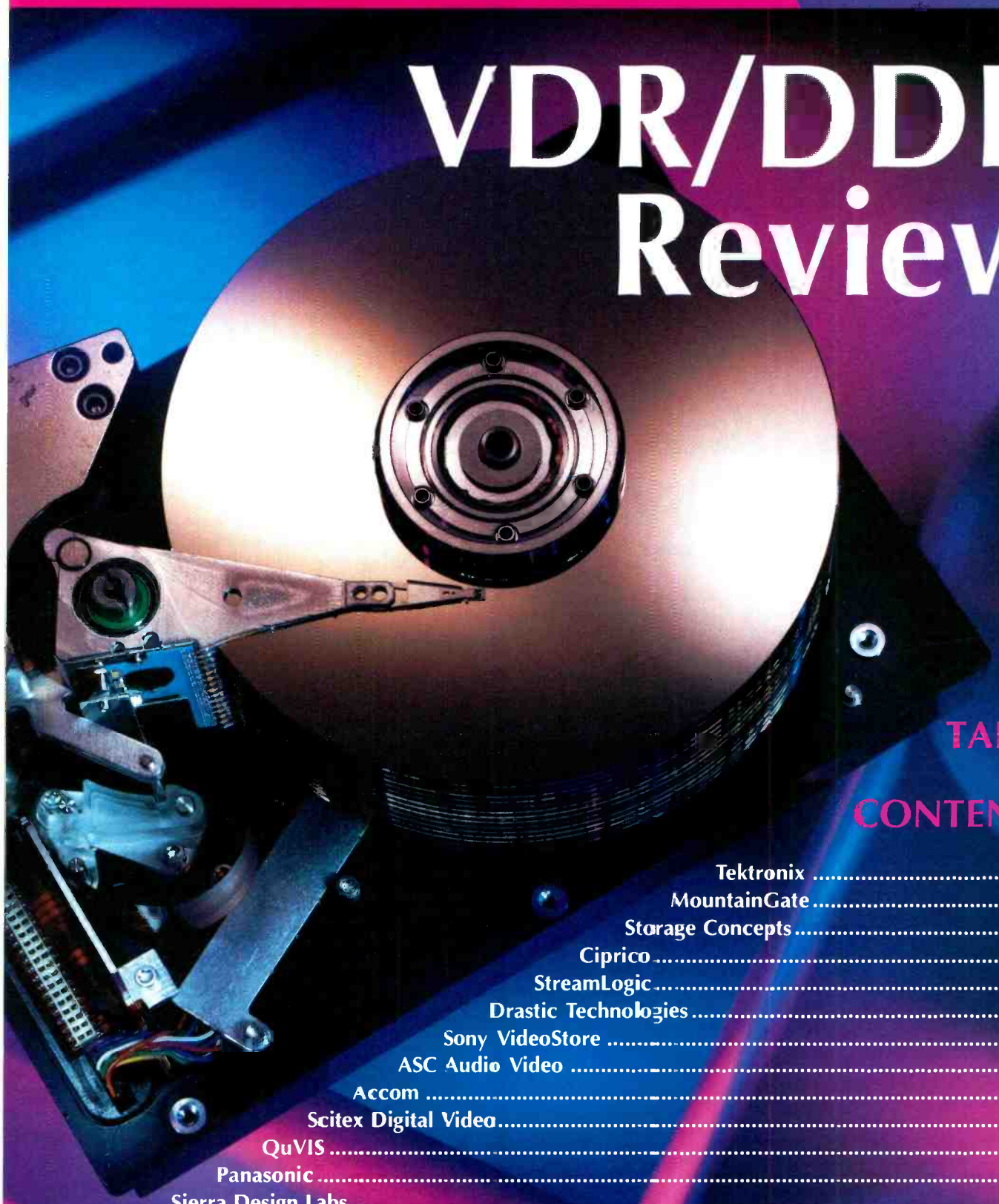
Making the decision to use disk-based recording is kind of like the old calculator/computer syndrome. If you wait to buy, it'll be cheaper and faster. But then you wouldn't have had the use of the product either.

So don't wait. After all, your competition won't.

Brad Dick

Brad Dick, editor

VDR/DDR Review



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Tektronix

By Adolfo Rodriguez

In the two years since its introduction at the 1994 NAB show, the Tektronix Profile professional disk recorder has become the industry standard in the still infant video disk recorder market. In this relatively short period, Profile has reached an installed base of more than 4,000 channels and is still growing.

Profile architecture

The backbone of the Profile system is a passive EISA motherboard with an integral 32x32 component parallel digital video router. The EISA bus is primarily for control of internal devices (digital disk recorders, video/audio/time-code I/O modules, mix effects, etc.) and transfer of audio data. Profile avoids burdening the EISA bus with the transfer of high-speed video data. Video information is transferred among devices in component digital format (8-bit CCIR-601) with the built-in router. Profile's architecture also allows the integration of external video signals with video played back from the internal digital disk recorders.

Probably the most important feature of Profile is its digital disk recorders (DDRs). Up to four DDRs can be housed in a Profile chassis, each with the capacity to play back or record audio and video independently and simultaneously. The DDRs are unique in that they all have access to the same set of disk drives. This means all DDRs can play the same material stored on the disk array within a fraction of a second of one another. This also means that one DDR can be recording video and audio and another — or all of the remaining DDRs — can be playing it back. For program time delay and commercial spot playback this is a powerful feature.

Recording times are determined by the amount of compression applied to the video and the capacity and number of disk drives connected. A standard Profile using minimum compression (highest bit rate) yields roughly 45 minutes of recording time. At a compression factor that gives broadcast-quality video, and using the maximum number of 4GB disk drives (a total of eight), Profile provides about three hours of recording time.

RAID storage

Another recent enhancement to Profile is the availability of RAID storage providing redundant protection to material plus more than a terabyte of additional storage per Profile (more than 85 hours at broadcast quality). The RAID 3 implementation chosen provides "hot-swapping" capability of discs with background rebuilds of data. RAID 3 was chosen due to its better handling of the type of data encountered in video applications where you are generally dealing with relatively few potentially large files (as compared to a computer network).

Using the maximum number of 4GB disk drives, the Profile provides about 10 hours of recording time.

Video compression

The digital disk recorders use standard motion JPEG (Joint Picture Experts Group) compression technology to compress video.

The quantization matrix values in the Profile have been optimized to provide the best possible picture quality in real broadcast situations. High disk drive bandwidth is accomplished by multiplexing an array of disk drives to achieve roughly 48Mb/s for each of the DDR channels. A 24Mb/s data rate yields pictures equivalent to first-generation Betacam SP using metal particle tape.

Audio

Up to four channels of audio can be associated with each video channel (although all 16 channels can be associated with one video channel). Audio is stored uncompressed and is sampled at 16-bits resolution with a 48kHz clock, which is locked to video. The audio is stored in a file structure separate from the video with a database-type link between the two. This scheme keeps audio and video synchronized, while still allowing for relative timing adjustments.

Integration platform

The Profile platform attends to all the critical details that make integration into professional video environments a simple task. There's a reference genlock input that locks all of Profile's outputs to a composite analog video signal. All outputs can be advanced or delayed relative to the reference signal and in addition, each output has independent timing adjustments relative to the primary timing offset.

All video interface modules support vertical interval time code (VITC). Input modules read VITC and convert it to data that is stored with the video and audio material. Output modules take the VITC data and reinsert it in the proper format as video exits the Profile.

Profile includes a longitudinal time-code (LTC) input that can be used to lock its operation to a house time-code reference. Once locked, video and audio can be played back with field accuracy at a specific time of day.

Eight channels of RS-422 device control are available for controlling the internal resources in the Profile platform. For developers who port their applications to Profile's processor system, the RS-422 ports can be used to control such external devices as VTRs, character generators and routers.

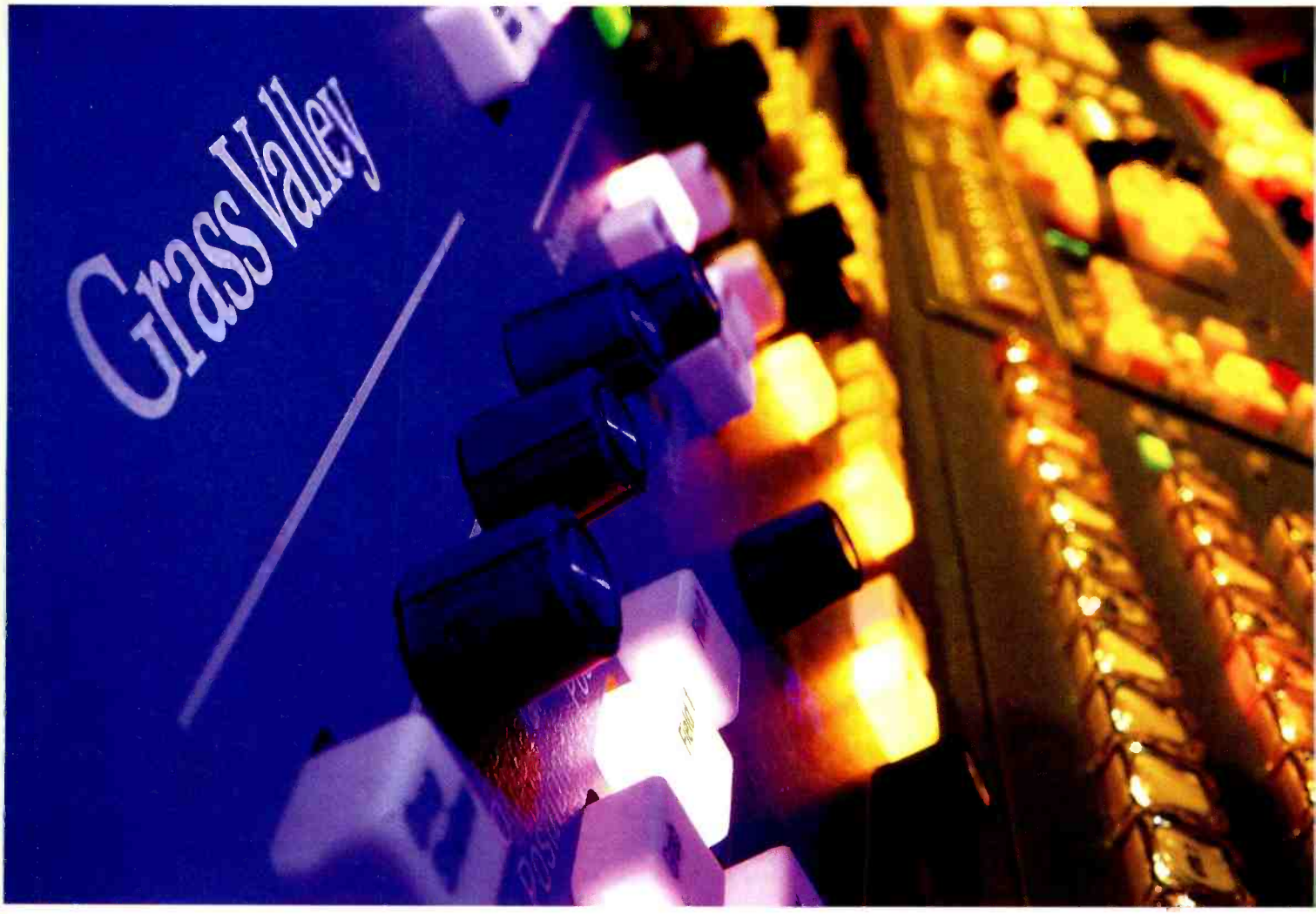
A mix effects option brings the capability of adding keyed signals, such as titles and logos and for doing transition effects between video signals. This mix/effects option provides all the basic transition capabilities, such as dissolves between foreground and matte, dissolves between foreground and background, key inputs, dissolves to and from black, and wipes with and without borders. A single card has two mixers and an additional card can be added for even more possibilities.

Profile video network

The Tektronix Profile Video Network is available for intrafacility (inside) environments. The key elements of the network include three tiers of storage distributed around the network, distributed applications and control interconnects to existing baseband video/audio facilities with RS-422 machine and an ATM (or other method) gateway to distant resources and media. Together these devices form an array of distributed storage. When interconnected with a fast network like Fibre Channel, a virtual server is created where material on any single Profile is available to any other using a simple copy command. ■

Adolfo Rodriguez is Product Marketing Manager, Video & Networking Division for Tektronix, Inc., Beaverton, OR.

Grass Valley



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The Grass Valley 2200-2i is just one of a host of video solutions from Tektronix. Find out more. Call 1-800-395-9478, Dept. 902.

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Tektronix

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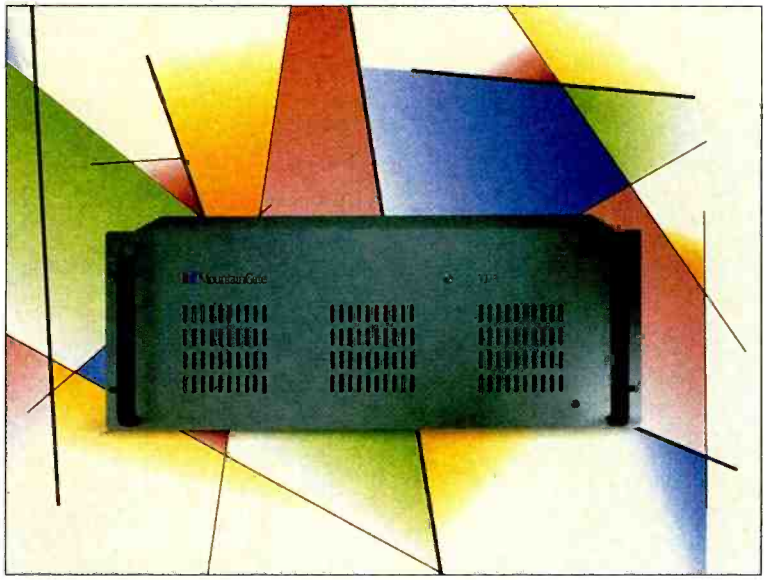

MountainGate

By Harry Aine

MountainGate's Video Disk Recorder (VDR) is designed to allow a wide variety of configurations custom fit for the unique demands of on-line editing, computer graphics, digital film, telecine, HDTV and other high-end video applications. The VDR's basic configuration offers broad bandwidth and real-time, uncompressed storage and playback of digital video. Since MountainGate's VDRs support multiple video formats (MVF), one device can support digital component and digital composite signals. HDTV models can also support digital component signals.

In the on-line edit suite, the VDR can take the place of a digital videotape machine, with full plug-and-play Sony VTR emulation and serial digital input/output. There is full support for SMPTE C time code, as well as extended Sony protocol for time line support if used with Sony's BVE-9100 editor.

As a source or record device, the VDR can be driven by an edit controller through RS-422 machine control or operated from the front panel for play, stop, fast forward, record, variable speed or other VTR functions. A single button on the control panel allows the operation to be switched between 525-line NTSC and 625-line PAL formats. Digital component or digital composite video is software-selectable using either a VT100 terminal or PC linked to the VDR. An embedded controller provides an RS-422 port, as well as video disk manager (VDM) software with a GUI interface for the UNIX or Windows NT platform.

As the on-line editing environment moves from linear to non-linear assembly, the VDR performs as a digital disk recorder (DDR), with field/frame-accurate access, caching, segment play mode and looping operation. Unlike the industry's many short-play DDRs, which are typically limited to storage of 30 to 120 seconds of video, MountainGate's VDR can be configured to handle 3, 6, 12, 25 or 50 minutes of digital component video, or double that capacity, up to 100 minutes, of digital composite video. This long-play format means that material for longer pieces, such as music videos, corporate videos or TV programs, can be stored and auto-assembled. Entire scenes and sequences can be handled at one time without the time-consuming loading and unloading associated with short-play DDRs. A feature important to music videos is the ability to do insert and assemble editing on each of up to eight audio channels independent of the picture.

The VDR is well-suited to film-to-tape transfer, secondary color correction, digital film and visual effects compositing. Because of its high storage capacity, a reel of film can be transferred from the telecine onto a VDR in lieu of a digital tape machine, which requires maintenance, parts replacement and tape stock. With an optional GPI trigger, the VDR is compatible with most pin registration systems. The VDR can also be configured to support 8:4:4 and 4:4:4 video resolution making it compatible for use with high-end digital color correctors, such as the daVinci Renaissance.

In telecine and digital film, where film's 24fps playback rate must be converted to and from video's 30fps playback rate, professionals must deal regularly with the problem of 3/2 pulldown. MountainGate's VDR becomes the critical link in the chain of events, handling 3/2 pulldown. It adds or removes frames as needed so that professionals can transfer film to video, do their visual effects processing electronically on workstations and in digital edit suites, then return that material back to film for theatrical release. Again, storage capacities of up to 50 minutes of D-1 quality video help keep whole scenes intact.

In the computer graphics area, where large files move between the storage device and the workstation, the VDR's integrated high-speed SCSI interface handles 3.5fps, the typical speed of an SGI SCSI port. While the VDR offers standard 8-bit YUV format, there is an optional 10-bit YUV configuration, which is ideal for high-end graphics. When interfaced through a fast SCSI connection to a server, the VDR is able to interface with an ATM network or any TCP/IP protocol. The server can also act as a buffer when more than one user needs access to the VDR's contents.

In the future, the interface will accommodate Fibre Channel technology, a high-speed network growing in popularity in broadcast television and post-production. As a fourth-generation product, the VDR has successfully kept pace with the industry's growing digital video needs since its introduction in 1991. ■

Harry Aine is product marketing manager for MountainGate, Reno, NV.

Storage Concepts

By Martin Bock

Storage Concepts invented the real-time parallel disk storage system for continuous video requirements in the early 1980s. Its experience started in the medical imaging business.

Medical storage beginnings

The specific application for this "video storage" is

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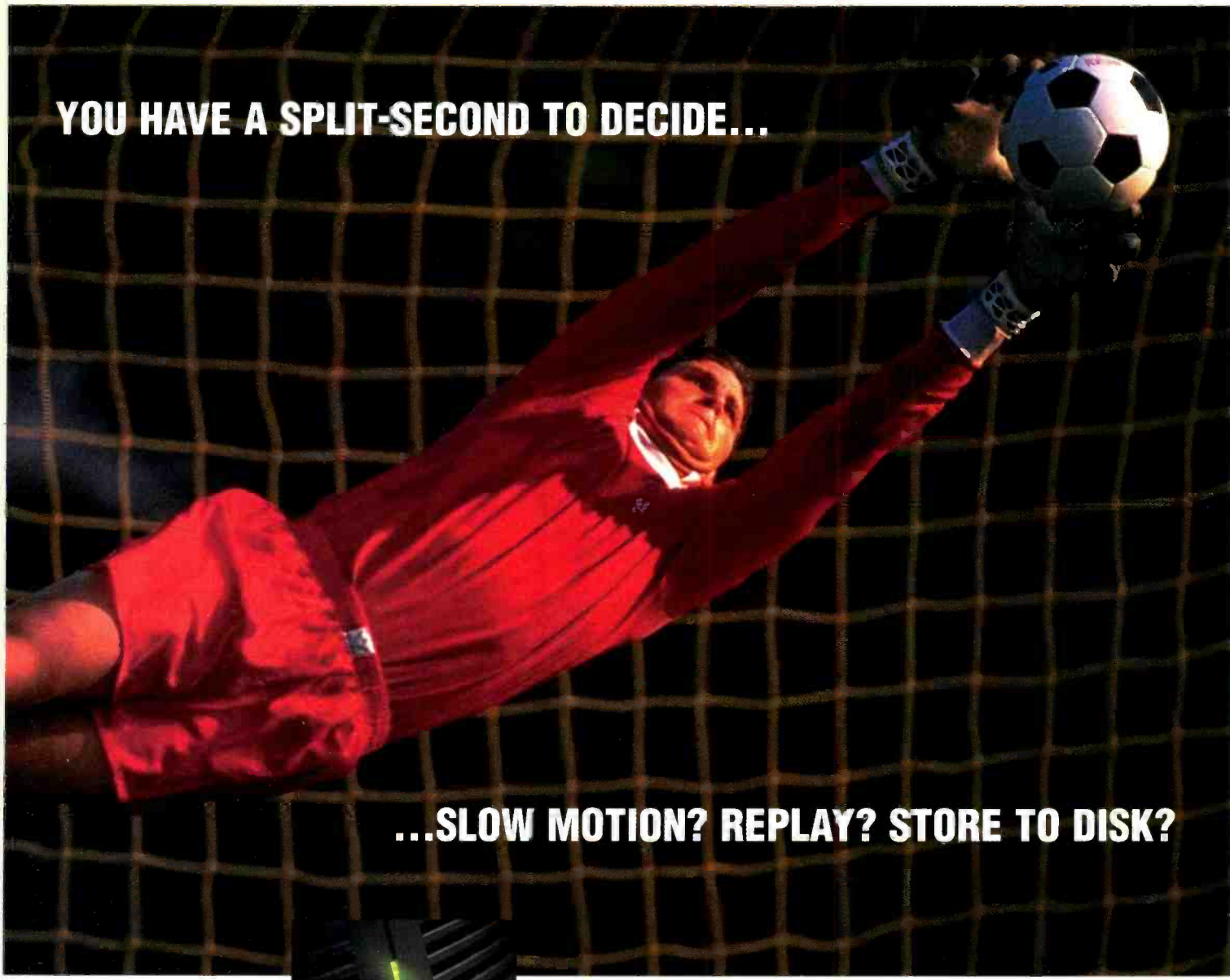

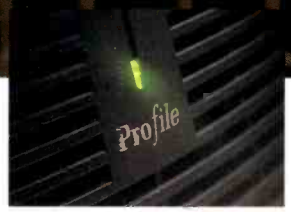

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digital cardiology, a diagnostic procedure requiring the capture of 1,024x1,024 12-bit images at 30fps, yielding a sustained digital data rate of 47MB/s, approximately 30% higher than required by CCIR-601. The image capture duration is typically 10 to 15 seconds, and the doctor captures approximately 10 sequences resulting in a storage requirement of just under 5GB per patient.

The imagery captured for this application is uncompressed because compressed imagery was not allowed, due to legal and liability reasons. Also, frames could not be dropped by law, since the patient was being subjected to x-ray.

Video storage

This long introduction has a point. The medical market's requirement closely parallels the transition now occurring in video image storage in the film and video market. The digital image storage requirement for medical did not have legacy interfaces, such as the film and video market. Their use of digital video storage was through computer-style interfaces not traditional analog video interfaces. This, of course, was a luxury for the market, allowing quick adoption of digital storage media.

PDT and RAID implementations

Since 1984, Storage Concepts has developed two forms of VDRs using magnetic disk technology: the parallel transfer disk (PTD) and parallel disk (RAID) architectures. Both technologies are in use today. The differences are subtle, but significant. PTD systems use multiple heads on the same magnetic disk to achieve the high data rates required by ITU-R-601. Real-time RAID systems use multiple synchronized disks in parallel to achieve high data rates. An advantage of the PTD is that it can achieve the desired video rates with fewer disks than the RAID device. A PTD disadvantage is that systems are typically built with small storage capacities of 30 to 60 seconds due to the cost of this unique and sole-sourced disk.

RAID systems require more disks to sustain video rates, but a pleasant fall-out of this technology is that they offer a sizable storage capacity, a necessary feature of useful VDRs. Because the Storage Concepts controller manages all error correction in real-time, its RAID devices additionally use standard low-cost data disks. Special AV disks are not required. The Storage Concepts real-time controller eliminates video stream interruptions associated with thermal calibration (TCAL) and disk error handling through the use of controller-based data corrections. The disk error-correction capability is not used because its correction times can create video interruptions resulting in dropped frames.

Storage Concepts maintains the philosophy that the user should have the option to use redundant disk technology in video applications. All Storage Concepts RAID products can, therefore, be configured for maximum bandwidth (RAID 0) or protected bandwidth (real-time RAID 3). This allows the cost-sensitive user to forego the redundant disks. As the video storage lengths increase, the power user will find the redundant disk comforting to himself and his clients. The redundant feature also becomes crucial if the storage is used simultaneously by several editing suites.

A powerful real-time RAID device is useless without performance connectivity to the application. Storage Concepts has selected Fibre Channel to provide that connectivity. Fibre Channel is a key enabling technology for FibreRAID's successful use in the video market. Prior to Fibre Channel technology, RAID devices used SCSI, and in some cases, HIPPI interfaces. The HIPPI interface is prohibitively expensive and supported by only a handful of users. SCSI, although prevalent in the

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database storage market and non-real-time image storage, did not have the sustainable performance required for continuous video applications until the recent introduction of UltraSCSI. UltraSCSI, which now peaks at 40MB/s, barely accomplishes the needs of one video stream. Fibre Channel, conversely is now supported by more than 150 vendors. Its current speeds are 1.062Gb/s or 100MB/s. This performance allows video to be transferred at rates above real-time, enabling 601 performance servers to be developed.

The FibreRAID supports two Fibre Channel connections. These interfaces are full 1.062Gb rates. The internal architecture of FibreRAID supports sustained video rates of 80MB/s through the use of up to eight parallel data drives, each supplying 10MB/s throughput. With disk technology doubling in throughput every 18 months, the full 100MB/s rate will be achieved with the incorporation of new future disks. ■

Martin Bock is vice president of marketing at Storage Concepts, Irvine, CA.

Ciprico

By Bill Moren

For many years SCSI-2 has been the dominant storage interface in the general computing market. However, with a 20MB/s maximum data rate (actually a bit slower for sustained operations) SCSI-2 doesn't have the bandwidth to support uncompressed video rates. An extension to SCSI-2, called UltraSCSI, has doubled the maximum data rate to 40MB/s, which is adequate for a number of video formats.

Another recent development, Fibre Channel, improves storage data rate capabilities to 100MB/s, which is more than adequate for any video format (including CCIR-601) and, for some formats, multiple streams of uncompressed video. Fibre Channel will become widely accepted in the broadcast community over the next few years. At NAB 96, for instance, HP, Tektronix, Avid, Panasonic, and Silicon Graphics announced support for Fibre Channel for use in the studio.

RAID and high-bandwidth storage

Without disk-based storage with the bandwidth to operate at uncompressed video data rates, there would be no migration away from proprietary VDR technology. High-bandwidth RAID has proven up to the task for this application. Not just any RAID will do the job, however. To operate in the role of a VDR, a RAID must support high sustained data transfer rates, with no loss in performance under any operating condition. This includes no performance degradation after a drive failure.

Of all the RAID architectures defined and implemented, only RAID Level 3 meets the needs of VDR applications. Unlike other RAID levels, RAID 3 stripes every piece of data across all the drives in the array, in parallel. This parallelism yields extremely high sustained data transfer rates, as all the drives in the array are transferring data simultaneously for each and every data request.

RAID technology is rapidly becoming the ideal storage technology for video disk recording applications.

A good example of high-bandwidth RAID technology are the disk arrays available from Ciprico, Inc. These arrays support a range of performance capabilities depending on which industry standard host interface is chosen. For instance, the 6900 series supports the UltraSCSI interface. With sustained data transfer rates of nearly 40MB/s the 6900 can be used when NTSC format video with RGB or RGB+alpha color space is required. For video formats with higher data rate requirements, Ciprico's 7000 series of Fibre Channel RAID disk arrays are a good choice. The first Fibre Channel disk array for the broadcast industry (demonstrated at NAB 96), the 7000 provides sustained data rates of more than 80MB/s and will operate at more than 90MB/s as higher-speed disk drives become available.

Ciprico's 7000 series disk arrays employ an 8+1 architecture, which ensures enough drive bandwidth to operate at video speeds. Furthermore, each drive in a Ciprico array has a dedicated SCSI channel, allowing every drive to operate simultaneously without having to contend for a common SCSI bus, an architecture common to most lower-performing RAIDs.

For VDR applications, however, simple media redundancy is not adequate. In addition to remaining on-line after a drive failure, the RAID must also continue to operate at full bandwidth. Ciprico's RAID-3 implementation performs the regeneration of a failed drive's data on-the-fly, with no performance degradation. Special hardware is used that resides on an internal data path, allowing all disk data to flow through without loss of bandwidth. The ability to operate at full speed after a drive has failed is one of the characteristics that makes Ciprico's RAID implementations ideally suited for VDR applications.

In addition to media redundancy, power supply redundancy is also important. Of the major active components in a RAID disk array, the drives and power supplies are most likely to fail. Ciprico's products support dual, load-sharing power supplies. In case one of the power supplies fail, the other has sufficient power to operate the entire array. Additional levels of redundancy are also possible. For instance, the 7000 series comes standard with redundant cooling fans.

Off-the shelf solutions

RAID disk array technology is an ideal alternative to the traditional proprietary approach to VDRs. It allows the use of one off-the-shelf computing platform as both the disk recorder and editing workstation. High-bandwidth RAID products, such as Ciprico's UltraSCSI and Fibre Channel disk arrays, have the performance to accommodate uncompressed video of any format. Redundancy and capacity features provide the flexibility needed for most any real-time environment. ■

Bill Moren is senior product manager at Ciprico, Plymouth, MN.

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ifying standard disk drives to achieve uncompressed video recording on a single disk drive. The modification involved the installation of a multihead read channel inside the disk drive. This resulted in 32- and 64-second disk recorders of unparalleled utility for high-end short-form applications. For longer durations this solution becomes costly. Sadly, this adaptation is much more difficult with today's low-cost disk drives because the track density is so great that each head cannot be assumed to be over the same relative track.

Second-generation VDR

In 1991 the reality of video compression techniques and the yearly improvements in disk-drive cost performance made it possible to develop a non-linear editor based on a standard platform computer with third-party plug-in boards.

This architecture was well-suited to off-line editing applications and products from companies like Lightworks and Avid. They were among the first to gain acceptance in the industry. The tight coupling of the video circuitry and the graphics display is essential in these applications. It allows the editor to manipulate a richly animated set of editing tools in the time line user interface.

Non-linear off-line editing systems of $100K yield a good return through time savings in post-production. However, when a VDR is based on this architecture and applied to on-line or broadcast applications the fit is not so good.

An architecture based on a standard platform computer running a standard operating system and multiple third-party boards suffers from many problems. The packaging of a computer does not ordinarily meet the stringent standards of the broadcast industry. The standard operating systems and file systems do not yet support the real-time needs and performance of broadcast applications. Few combinations of third-party boards are really plug-and-play. In fact, many developments using this architecture can better be characterized as a continuous compromise between open architecture and proprietary adaptations.

High cost stands above all the other problems of the architecture. It is difficult to develop a second-generation VDR to compete on price with a tape recorder.

Third-generation VDR

A new generation of highly integrated embedded disk recorders have been developed in order to address the cost-sensitive applications that have traditionally been served by tape devices. Such a disk recorder will comprise a single low-cost circuit board integrating digital and analog video circuitry, JPEG compression, digital audio processing, a RAID-based disk interface, time code and machine control. All of these are controlled by an embedded microcomputer running a lightweight, real-time operating system.

Fourth-generation VDR

Is there a future for stand-alone hardware or are all the problems going to be solved by software running on standard computers? To answer this we can draw on the tired analogy between the desktop publishing and desktop video. It is true that standard word-processing software running on a standard PC has replaced dedicated word-processing systems. Page composition, graphics and color retouch workstations have become obsolete. The only further hardware required is a laser printer and a scanner.

So it is possible that the destiny of the third-generation disk recorder is to evolve into a LAN-attached peripheral. Imagine having just composed a sales presentation in say, PowerPoint running under, say, Windows 97. You select PRINT and the job is sent off to a VDR-like device on the network, which assembles your edit, renders your graphics and writes it all out to a CD-ROM or DVD. Now that's a real solution! ■

Reza Rassool is chief engineer, AV disk recorders, StreamLogic Corporation, Chatsworth, CA.

Drastic Technologies

By Karen Taul and James Brooks

The digital disk recorder (DDR) is often looked to as a device that will offer the promise of all-digital production and playback for broadcast environments and video/audio post. Ironically, much of the criteria that applies to analog VTRs also applies to DDRs.

Replacing the VTR

In order to deliver this promise of digital video technology, a DDR must match or surpass the flexibility a VTR can provide in a variety of environments, while simultaneously improving reliability and profitability. It is with these specific goals that Drastic Technologies developed the VVCR.

Although lossy encoding may be sufficient for some applications, a DDR that is incapable of offering visually lossless recording dramatically reduces or eliminates many possible applications. VVCR exceeds the image quality of broadcast VTRs by offering a compression ratio of 2.5:1. To maximize storage, rates of up to 20:1 or off-line modes can also be selected. VVCR plays and records NTSC and PAL video at full CCIR-601 resolution. To maintain signal quality and flexibility, VVCR accepts and generates composite, component, D-1 and S-Video signals, as well as balanced audio signals.

Electronic bumping

The method of bumping used by VVCR is identical to that of a VTR. The VVCR is unique in its ability to perform sophisticated editing functions including preroll and full frame preview. Its fully independent video and audio channels allow audio, video or both to be added or overwritten anywhere on the drive. In addition, the audio scrub feature allows easy edit point location. Without these abilities, a DDR is rendered ineffective in an edit suite and, therefore, is unable to replace a VTR.

To achieve superior picture quality while maintaining efficient storage of video and audio requires an accommodating and particular design. From its inception, Drastic Technologies' Fast File System (DFFS) and specialized memory buffer handling were designed with performance in mind. VVCR's substorage system applies storage specifically where needed without the restriction of recording to fixed

time-code locations. Material can be recorded or re-recorded anywhere within VVCR's 24-hour virtual time code. The storage system also accommodates varying compression rates resulting in seamless playback of recorded material while using a minimum amount of storage.

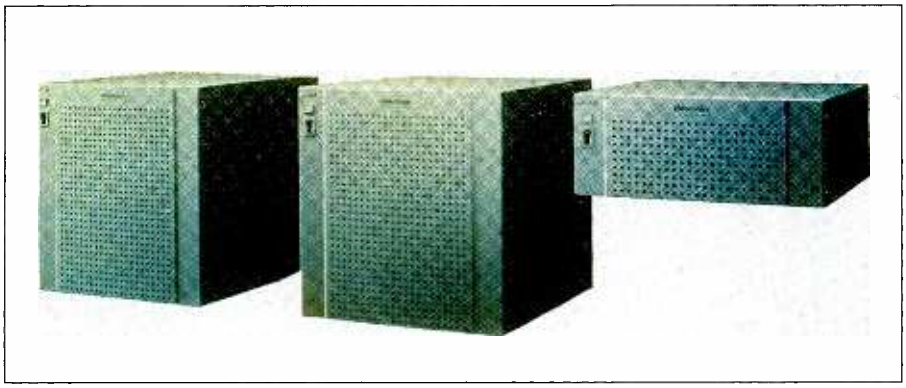
Broadcast applications

The VTR is a mainstay in broadcasting and insertion applications for many of the same reasons as it is in the edit suite. Here too, a DDR is expected to perform like a VTR in respect to image quality, functionality and compatibility. Functionally, the key to frame-accurate re-broadcasting is to achieve synchronization using standard edit methods and bumping procedures, both of which are provided by VVCR. On-air or spot insertion environments operate with no margin for error, therefore, reliability is crucial. The VVCR's RAID-based architecture provides the security of fault tolerance, assuring timely playback.

Drastic Technologies recognizes the need to increase efficiency by integrating with the industry-proven insertion and on-air systems rather than dictate work flow with complicated operations. This is aided by VVCR's use of contiguous time code expected by the controller. Ultimately, the DDR must be as easy to control as the VTR. The VVCR provides direct front-panel control including frame and field pause in addition to Sony/SMPTE RS-422 protocol, GPI, RS-232 and MIDI control available on industry standard connectors.

The issues of reliability and control are involved in the still-store, clip store or display controller applications VVCR supports. The recorder has also been called into service as an industrial process monitor, a dub recording source and animation recorder. It is, in fact, the image quality of VVCR that makes these applications viable. For fast-paced sports or events coverage, high-quality slow-motion or dynamic motion control is in demand. VVCR provides more than just compatibility with current slow-motion controllers. Drastic Technologies' revolutionary adaptive interpolation technology provides unparalleled slow-motion playback while minimizing the artifacts inherent in slow motion. The variable-length loop record function allows simple management of live material for playback. Other features include multiple head, same source RAID technology development allowing for multiple time delay, as well as multiple channels for insertion systems. Non-linear playback support allows one VVCR to do the work of multiple VTRs, playing a series of edits or spots without the pre- and post-rolls normally associated with tape-based spot playback. Because the VVCR is built on the solid foundation of complete VTR emulation, it makes possible these current applications while paving the way for new and exciting future developments. ■

Karen Lynn Taul is director of marketing, and James Brooks is head of development for Drastic Technologies, Downsview, Ontario, Canada.



Sony VideoStore

By Jerry Berger

As a wave of digital disk recorders and players make their way into the marketplace, the need to focus on system reliability and flexibility, especially during critical playback and recording times (i.e., Sunday afternoon football), is paramount.

Unlike tape recorders, digital disk recorders provide instantaneous access of recorded material. In the analog world of tape recorders, certain safety nets have been put in place (dual recording, for example) but the digital world is still evolving with its own back-up mechanisms. The redundant record and playback features of the Sony VideoStore disk-based multichannel file server are prime examples of safety nets employed in the digital world.

Four levels of fault protection

The VideoStore system's four levels of fault tolerance are:

1. Predictive maintenance, a Sony innovation, providing the ability to alert the user of potential component failures prior to the failure occurring.
2. Non-disruptive faulting: The ability to suffer numerous combinations of multiple points of failure and continue to perform without any impact to performance.
3. Hot swappability of the Media Unit RAID hard-disk drives and power supplies, and several of the Media Control Units components, as well.
4. Automatic data reconstruction upon replacement of a failed hard-disk drive.

Based on RAID 3 technology, the Sony VideoStore system combines instant random access to stored data, large storage capacity and high-quality MPEG-2 (MP@ML) compressed video in an integrated, fault tolerant, multichannel video transmission system.

The system architecture contains a cost-effective and centralized design rather than the channel buffer design. This way, any clip may play to any output at any time and be revised up to the last second prior to air.

The Media Control Unit (MCU) contains all the control electronics, CPU, as well as communications and bus architecture for the VideoStore system. Up to 12 independent and discrete output channels per Media Control Unit may be installed. Multiple Media Control Units may be linked together with an optional clip exchange board resulting in effortless library management of multiple VideoStore systems. Clips only need to be encoded once and the clip exchange option facilitates the distribution of the encoded data to and from multiple MCUs.

Redundant low-volume fans and power supplies are installed to minimize single points of failure. The MCU provides the benefits of Sony's RAID 3 predictive maintenance, hot swappability and non-disruptive faulting even though there are no hard-disk drives (HDDs) in this unit. In addition, the MCU supports remote VideoStore systems diagnosis through a dedicated RS-232C port.

The VideoStore system can be easily and economically expanded to accommodate up to seven media units for added storage capacity. Each media unit is comprised of six high-performance HDD in a 5+1 RAID 3 configuration. Each HDD currently stores 2.1GB or 4.2GB of information, effecting a storage capacity of 4.3 or 8.6 hours per media unit. The VideoStore system is designed so that off-the-shelf drives can easily be interchanged as hard-disk storage technology evolves, thereby increasing storage capacity exponentially. In addition to the features of predictive maintenance, non-disruptive faulting and hot swappability of almost all internal components as in the media control unit, the media unit also provides for automatic (without operator intervention) data rebuild for any lost HDD in the VideoStore System upon insertion of a replacement drive.

MPEG-2 decoder boards

Sony's VideoStore system can be configured with a two-channel video output board designed for vertical switching applications, such as in cable commercial insertion. In addition, a single-channel RS-170A gen-lockable board has been designed for more sophisticated integration into master control environments. Both decoder boards have analog composite or component outputs allowing for easy integration into existing facilities.

Superb picture quality

The VideoStore system incorporates Sony's own MPEG-2 (Main Profile @ Main Level) compatible algorithms. This system is designed to produce high-quality pictures due in part to a wide window of motion estimation/compensation. Also included in the system is a built-in frame synchronizer to enable acceptance of non-synchronous feeds, such as satellite transmissions or non-time-base corrected video-

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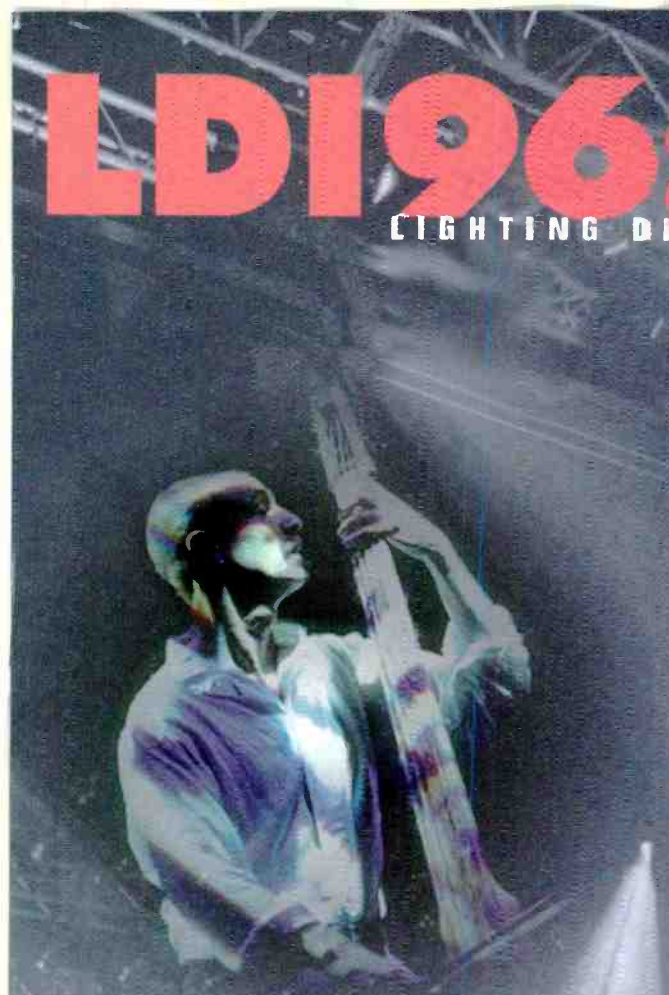

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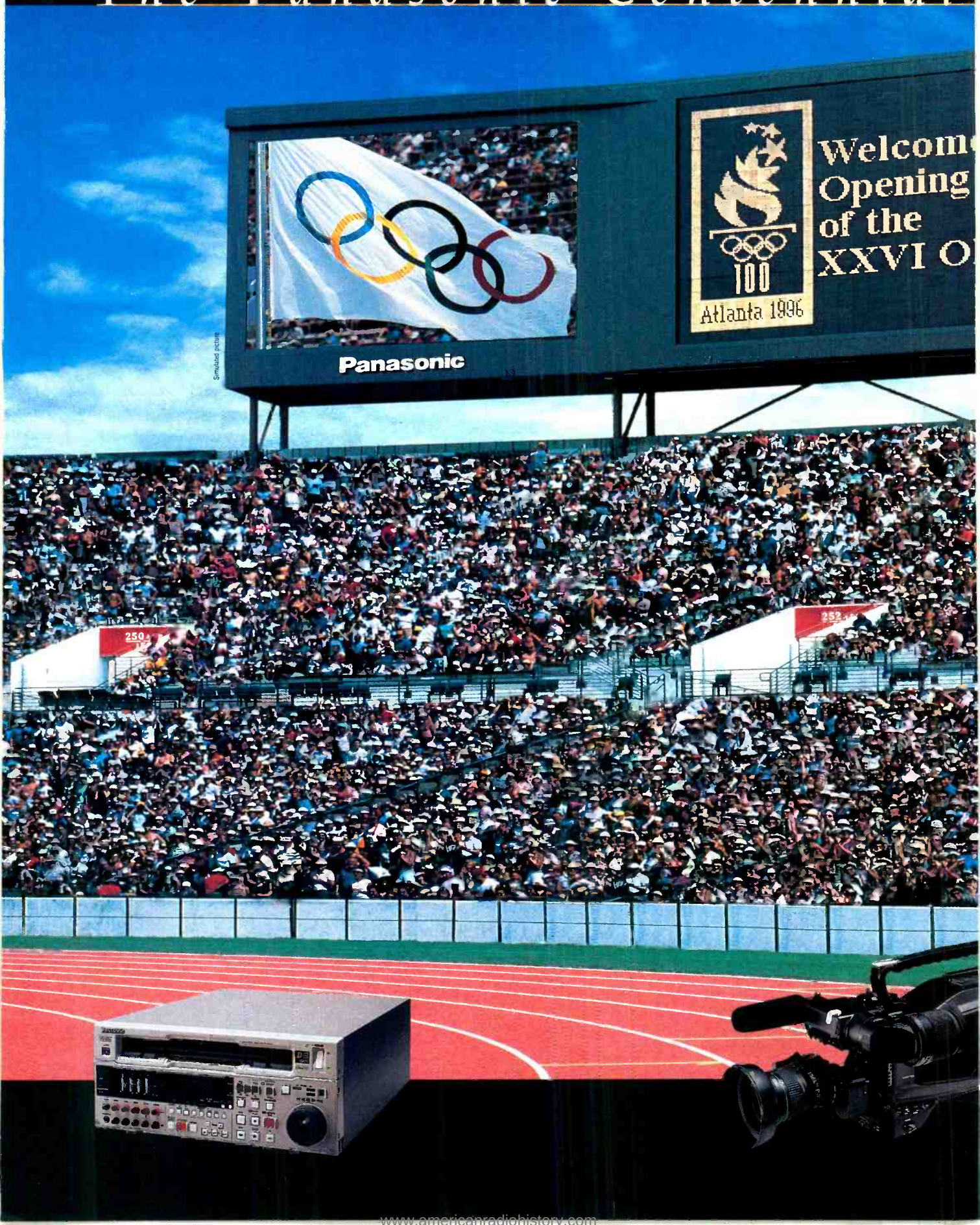

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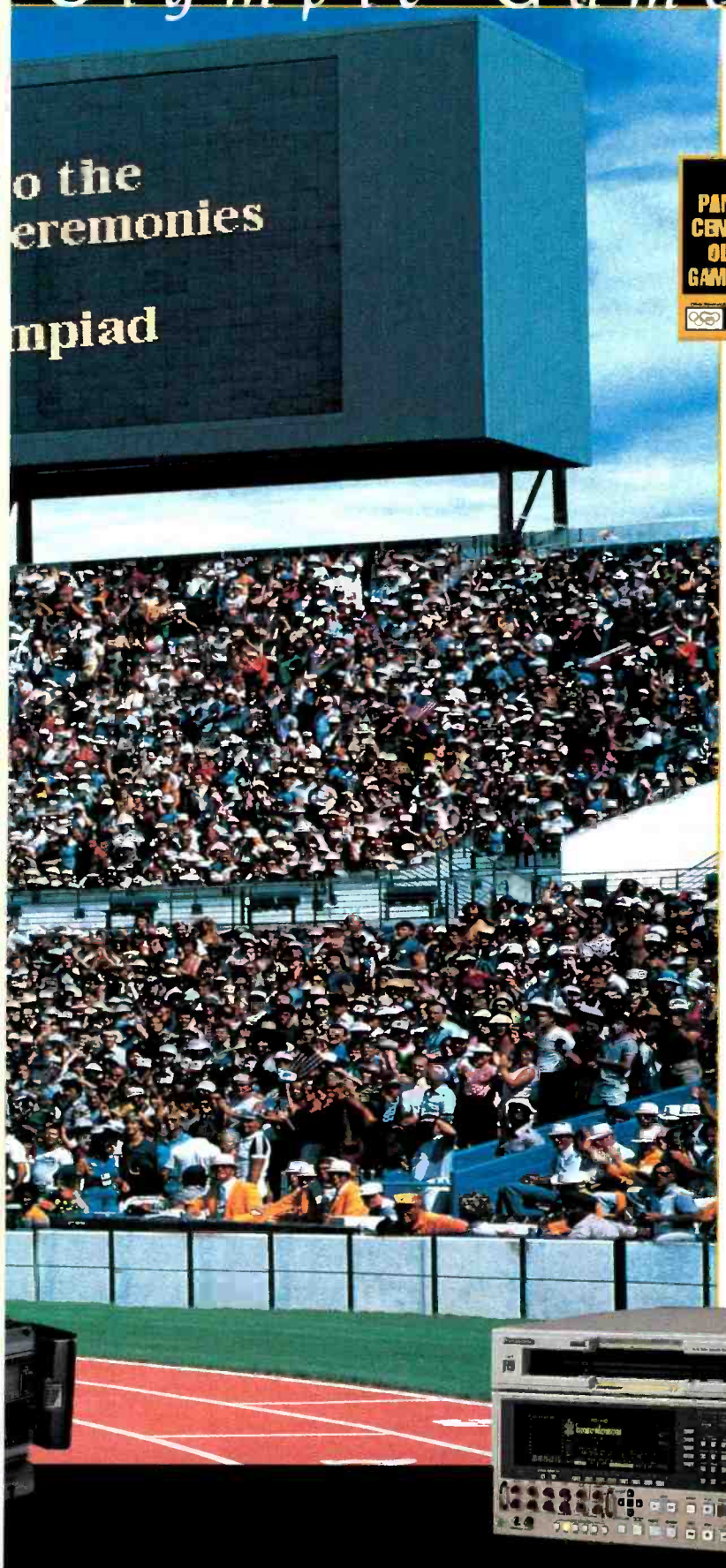

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tape sources. Additionally, the system incorporates editor-like VTR machine control of the source tape deck.

There is also an integral decoder board within the encoder that provides for instant quality assurance and verification. Furthermore, integral audio multiplexing is included. The system contains multiple format video, audio, bitstream and control interfaces. Through SonyUs open control protocol, system integrators can use any PC or control platform to control the VideoStore system.

The future of dependable digital disk recording will rely on a design philosophy that is able to know when and where failures are likely to occur. Anticipating and resolving critical points-of-failure within a system is key. Therefore, the design philosophy should anticipate the multiple operations enabled by digital disk recording and provide more than ample headroom for these tasks while providing room for future growth. The ability to record, playback multiple channels, rebuild failed hard drives and distribute via wide area networking clip distribution all simultaneously and with consistent reliability is key to the value of a disk-based recording system. ■

Jerry Berger is manager video server technology, Sony Business & Professional Products Group, Montvale, NJ.

FOR MORE INFORMATION, CIRCLE ACTION CARD (208) OR CALL 800-472-SONY OR VISIT THE WEB PAGE AT: WWW.SEL.SONY.COM/SEL/BPPG/VIDEOSTORE/INDEX.HTML.

ASC Audio Video

By Todd Roth

The VR is a one- or two-channel digital disk recorder that comes in two different hardware configurations and offers a choice of storage options. This flexibility allows VR systems to be configured in the way that best meets the unique demands of the customer. By taking a building block rather than a closed box approach VR systems become more than just simple DDRs.

VR main unit features:

- one or two independent motion-JPEG compression/decompression channels (in the same box);
- 1.6 (mathematically lossless):1 to 20:1 video compression;
- full CCIR resolution (including the vertical interval);

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- 0-109 IRE video response;
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- a half-line shifter for smooth and stable slow-motion playback;
- Split audio and video, supports scattered record (no fragmentation issues);
- four main and two monitor audio channels per video channel (balanced, +4dBu);
- LTC/VITC reader/generator with character generator output per video channel;
- Optional CCIR-601 with embedded audio.

VR storage features:

- UltraSCSI, Fibre Channel and SSA;
- true multichannel access to common or shared storage;
- multiple redundancy strategies, including RAID;
- up to 120 hours of on-line capacity;
- support for removable media;
- support for computer tape backup systems including robotic libraries.

The VR main unit

The VR is the building block in our line of multichannel digital disk recorders and is offered in two primary configurations. Both configurations support dual compression/decompression channels and can be integrated together in a shared storage environment. Both configurations also support RS-422 (Sony, Odetics, Louth and Pioneer protocols) and TCP/IP system control. These units are based on Pentium Pro/PCI bus computers running Windows NT. By choosing Windows NT as the operating system the benefit of true multitasking is gained, which allows third-party packages (i.e. Pinnacle's Genie and Chyron's Inscriber) to be integrated into the platform.

Platform 1

The first configuration can have a single record and a single playback channel. It supports up to four real-time 2-D DVEs that can be used for performing dissolves, wipes, tile effects, background generation and rendering. It also has an internal character generator. This VR version includes a 10-bit gen-locking main output, an 8-bit preview output and an independent video key channel that supports luma, chroma and graphics keying. Also available as options are 3-in/2-out CCIR-601 digital video, an internal LTC reader generator and two RS-422 (master and slave) SMPTE ports.

The software applications geared to take advantage of this platform are aimed at:

- NLE — an integrated non-linear editor that supports Pinnacle Genie and Fusion;
- Post-production — real-time effects;
- Live sports — slow-motion, instant replay and highlights.

Platform 2

The second configuration supports two record/playback channels. It has in internal 6x2 input router that accepts up to six composite, two CAV or three Y/C signals. For each video channel it has an integrated LTC/VITC reader/generator with a window insertion on a separate video monitor output. Each channel also has two RS-422 (master and slave) SMPTE ports. This platform also optionally supports 3-in/2-out CCIR-601 digital video.

The software applications geared to take advantage of this platform are aimed at:

- Commercial insertion — two independent channels;
- Network delay — potentially a one box solution;
- Pre-read — lossless multigeneration layering (using CCIR option).

Devices based upon both platforms can coexist using shared storage to create the integrated digital broadcast environment coveted by stations around the world.

UltraSCSI

All systems come with UltraSCSI support (40MB/s, backward-compatible with all existing SCSI levels). The UltraSCSI bus is useful for supporting customers' existing hard drives, building smaller (less than six-channel) systems, supporting Iomega's JAZ 1GB removable drives, and most importantly, supporting tape-based near-on-line storage.

UltraSCSI-based systems require a hardware RAID for redundancy, for increasing the storage system bandwidth to allow multichannel support, and for increasing the maximum amount of storage capacity beyond the 15-drive limit.

The UltraSCSI port is also used for supporting tape back-up drives, such as the 20GB Exabyte Mammoth (two Mammoths can be stripped together for 40GB of twice real-time 6MB/s backup). This port also can be used to control the Exabyte EXB-400 series robotic tape libraries with its 1.6 Terabyte maximum capacity (about 120 hours).

Fibre Channel

The VR system can be optionally configured with a Fibre Channel Arbitrated Loop storage system. With its capacity of 100MB/s (90 after overhead) and using ASC's patent pending "Offset Data Stripping" technology, up to 35-channel systems (at 2.4MB/s per channel) can be realized. Fibre Channel also increases storage to 127 devices, allowing up to 120 hours to be shared between 35 channels. Due to the nature of this architecture and the capabilities of the Pentium Pro processor, RAID can be supported without additional hardware RAID controllers.

The road ahead...

Due to the diverse nature of the supported storage architectures, VR systems can be configured in nearly any manner to suit the specific needs and scope of the project or intended application. This flexibility also allows customers to develop and broaden scope of that same project or application. Like with most new paradigms, technology usually only manages to pave the road, while final success is defined by implementation. As is the case when dealing with any kind of diverse and flexible solution, the more thought and effort given to defining the problem will pay off as a more successful, robust and effective implementation. ■

Todd Roth is vice president of research and development for ASC Audio Video Corporation, Burbank, CA.

Accom

By Connee Zugelder

While the creative process is virtually unlimited, one of the limitations and mysteries of the computer video production process is I/O, namely, video input/output. Upon assembling or completing a video project, how does the artist output video from the computer? How does a user bring material into the computer to retouch video for effects and compositing work? What affordable options are available to output uncompressed video from a computer in a reliable manner?

Accom's resolution to the computer video I/O dilemma was to introduce the Work Station Disk (WSD), a digital video disk recorder (DDR). The WSD was the first affordable desktop-sized DDR system.

In the early days, the most popular method of computer video output was installing a frame buffer board into a computer and performing single-frame records to a VTR device. This tedious process caused premature wearing to the VTR record heads. The major disadvantages to this method were the mandatory 5-second prerolls before recording each frame, the difficulty of randomly accessing single frames, and the degradation to the digital computer file being converted to analog just to do a preview. The cost of this method began to add up when each computer needed its own frame buffer board, plus an external disk storage device to store images.

DDR technology provided a better solution for uncompressed computer video I/O and storage. The WSD is what we call a video subsystem, a combination of a video frame buffer board for video I/O capability and an external hard drive providing digital storage of images — all in one machine. The system provides high-quality uncompressed digital storage (CCIR-601 digital component) plus the digital serial and analog component (RGB/Betacam) video I/O hardware needed to output true broadcast video.

Bridging between artists and video

The Accom WSD provides computer artists with a video bridge between the computer workstation and VTR devices. Images are created, composited, animated and manipulated in the software application environment then transferred digitally from the workstation to the WSD via computer data transfer protocols, such as Ethernet and SCSI. This process keeps computer images in a digital format for real-time preview. Once images are stored on the disk, the WSD can output video in real time to analog or digital VTR devices.

Typically, facilities have a combination of computer platform systems in use. The flexibility of connecting a WSD to an Ethernet network allowing remote access from any computer workstation is a real advantage. The system supports an extensive Ethernet command set for full control and image transfers all directed from the computer. On an Ethernet network, any computer using TCP/IP protocol can access the DDR. For many users, the WSD is the bridge between different computer platforms.

Control is crucial

VTR control is an important DDR feature. WSD includes a comprehensive set of VTR control and edit commands, providing frame-accurate editing from the WSD to an analog or digital VTR. The control commands and interfaces provided ensure the editing process is simple and precise. The system completely automates the entire process of recording images from the computer to the WSD and then out to a VTR.

WSD offers proprietary technology options for Silicon Graphics workstations, such as the extremely fast GIO bus interface option. Along with providing fast digital transfers, the GIO option includes real-time preview of video playing off the WSD on the Silicon Graphics monitor. The speed and quality of the GIO transfers provide a fast, productive method of outputting images. The WSD includes a graphical user interface (WSDVCP) for Silicon Graphics workstations. This software provides Ethernet, SCSI and GIO remote machine control, image transfer utilities, a browser utility, plus full VTR control and editing.

The DDR is an important tool for any task requiring real-time playback of digital video, looping of images, creating segments, playing at variable speeds, plus the ability to randomly access any frame. DDR systems are essential in computer graphics applications and in post-production editing environments. The WSD includes Sony and SMPTE protocols for use with edit controller devices.

The ability to quickly preview, record and digitize video from a computer, while offering frame-accurate VTR editing and control are essential features for computer video processing. Uncompressed digital storage is important for compositing work to ensure high-quality material. The Accom WSD is an affordable, flexible and uncompressed DDR device that streamlines video I/O for any computer platform. ■

Connee Zugelder is WSD product manager for Accom, Menlo Park, CA.

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Scitex Digital Video

By Steve Smedberg

The Digital Video Abekas Diskus offers 10-bit uncompressed recording and a broad array of capabilities including segment playback, fully variable speed and slow-motion playback featuring the powerful FluidFrame slow-motion interpolator option.

Diskus is completely platform independent and is easily integrated with all the most popular graphics workstations in use including SGI, Apple Macintosh and Windows NT machines. Transfers to and from these computers can be made using Ethernet, SCSI or fast and wide SCSI-2. The DDR is available with either 31 or 62 seconds of storage.

10-bit uncompressed images

Uncompressed CCIR-601, 10-bit digital video storage is a unique and significant feature of the system. This is because most graphics are in RGB format, which is generally eight bits per color channel (sometimes called 24-bit graphics). On the other hand, high-end digital video exists in YUV format. If you convert from 8-bit RGB to 8-bit YUV, resolution can degrade by as much as 50% in some cases. (A white paper entitled "Relationship Between 8-Bit RGB and 10-Bit Y, R-Y, B-Y Signals" is available at Scitex Digital Video's web site at www.scitexdv.com.) To reduce that loss, a DDR needs to provide more bits. The DDR's 10-bit YUV format provides the closest reproduction of 8-bit RGB images available in high-end digital video. The result is reduced banding and smoother gradient transitions from one color to another.

The recorder's FluidFrame slow-motion feature highlights this improved image quality by eliminating jump and jitter by mixing multiple fields to produce smooth in-between frames. The result is exceptionally smooth slow-motion with crisp resolution. The system can also convert between RGB and YUV formats in real-time when equipped with the color-space converter option. Rotoscoping can be performed using RotoPhoto, the Diskus plug-in for Adobe Photoshop. The RotoPhoto software package also includes a plug-in for Adobe Premiere and DiskNet—a batch file transfer and color-space conversion tool for Macintosh. This power makes it an ideal alternative to expensive proprietary high-end paint systems.

The basic recording system provides 31 seconds of uncompressed, 10-bit, CCIR-601 storage. This means it is fully compatible with the best component digital video systems in use, including the Sony Digital Betacam VTR and the Panasonic D-5 machine. All Scitex Digital Video Abekas products also offer 10-bit I/O. The standard system comes with serial digital input and output, two component analog outputs (one YUV and one RGB), SCSI (including fast and wide SCSI-2), Ethernet, RS-422 control, as well as a LINC interface. The 62-second version contains all of the features of the 31-second machine plus seamless loop and segment capability. A 31-second system can easily be upgraded to a 62-second device.

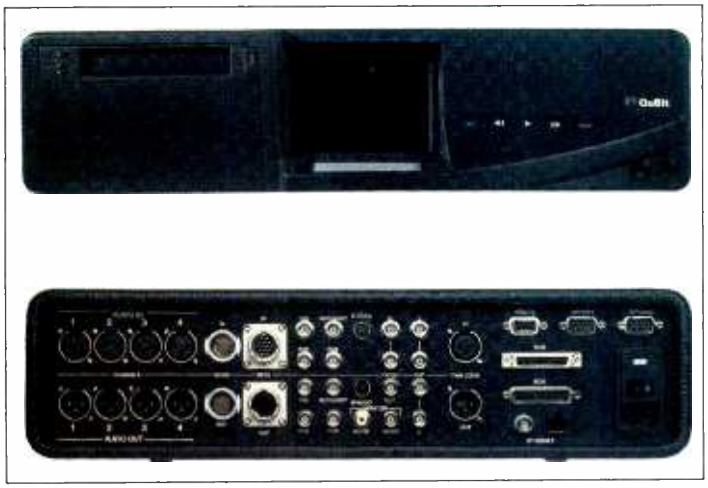
Diskus can play back perfect quality stills in either field or frame mode, making it equally at home with film- or video-based material. Playback speed is continuously variable from 50x reverse to 50x forward in 0.001x increments. Film playback mode allows you to convert 24fps film images to 30fps video images for playback in 525 video environments.

Control is simple using the on-screen GUI interface or the optional dedicated control panel. The recorder can further be controlled by most edit controllers and VTRs — including CMX Omni, Accom Axial, Grass Valley and Sony — via the standard RS-422 interface. It can also use RS-422 to control a VTR for laying animations off to tape and serve as a cache device during edit sessions.

The built-in segment editor allows non-linear editing on the material recorded on the disk. Segments can be edited and copied between segment lists to allow different versions of the sequences to be stored and compared. Macro events and timed pauses can be programmed into segment lists. The DDR supports 99 segments, which can be distributed among nine segment lists. On the 62-second DDR, the segment playback is seamless and can be used for final output.

The built-in Ethernet interface allows a simple, low-cost TCP/IP multi-user connection to a computer network. Because the recorder accepts files in many different formats and stores them as 10-bit YUV files, it offers tremendous flexibility in selecting from among the most popular graphics applications. The standard interface allows connections up to six meters and the differential supports a connection of up to 25 meters. ■

Steve Smedberg is a product manager for Scitex Digital Video, Redwood City, CA.



QuVIS

By Larry Strober

The standard QuBit can record up to one half hour of 4:2:2-quality video with 24-bit stereo audio, either digital or analog, and SMPTE time code, whether LTC or VITC. With the addition of affordable off-the-shelf hard drives, internal storage can be increased to three hours and to 12 hours by adding external drives. As drives with higher capacities become shippable, available storage capacity will again increase.

Another unique feature of the VDR is the built-in tape drive for archiving, backup or transport capabilities. QuBit stores up to two hours of recorded material on a 20GB removable tape cartridge. With the tape capability, Betacam-quality signals can be recorded to tape and hard disk concurrently, creating a backup automatically while you are recording the original

material. Higher-quality video settings (remember the QuBit is user configurable) require the hard drive for real-time recording, with transfer to tape for backup and storage occurring in non-real-time.

Working with myriad formats

Most video editing facilities work with a myriad of standard formats. In the past, this has meant purchasing individual equipment for each format that you need to support. Enter QuBit! QuBit can be configured to emulate the signal characteristics of most videotape recorders on the market, with varying record times based on the amount of signal data that a given format represents. Using its own method for data reduction and noise elimination the recorder samples the incoming signal at 12-bit resolution (around 9MHz) providing the operator with a choice of signal quality settings that range from "better than D-1" to "about S-VHS " levels. The higher sampling rate affords an editor more latitude when working with keyed graphics. The computer graphics artist will experience cleaner compositing of computer-generated footage with live action footage.

QuBit can record more than the standard three-channel video signal stated as 4:2:2. A higher-quality signal, 4:4:4 or even 6:6:6 can be recorded on the standard unit. In addition, it records a fourth channel of information, the alpha key channel, enabling 4:2:2:4, 4:4:4:4 or 6:6:6:6 recording or more esoteric combinations depending on individual requirements.

QuBit is supportive

Editors can use the VDR in the same manner as they would use any industry-standard VTR. In fact, you can replace just about any VTR in your facility with QuBit because QuBit supports a variety of RS-422 protocols for editing equipment. Time code is recorded on its own track, allowing the operator to record up to four tracks of digital or analog audio at up to 24-bit resolution. QuBit also gives editors access to advanced time-code control. You can work with the original as-recorded time code; you can alter the time values to better fit with other recorded footage you are working on; or you can even bounce time code from LTC to VITC or drop frame to non-drop frame status. This kind of flexibility provides a video editor with features allowing total control of a project in an efficient and user-friendly environment.

Fast computer network connections (SCSI II fast and wide, Ethernet 10Base T, Ethernet 100Base T) allow you to transfer video and imagery to and from QuBit with minimum of effort. QuBit works with TCP/IP and NFS network software. When all machines are connected and turned on, the computers see the recorder as just another hard drive on the net.

Once footage has been recorded, it is treated as a video clip and as a sequence of still images. Computer graphics artists can retrieve stills and sequences from any clip on the drive, allowing them to bring live-action footage directly into 2-D or 3-D graphics and animation packages. Once they render completed frames back out to QuBit, computer artists can then play the resulting clip to see if it meets their approval. In this manner, QuBit acts as a bridge between the computer graphics and video production domains, providing seamless access to the shared data.

Control can be exercised from a set of standard VTR transport controls and a combination touch-pad/LCD monitor command center. Through an intuitive software-driven interface, the user can adjust all of the recorder's audio and video settings, perform image and video file maintenance and run diagnostics. ■

Larry Strober is vice president marketing and sales for QuVIS, San Rafael, CA.

Panasonic

By Joe Videtti

The Panasonic LQ-D5500, the market's first erasable digital optical VDR provides broadcast-quality, high-density digital recording and solves the need for cost-effective, quick random access for broadcast and post-production applications.

This VDR represents the fourth generation of Panasonic optical video disc recorder/players using Phase Change (PCE) technology. It records 41.5 minutes of digital compressed video and two high-quality 48kHz/16-bit uncompressed digital audio (PCM) channels. PCE allows direct overwrite to the optical substrate, which is faster than magneto optic because of direct overwrite (no erase-only cycle is needed) and has proven highly reliable over the last six years in the company's family of optical video recorders and optical disc storage devices.

The LQ-D5500 uses the same digital signal structure and compression as Panasonic's 1/4-inch (6.35mm) DVCPRO digital component format. The LQ-D5500 and DVCPRO can be linked to form a cost-effective acquisition and editing system for applications such as high-speed news production.

With an average access time of 0.5 seconds across the disc, the VDR offers advantages in editing and production speed. A disc can be rewritten more than 10,000 times and played back more than one million times, assuring high reliability and low replacement costs. The recorder is equipped with two heads, one for each side of the disc. When one head is at the disc's inner side, the other head is at the outer side, and they move in opposite directions. The sum of the signals picked up by the heads is the output data. This system ensures a constant recording rate at all head positions and equally fast access to any point on the disc.

The VDR delivers more than 5MHz luminance and 1.5MHz chrominance bandwidth, plus a 50dB

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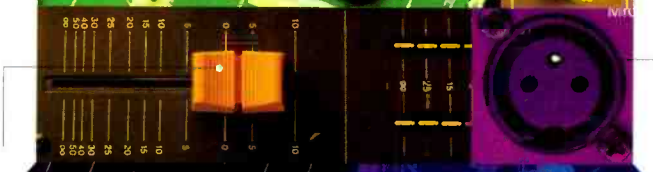

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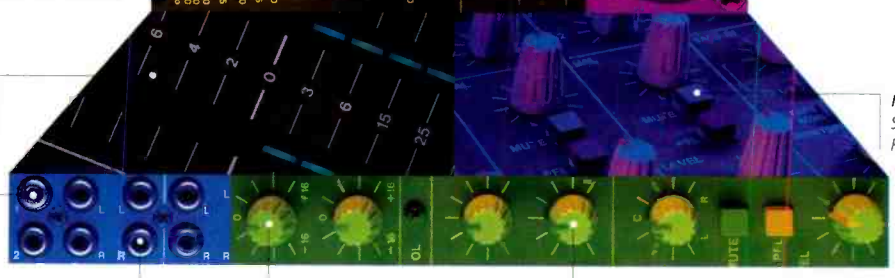

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video S/N ratio. This means a high-resolution broadcast-quality signal and degradation-free, multigeneration editing and dubbing through digital I/Os. The unit provides a full-frame playback at up to 40x normal speed in forward and reverse and operates with SMPTE time code or frame-number addressing. The unit can accept four different signals: NTSC composite, Y/C component, RGB and serial digital component.

Range of applications

Because of its random-access capability, the system is ideal for sports replay because it can immediately go back to the start of a play (or event) for viewing either in full motion or slow motion; with the variable speed capability the video can be viewed either forward or reverse in speeds ranging from 0.03 frames per second to 40x. With the use of a slow-motion controller (such as the Panasonic AJ-A7), two decks can be controlled with up to 99 cue points.

Post-production work can be done more quickly with the use of an optical VDR because it is not necessary to do re-roll or A-B roll to access or record the video and/or audio. Random access eliminates search and rewind, which translates directly to saved time and increased productivity.

Animation production time is decreased significantly by the use of the optical VDR, because it can record each frame as it is output from the animation device. Cuing, pre-roll and post-roll are eliminated.

Image databases with large numbers of high-quality video images can be stored and quickly accessed. One disc can hold 73,400 images (accessible in 0.5 seconds), far more and at greater quality than other types of removable random-access storage such as CD-ROM or 5.25-inch optical.

DV compression

The LQ-D5500 VDR uses the discrete cosine transform (DCT) process as defined for DV format 1/4-inch recording. The DCT mathematical operation converts raster-based pixel data into coefficients that represent the energy portion of the frequency spectrum, beginning with the DC value and rising. Because the natural distribution of energy in a picture is ever decreasing as frequency rises, the higher coefficients naturally become smaller.

The compression system operates intraframe, i.e., there are no motion artifacts because each frame stands on its own.

For standard definition, the signal structure is digital component 4:1:1. In addition to the widely recognized benefit of component transparency, by keeping the luminance component at the full sample rate, picture resolution is the equal of studio formats like D-1, D-5 or Digital Betacam. By reducing the chrominance sampling rate to half the studio standard, the absolute data rate was reduced but chroma detail remained better than NTSC or PAL.

This allows two significant advantages. First, the compression system operates intraframe, i.e., there are no motion artifacts because each frame stands on its own (unlike MPEG, for example) and frame-accurate control and editing is facilitated. This means each frame is complete and available for still or slow-motion or editing. Note that DV automatically selects between frame and field mode compression depending on the amount of picture change between fields, but never exceeds the one-frame boundary.

Second, the compression ratio is only 5:1, assuring that compression artifacts would be kept to a minimum even with the payload video data rate of about 25Mb/s.

A versatile solution

The Panasonic LQ-D5500 combines the superior picture quality and multigeneration capability of digital video recording with fast random access and excellent reliability. The highly durable disc allows repeated recording and playback with high reliability, thereby reducing disc replacement costs. The unit's feature set makes it ideally suited for editing, news and spots for broadcast and CATV stations, as well as such dynamic specialty applications as multimedia production, presentations, graphics and animation, among others. ■

Joe Videtti is product marketing manager, Optical Video Disk, Panasonic Broadcast & Television Systems, Secaucus, NJ.

Sierra Design Labs

By Chris Romine

Sierra Design Labs' (SDL) family of video disk recorders now includes Diskcovery and Quickframe models ranging in capacity from three to 96 minutes of uncompressed 4:2:2 component digital video. These field-expandable, full-featured VDRs are designed around a modular, RAID-based architecture. Their internal bandwidth far exceeds the requirements for real-time CCIR-601, thus providing seamless non-linear playback and recording of 8- or 10-bit uncompressed video and four channels of AES/EBU digital audio. Several hundred of these flexible VDRs are in widespread use in more than 29 countries supporting applications ranging from feature animation to on-air broadcast.

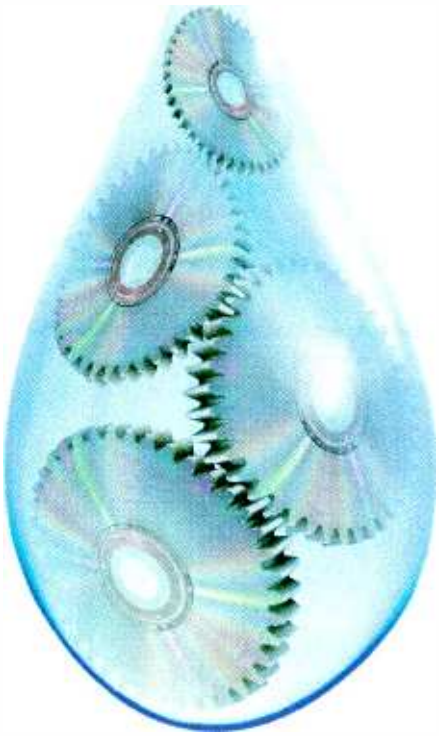
Connectability

All SDL VDR models include Ethernet and fast SCSI computer connections whose protocol is industry standard. Popular workstation applications with direct device driver support for SDL's disk recorders include Softimage, Discreet Logic, Alias/Wavefront, Parallax and many more. Device control and file upload/download support is provided for SGI platforms, while Diaquest's Animaq Digital software provides similar capability for Mac and PC platforms, including Windows NT.

SDL's own Anteras software package provides a true multi-user, multipath network solution connecting multiple workstations to one or more Quickframes or Diskcoverys with protected partitions and robust file conversion and management functions. Frame-accurate edit control for multiple Quickframes and/or VTRs minimizes the amount of support equipment required for video acquisition and layoff.

The SCSIframer

The SCSIframer VDR front-end serves video and audio to multiple workstations in a department-level network with performance up to 15fps on each of four ports over 8- or 16-bit fast SCSI. Each SCSI port incorporates a full-bandwidth CCIR-601 frame



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Circle (41) on Action Card

buffer. Combined with an optimized 30fps connection to Sierra's VDR, these frame buffers provide a virtually collision-free "Virtual DDR" connection to multiple workstations simultaneously. Any or all video streams may be viewed by a user from the built-in component and composite analog monitor outputs. Projects can now be supported that require paint, effects, compositing and editing without moving the material from the VDR until the job is complete. The extended capacity of SDL's VDRs allow multiple projects to be supported simultaneously. Major production and post facilities using this high-performance video server solution include Unitel/Editel, it/Greenberg and Industrial Light & Magic. SDL's commitment to modular design and future upgradeability includes plans for a Fibre Channel option with retrofit capability.

Wide area networks serve up uncompressed video from Quickframe VDRs through Sierra's new NFSfile server, which provides a network file system (NFS)-compliant protocol interface over Ethernet. Higher-performance ATM fibre network support will be added later this year to the industry's most complete family of networked video disk recorder solutions. SDL's Audioframer option adds AES/EBU audio and VITC time-code support to its VDRs. Audio can be embedded/de-embedded in SMPTE 259M/272 or discreet XLR I/O. VITC time code can be moved to video line pairs selectable by the user. Even a popular video switcher's 34-line delay can be removed with a simple switch closure on the back of the Audioframer.

No obsolesce

In addition to typical post-production applications, 4:2:2:4 key channel configurations are widely used by the major networks for graphical and character generator on-air. SDL has begun shipping 4:4:4 alpha channel VDR configurations into telecine facilities and offers 4:4:4 CGI solutions as well. Full GPI support, extensive macro capability and integration by such companies as DaVinci and SteadyFilm add to the Quickframe's value in telecine bays.

Sierra's VDRs incorporate Sony and SMPTE RS-422 protocols with extensions for compatibility with all major editing systems. The recent addition of Quickframe support to Accom's popular and powerful Axial editing environment, including RAVE, provides edit bays with a combination of the latest edit and long-format DDR/VDR technology for the first time. Sierra's own Control Panel supports all VDR functions and adds cuts-only edit control of a combination of up to four VDRs or VTRs.

In addition to a rapidly expanding end-user base, the Quickframe has earned a solid reputation as an OEM product for companies that include Dynatech Colorgraphics (Mosaic 360), Hewlett Packard (HP 4:2:2 VDR), Orad and Play (Time Machine). ■

Chris Romine is president of Sierra Design Labs, Incline Village, NV.

Pioneer New Media Technologies

By Jim Burger

Pioneer's Digital FastFile is a broadcast-oriented, inexpensive, high-quality stills and clips system. It integrates hard-disk storage, MJPEG video compression with a proven video database management software system and operates from a personal PC. Combined with a Windows-based operating system, the FastFile software allows you to create a computer archive of still images and video clips for instant playback. When you need to assemble something quickly, these cuts can be instantly found and retrieved for viewing. Your footage can also be organized into a playlist format, which can then be played in its entirety or one event at a time with just the touch of a button. In addition, Digital FastFile offers you unmatched flexibility by allowing you to control your archived footage from a personal computer.

Better, faster, cheaper

Pioneer's Digital FastFile System provides the features, functions and options you need for better, faster and more cost-effective operations now and for the future. There are numerous broadcast applications for Digital FastFile, because it emulates a high-quality component digital VDR that's capable of up to two hours of record time on the standard system. For instance, Digital FastFile can be used in such applications as sports highlights, news presentations, segment bumpers, still-store, slow motion, show opens/closes, clip store, on-air playback, commercial insertion, mobile facilities, graphics animation and weather maps.

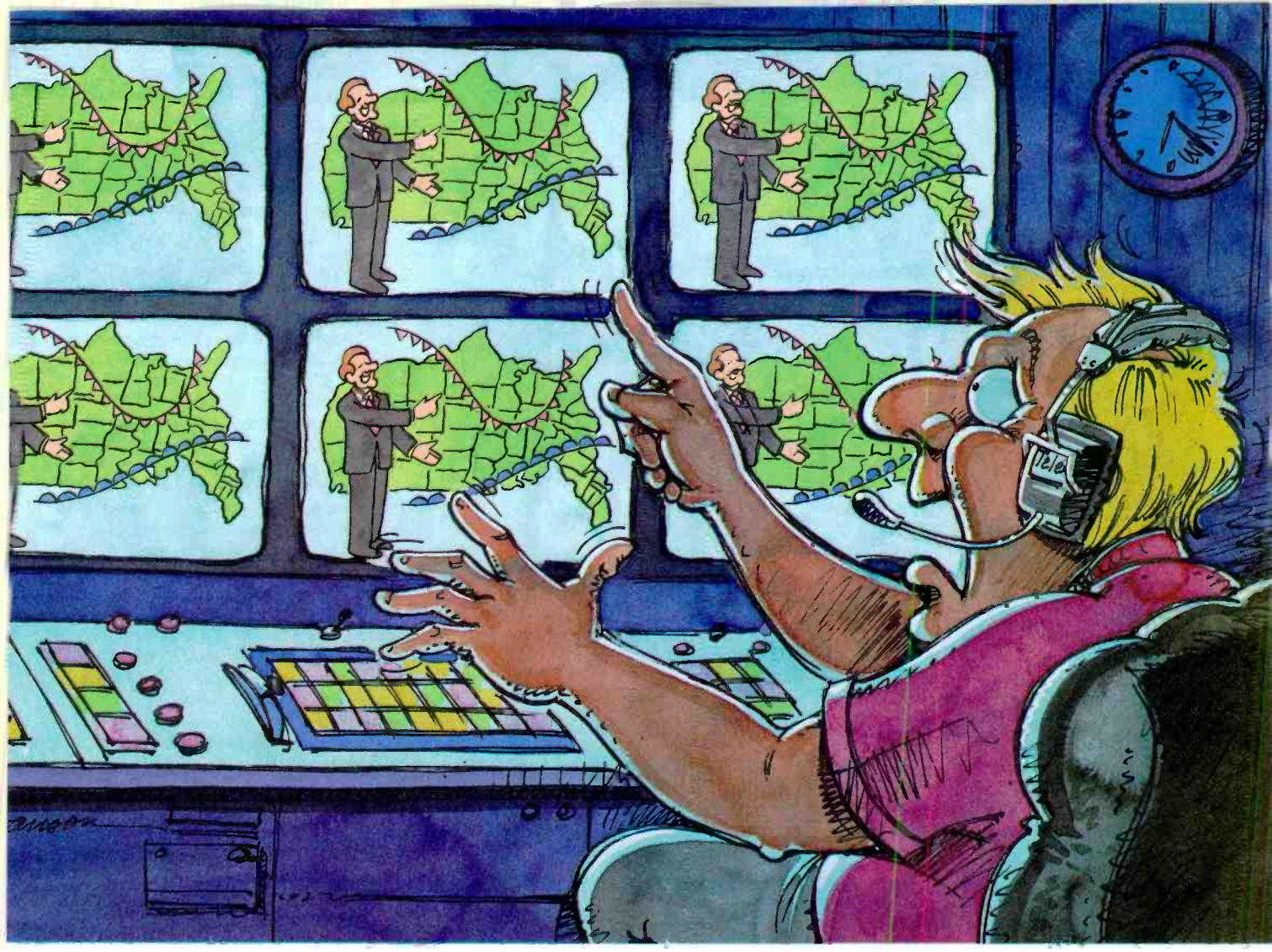
Digital FastFile, using scaleable MJPEG compression, can record at transfer rates of up to 64Mb/s, which provides from 15 minutes to two hours of record time on a standard system, with optional expandable storage for longer record/playback times. Because it's hard-disk-based, seamless random access for non-linear playback is possible with fully insertable independent video and audio channels. This also allows for digital video along with slow motion audio capabilities.

The user interface and software management is extremely user friendly. The operator can control the system using either the mouse, keyboard or keypad while the operational menus and status are displayed on the video VGA monitor. The FastFile GUI is composed of several parts: the main menu, toolbar, control panel, jog wheel, edit sheet and status bar. In each case, simple mouse clicks or keyboard/keypad entry facilitates operation. The software GUI emulates the controls seen on a VDR and makes the transition from front-panel control to software GUI seamless. For list management, pull-down menus contain options for opening, closing and managing your master lists and can be activated through mouse or keyboard commands. For previewing your list, the software gives you the option to display the files as thumbnail images to help in your decision-making process. The FastFile software automatically sorts the recorded stills and clips and provides the ability to store multiple playlists. In addition to instantaneous retrieval of your content, emulation of full-frame still and pause for the stored video, as well as slow motion control is easily accommodated.

The Digital FastFile system features NTSC or PAL composite, Y/R-Y/B-Y and S-VHS I/O with optional serial 4:2:2. Audio processing is accommodated with either two- or four-channel capability and sampled at 44.1kHz with 16-bit precision.

Users of Pioneer's VDR series of video disc recorders can also use the FastFile software to create a computer archive of stills and video clips just as in the case of the Digital FastFile system. ■

Jim Burger is national sales manager with Pioneer, Long Beach, CA.



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Fast Forward

By Paul DeKeyser

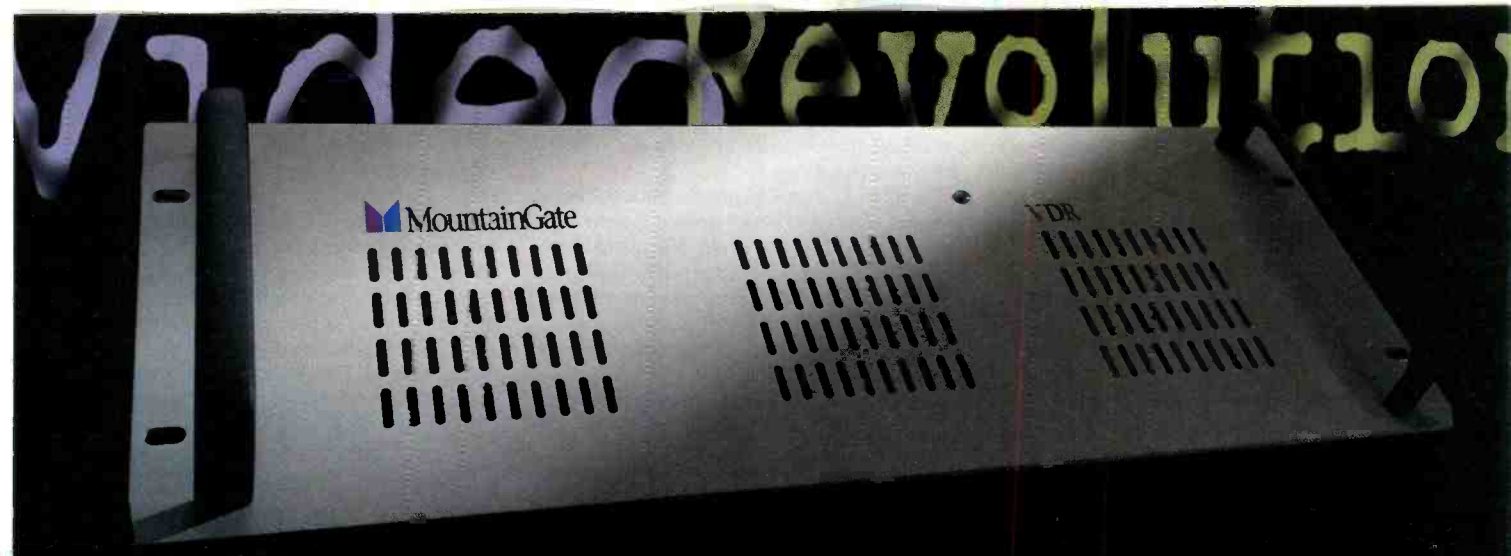
Fast Forward's newly introduced Omega Deck family of video disk recorders includes a single-channel version; a two-channel version, the Omega Double Deck; and a two-channel version with built-in RAID controller, the Omega RAID Deck. The entire family provides composite and analog component (Y, R-Y, B-Y) video inputs and outputs, genlock input, an RS-422 port, SMPTE/EBU longitudinal and vertical interval time code, and two channels of balanced audio per channel. The front panel provides a bright touchscreen LCD for status display and user configuration and also presents large, accessible and intuitive controls for commonly used functions. The distinguishing features of these products are superb image quality and an unprecedented low list price.

Variable compression

All of Fast Forward's recorders are based on motion JPEG with dynamic quantization. The basis for the Omega family is a highly integrated fourth-generation video/audio codec that includes an on-board SCSI-2 fast and wide disk controller. The codec is capable of moving data as fast as the storage media will support at rates up to 16MB/s. Firmware can dynamically meter video compression to the maximum data rate installed media will sustain or to a slower fixed data rate if desired.

Loop recording is a feature of the Omega decks that benefits sports, news and surveillance applications. The user specifies either a duration or a region on disk, say 10 minutes. Recording then cyclically writes through the same region on disk, replacing the oldest video once it has filled the region. Recording may carry on for hours, but the result in this example is that the VDR retains only the most recent 10 minutes when it stops recording. In addition, the user can tag and protect sections during loop record perhaps to recall highlights of a sporting event.

The Omega RAID Deck provides simultaneous record and/or playback of two independent video channels to a common storage media. When both channels record simultaneously, each channel is restricted to a separate user-configurable partition of the media. Otherwise, each channel can play back



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Thanks to a direct high-speed SCSI interface, the **MountainGate VDR** is fast enough to eliminate the bottlenecks commonly associated with post-production work. And, you can use the VDR's network interface to send source material **digitally** to any number of workstations. Another time, and cost, saving measure.

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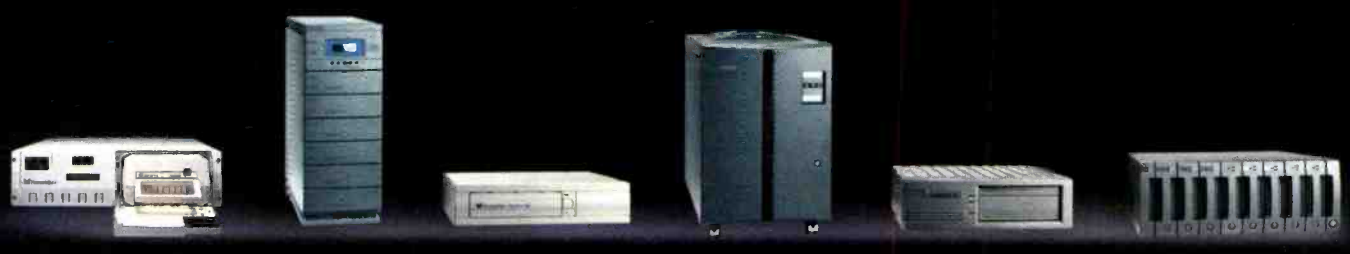

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randomly without restriction. When one channel is recording and the other playing, newly recorded material is available to the playback channel with a delay of 10 frames. News and surveillance applications can review an event without disturbing recording. Sports crews are capable of showing an instant replay without missing any of the action, and make full use of the Omega family's continuously variable, noise-free slow motion.

More Omega features

Several Omega features are well-suited for post production. The RAID deck serves as a random-access A/B roll source machine for a downstream switcher or DVE. All Omega Decks support the ability to slip each channel of audio with respect to video; that is, to move the start point of a segment of audio relative to video. Videomedia in particular has taken advantage of the VDR's unique features in their latest controllers.

The RAID deck implements pre-read capability by playing on one channel and recording on the other, then substituting the newly recorded material for the original source in subsequent playback. The device's pre-read is the functional equivalent of a digital tape deck; however, there is a generational loss because the video undergoes a decompression/compression cycle each pass.

RAID and Double Decks economically provide two channels of commercial insertion, controlled by Sundance Digital's software.

RS-422 control supports the Sony/SMPTE protocol including Odetics Broadcast extensions. This control interface has the profound benefit of making the Omega decks compatible with existing controllers. However, this control interface is the single greatest encumbrance these products bear: it encourages users to think of digital recorders as tape machines. You can extend the protocol to support many functions unique to a digital recorder, such as selective deletion of video. But other features are hamstrung by a protocol designed around a linear tape recorder. For example, because the Omega decks perform random-access playback, the most efficient way to edit material is to provide the machine with an edit decision list. This compact data can be transmitted quickly over RS-422, instantly reorganizing some or all of recorded source material. ■

Paul DeKeyser is president of Fast Forward Video, Irvine, CA.

Rapid Tech

By Steve Levine

The VISTOR II MultiStream VDR made its debut at this year's NAB Show. Based on Rapid's new MSX MultiStream Xpress two-channel intelligent video system card, the VISTOR II is an NTSC- or PAL-based non-linear hard-disk-based digital editing recorder/player that works within a Windows NT environment. A SMPTE time-code locked and frame-accurate RS-422 controlled transport, the VISTOR II uses dynamic compression to adjust encoder parameters on the fly to achieve the highest quality video while maximizing record and play time. The VISTOR II provides a dual stream real-time VDR solution for the broadcast and video production markets and emulates the best functionality of tape machines, as well as containing the features sought after in a state-of-the-art dual stream 4:2:2 component VDR. In application, the VISTOR II can emulate a multistream editing VDR, a multistream commercial insertion system or a production cache with effects. Using a non-linear editor that supports multistream extended Odetics control protocol, the system can be used for on-line non-linear editing.

With third-party commercial insertion software, the VISTOR II can double as a multistream commercial insertion system and by adding a third-party 3-D DVE, the VISTOR II can be used as a production cache for on-air productions. In this application, the unit can segue between A and B streams of video. Fast wipes, fades and 3-D effects can be programmed to roll with two video and four audio streams residing on a common fault-tolerant storage device like the VISTOR II.

VISTOR II features

Rapid Tech's VISTOR II features digital recording of video and audio onto a scaleable hard-disk drive system. With dual stream capability, the VISTOR II can perform simultaneous play-while-record/record-while-playback or two-channel simultaneous play. Audio can be recorded either together or at separate times from the video. Also, the four independent audio inputs and outputs can be bidirectionally configured during playback and record. Compression is accomplished through Motion JPEG onto the VISTOR II's internal or external hard drive. Rapid Tech has refined this recording method to reproduce near D-1 quality at its lowest compression ratio, which results in lossless video reproduction. Audio is sampled at 48kHz with 16-bit resolution across the four channels. A real-time dynamic codec system allows all video transitions and changes to be robustly captured without dropped or missing frames. A 50/60 field per second capture is standard for the entire VISTOR II product line.

In order for a VDR to qualify for world-class status, it must be able to accommodate a diversity of video formats. As such, the VISTOR II features NTSC and PAL capability, two-channel composite and component output capabilities along with Y/C inputs/outputs and four 16-bit digital audio channels with optional 4:2:2 digital video I/O. For controlling the device, RS-422-based editors or computer-based control devices may be used to actuate editing or playing of the unit. The VISTOR II uses the extended Odetics protocol, which allows for a clip-based file system with multiple control ports to handle non-linear editing operations. VISTOR II's emulation scheme encompasses all popular machines including the Pioneer VDR-1000 LDP and Sony digital Betacam series decks. ID response is adjustable to accommodate unique editors requiring specific ID returns. The VISTOR II's RS-4:2:2 interface is a 9-pin 38kb standard. The VISTOR II is compatible with Sundance's EventMaster, Pinnacle FlashFile/FlashClips and all Videomedia-compatible V-LAN interfaces.

The VISTOR II comes with two or more SCSI-II fast and wide drives. They are striped as Raid 0. Performance is incremental as drives are added giving approximately 5-5.7MB/s per drive. For example, a 9GB drive can store approximately 30 to 40 minutes of Beta SP-quality program. A minimum system with two lossy video channels and four audio channels can be achieved with two 2.1GB drives. Four drives allow dual streams with one lossless and one lossy video channel with four audio channels to be achieved effortlessly. Of course, fault-tolerant storage can also be accommodated using a RAID 3 configuration with a parity drive. As an option, VISTOR II also offers the ability to perform hot swapping.

The last packaged feature of the VISTOR II is a floppy-based software utility that comes with the unit called the MultiStream Player/Recorder (MPR). The MPR is a Windows NT GUI, which comes with its own Install Wizard and allows the user to initiate recording, playback and simple non-linear editing based on clip labels that can be strung together. Because the MPR drives the internal MSX board, it has the functionality to take advantage of all of the capabilities of the MSX including independent playback of video and audio on separate output channels. ■

Steve Levine is the president of Rapid Technology Corporation, Buffalo, NY.

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Some people say digital acquisition will never catch on.

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Digital Betacam® acquisition offers new creative options in television and movie production. More and more directors and cinematographers are seeing for themselves that shooting digital is a creative breakthrough – one that can lend a unique style and look to their projects. Use it for an entire program, or for shooting inserts to be used in conjunction with film. Either way, 4:2:2 digital origination gives you detail you just can't capture on analog video. Rich colors, higher picture sharpness and a more extended dynamic range than film transfers. **You get high production values at a lower cost than shooting film.** For independent filmmakers whose budgets dictate the use of 16mm and Super 16mm film, this camcorder and portable camera/VTR combination offers new and innovative production values – at a lower cost than shooting film. And 4:2:2 digital transferred to 35mm film rivals the quality of 16mm and Super 16mm blown up to 35mm for theatrical release. **Digital masters ensure the highest picture quality and extend the shelf life of your television programming investment.** Program libraries are becoming broadcasters' most valuable assets – and 4:2:2 Digital Betacam is the best source material for protecting them. It also gives you a cost-effective bridge from today's post-production world of Betacam SP. It's clearer than ever that digital is here. And its name is Sony. For more information, and a complete list of DVW-700, BVP-550 and DVW-250 rental houses, call 1-800-635-SONY, ext. DEC.

SONY

At the Center for Advanced Computing and Communication of North Carolina State University (Raleigh), scientists initially developed a novel approach to bit-rate control (called *traffic descriptor)* to support consistent image quality in event of encoder rate bursts. Furthermore, they explored various techniques to separate the video bitstream into a *base layer* containing the essential signal data and a low-fidelity rendition of the image, plus an *enhancement layer* providing the finer detail. That strategy, however, was found to be inefficient because the increased quantization noise in the interframe prediction loop prevented the encoder from marking regions that remained unchanged from image-to-image.

A more robust two-layer codec architecture was proposed as an alternate. Together with the traffic descriptor that specifies the base-layer peak rate, sustained rate, and maximum burst size of the combined signal, the two-layer codec significantly improves perceptual quality in video teleconferencing applications.

Other important work on low bit-rate image transmission is under way at the University, Laval (Sainte-Foy, Quebec, Canada) and the University of California (Berkeley).

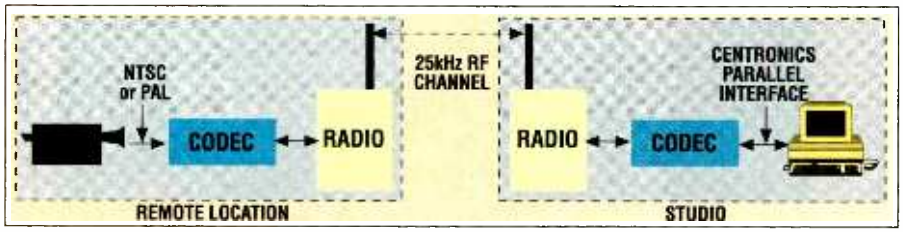

Figure 1. *A potential application for image delivery over narrowband RF links is shown in Racal Communications' RAICATS system.*

Image quality concerns

Serious image degradation is often seen when the compression algorithm operates on non-overlapping regular pixel blocks. Due to distortions that are necessarily introduced by lossy compression, discontinuities form in reconstructed images. These are known as *blocking artifacts* and are particularly noticeable because they lie on the regular grid formed by block boundaries. Current DCT-based compression standards can be viewed as highly specialized digital spatial filters, with their impulse responses regarded as proportional to the transform basis vectors. Blocking artifacts occur because basis vectors terminate abruptly.

Artifacts virtually can be eliminated, however, if the basis vectors are gradually tapered to zero. To achieve near-perfect reconstruction of an image from its transform coefficients, the basis vectors must extend to overlap adjacent blocks. That is precisely how the *lapped orthogonal transform* was born. It realized an approximate taper to zero but still produced some blockiness. A derivative of the lapped orthogonal transform, the *modified fast lapped transform* (MFLT), was furthered by work begun at the University of Cambridge in 1990. The MFLT computed rapidly, completely eliminated blocking, and was hierarchic so that other coding artifacts (*ringing* and *blurring)* also would be minimized.

With the EREC, data to be compressed is split into blocks, each one of variable bit length. Every such block is identified by an *overall prefix code*. The decompressor "knows" when it finishes decoding a block without reference to subsequent information. The total sum of bits submitted for coding is also restricted to less than or equal to a pre-selected value that can be transmitted within the EREC structure. Underlying that method are fixed-length blocks that ensure that the decompressor is always properly positioned (and synchronized with the compressor) to start decoding at any data block.

At high BER, error propagation of the EREC is actually less than at low BER. That feature is realized by allocating each variable-length block of encoded data to a fixed-length slot in a pre-defined code array. Some blocks are short and their slots unfilled, while others are longer than their slots and allowed to overflow into slots that are not saturated. Therefore, each block starts at a known location and can be decoded without dependence on other blocks (or any errors they may contain). Later bits in any given block (typically the higher-frequency transform coefficients), while more prone to error extension, are actually of less visual significance. The subjective effects of bit errors are thus minimized.

Test images at the Signal Processing and Communications Laboratory have remained recognizable at a BER of 10^{-2} or worse. Furthermore, incorporating the EREC into the MFLT also provides negligible error extension, hence the property of graceful degradation is added.

The EREC strategy appears to have several advantages over conventional variable-length techniques employed in Huffman and arithmetic coding. When combined with error-correction, such schemes do offer distortion-free results at a BER below some fixed threshold, but deteriorate rapidly when that threshold is exceeded. Because the EREC avoids catastrophic failure, it is quite versatile, and can be combined with many variable-length encoding algorithms for still image, motion video and audio applications. When properly applied, there is virtually no redundant information.

Even in the face of increasing BER, performance remains nominal and image deterioration is graceful, rather than catastrophic. The latter attribute is important. First, it can afford advance warning of difficult transmission conditions, allowing users to take appropriate remedy by re-dialing a telephone hook-up, changing cellular networks or switching radio frequencies. Second, during periods of interference, the disruption lasts only so long as the burst or fade, and permits one to make maximum sense of uncorrupted data that is properly received.

Practical applications

Commercial potential for very low bit-rate video coding is quite large. As one example, Cambridge Neurodynamics of Cambridge, UK, developed and implemented an MFLT-EREC codec based on the TMS320 chip. The single-board configuration operates in stand-alone mode or in conjunction with a PC, accepts color slow-scan video or still imagery, and produces a shaped bitstream for transmission. On the decode side, the image is reconstructed for display from the digital bitstream. Meanwhile, Racal Communications of Rockville, MD, is offering a compact, portable wireless image transmission capability (using the MFLT-EREC codec) for military applications.

HDS of Reston, VA, markets a portable video surveillance capability. Using a proprietary error-mitigating codec, the system records motion video of sufficient fidelity that it is useful for criminal prosecution. Video sequences can be received from covertly-mounted cameras over wireless commercial carriers.

Readers with Internet access who desire an added glimpse of what the future holds for transmitting motion video over noisy, narrow-bandwidth channels can point their web browsers to http://www.vdolive.com.

The future looks promising for continued improvement of image compression algorithms and their performance in the real-world applications for broadcasters. ■

Lee J. Nelson is an analyst and consultant in the high-performance electronic imaging industry, based in Falls Church, VA.

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Circle (46) on Action Card

By Skip Pizzi, technical editor

Rededicating the DAW

Digital audio workstations are changing shape.

The Bottom Line:

Recent trends among digital audio workstations (DAWs) have shown movement away from the point-and-click operation of general-purpose computer platforms in favor of dedicated control surfaces or fully proprietary systems. Other developments include improved file transfer, audio restoration and system integration. $

This CBC post room in Toronto is one of four at the facility using the PostTrio DAW system from Studer Editech. Multiple projects are handled on the system's removable 4GB hard drives.

The digital audio workstation continues to defy all predictions for its eventual place in the teleproduction environment. In fact, the definition of what constitutes a DAW remains evolutionary and elusive.

In the most general terms, a DAW is characterized by three essential elements: 1) analog-to-digital (A/D) and digital-to-analog (D/A) audio conversion circuitry; 2) non-linear storage (typically hard disk or magneto-optical disk) for random access to digital audio data; and 3) a graphical user interface (GUI) for manipulation of stored audio data.

Along the way, a DAW may also include various interfaces for synchronization to video or other audio devices, machine control and/or sampling-rate conversion routines, network I/O, SFX-library and database-style file management functions and proprietary interfaces to other hardware.

A DAW's audio manipulation capabilities may also vary widely, from mono cut-and-paste editing to large-scale multitrack mixing and audio processing. As these systems have matured, development has become increasingly attuned to the specific needs of various sectors of the audio production community. This has created an ever-widening array of systems, and while a few products and manufacturers have left the scene, the net number of available choices continues to increase.

Dealing the cards

The low end of DAW spectrum is defined by the "some assembly required" syndrome. PC/Windows or Mac platforms can be turned into simple DAWs with the addition of a sound card and some software. Even some sound cards designed for consumer use are sophisticated enough to be used for this purpose, but a few "professional" cards offer helpful features, such as AES/EBU digital audio interfacing, MIDI and/or SMPTE time-code synchronization capability and higher-quality A/D and D/A conversion.

Some recent platforms in the Macintosh environment include adequate sound-card hardware as standard equipment. These computers require only software to become a DAW. Similarly, many "multimedia" PCs now come packaged with after-market sound cards already installed, allowing them also to become DAWs with the installation of software only.

These systems are useful as off-line audio editing or pre-production stations, although in some cases they can be used for the final soundtrack production of simple projects. Some software-only systems are capable of up to 16-track editing, mixing and audio processing.

In networked environments, where users are working with sound files that have been uploaded to a server from other platforms, the quality of the sound-card hardware on "edit-only" platforms has no effect on the audio quality of the file. Only the hardware used for the initial upload, ultimate download or intermediate conversion of the file has any bearing on its audio quality. Therefore, a multi-user network can be equipped with a few workstations with high-end audio hardware, and the rest of its platforms can use an inexpensive (consumer) type of audio card, as long as it supports the file format used.

The party platforms

The general-purpose (PC and Mac) community in the DAW marketplace favors the Macintosh platform. In the last few years,

however, the PC has made significant strides to catch up in market share, and it has proven more cost effective for some applications.

Soon this divergence may become moot as several Mac-based DAW-makers begin to offer PC and/or PCI-based (PowerPC/Power-Mac) versions of hardware and software.

Meanwhile, the third "player" in the DAW platform wars has been the proprietary or dedicated system. Contrary to the common wisdom, the proprietary approach has maintained its share against the general-purpose platforms and even surged of late. Whereas earlier proprietary systems populated the high end of the DAW market, this current wave has deployed itself throughout the complete DAW pricing spectrum.

The trend toward dedicated systems is exemplified by Avid Technology/Digidesign's ProControl, a new hardware controller for its Macintosh-based DAWs.

Some of these recent proprietary systems have taken the form of the *digital audio dubber*, a relatively new class of device designed to improve the versatility, portability and efficiency of the traditional DAW. These units are either two-track or multitrack (typically supplied in eight-track modules) digital disk recorders that store a reasonable amount of audio on removable media, which can subsequently be fast uploaded to (or directly accessed by) a "mothership" DAW of the same manufacturer. In some cases, multiple units can be interfaced and synchronized to video or other outboard devices.

Other similar systems are designed to remain as stand-alone hard-disk audio recorders, without removable media or any expectation of mating to a larger, full-blown DAW. These units are more direct replacements for the two-track or multitrack tape recorder, adding only random-access capability and perhaps some editing, without the mixing or audio processing features of the typical DAW.

One other low-end approach is a variant on the MiniDisc (MD) that integrates an *MD-data* (i.e., the MD equivalent of CD-ROM) recorder and a small mixer in a single "portastudio" package. It allows up to 37 minutes of four-channel audio to be stored on a single (2.5 inch) MD.

File transfer

Increasingly, the removable media can also allow audio files to migrate across systems and platforms by virtue of the *Open Media Framework* (OMF). A growing number of DAW systems support this file format, which carries audio and, in some cases, editing/mixing/processing attributes between different DAWs. Some systems read the OMF file format directly, while others recognize it but have to convert the OMF file to their native format before further work can be done.

While OMF allows a project to move more easily between facilities, it also bodes well for archival storage within a single facility. This allows a production facility to replace its aging DAWs with a wholly different system, but still have access to the older system's archives, as long as the old and new systems support OMF.

OMF has remained the province of higher-end DAWs, but recent developments have made file interchange possible at the lower end, as well. A number of file-conversion utilities are available for converting between "standard" audio file formats, such as AIFF or WAV. Similarly, a number of multimedia audio cards can read or write files in a variety of these "standard" formats.

The 360 Systems Shortcut redefines the low end of proprietary DAW systems. Using an internal hard drive, the 2-in/2-out unit offers simple and fast editing of stereo audio on dedicated controls.

Restoration

Once a feature found on high-end DAWs, a number of moderately priced DAWs now offer effective *audio restoration* software. These systems allow users to improve the fidelity of old audio clips from the archives or to salvage recent recordings with impairments from faulty equipment or practices.

Some systems perform their restorative magic in real time, while others crunch the files at some multiple of real time.

Although this is a welcome trend in DAWs, it is often not the panacea that producers hope for. In many cases, a restoration program's removal of one artifact only introduces another. Nevertheless, there are many examples on the air of audio that have been improved by the proper applications of DAW restoration software.

What's next?

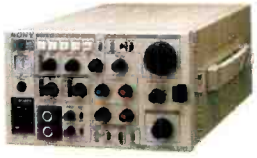
An incipient trend that may be welcomed as it migrates to lower price points is the integration of a random-access *video* "reference track" in DAWs. Already available at the high end, this replaces the U-Matic or other reference/work-print video with burned-in time-code used in many DAW audio-for-video projects. The productivity value of a random-access audio system is often squandered on such projects when the operator must wait for the slaved VTR to chase and sync to DAW time code during a post-production session. Having integrated, random-access video available maximizes the productivity of a DAW in the mix-to-picture environment.

Another development involves the emerging *digital video disc* (DVD) format. Unlike the audio-only CD, which was pre-mastered to a modified U-Matic tape format, the inherent multimedia aspects of DVD warrant a non-linear authoring and pre-mastering arrangement. The DAW is well-positioned to move in this direction, and a few DAW manufacturers are already developing DVD authoring and mastering systems to take advantage of this synergy (including 96kHz sampling and 24-bit resolution capabilities). Even the audio-only CD is moving away from the U-Matic pre-mastering format toward recordable CD (CD-R), so a number of DAW manufacturers are offering CD-R hardware and software for this purpose.

The application of a DAW will vary between facilities and often between projects within a facility. Nevertheless, the growing variety of systems and their inherent configurability provide solutions for practically every audio production need today, along with a solid migration path for the needs of tomorrow. ■

Editor's note: For information about specific DAW systems, consult "The Tapeless Audio Directory" (5th edition), by Yasmin Hashmi and Stella Plumbridge, published by Sypha, London, UK. (100256.377@compuserve.com).

For more information on DAWs, circle (201) on Action Card. See also "Digital Workstations," p.66 of the BE Buyers Guide.



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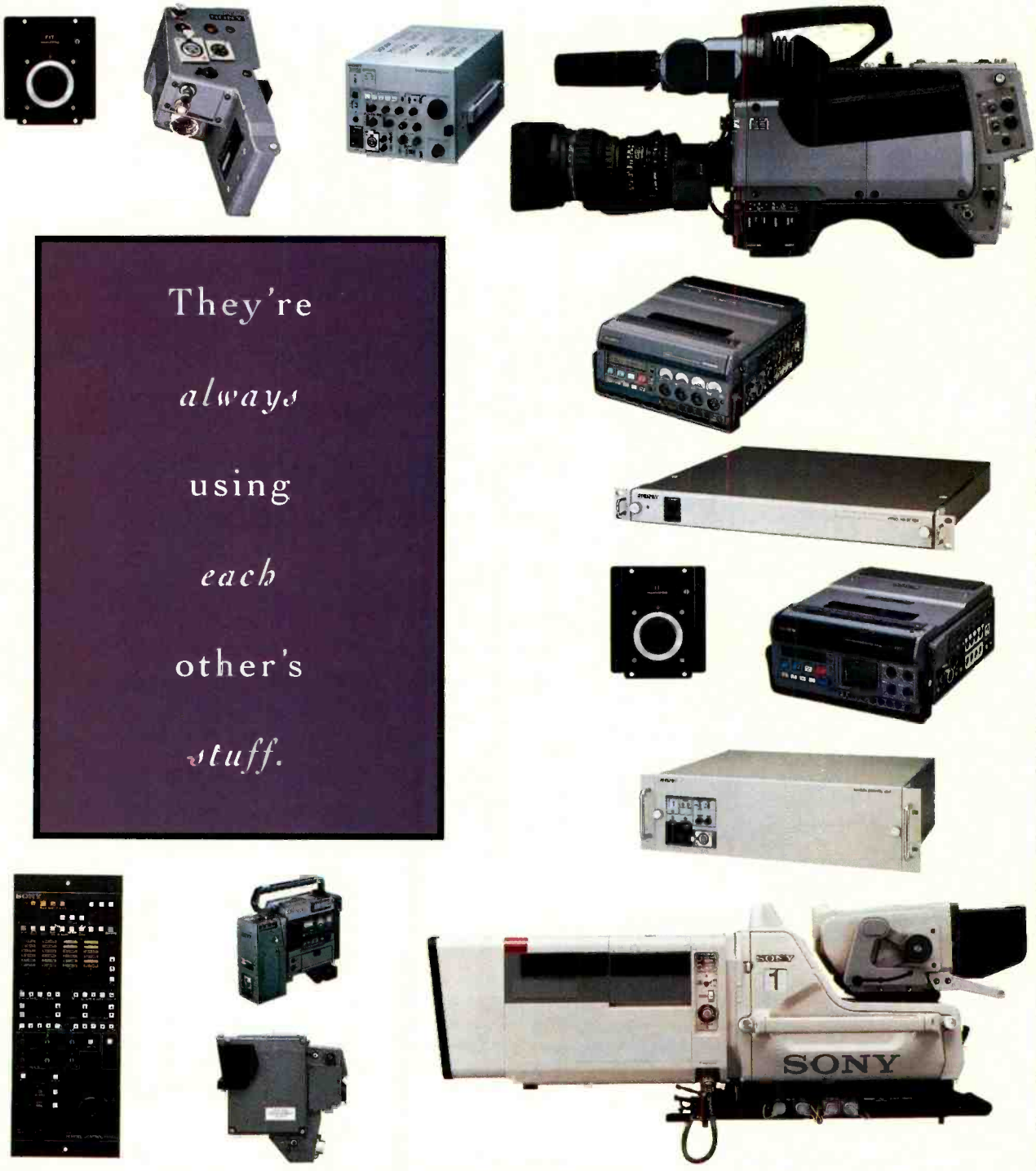

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SONY

By John D. Weigand

Networking your newsroom, part 2

Above photo: The CNN and Headline News newsrooms are a recently prominent example of today's networking technology. (Photo courtesy of CNN, Atlanta.)

The right newsroom system can make a difficult job easier; the wrong one can make it impossible.

The Bottom Line:

Computers have been in newsrooms for several years. However, integrated newsroom systems capable of distributing video are a rather recent innovation. Today's desktop scripting and editing tools are a far cry from typewriters, and require far more from staffers for proper operation and maintenance. As much as these systems offer, they can be worse than nothing if not working properly. Staffs will come to depend on these systems and steps must be taken to ensure continued, reliable operation. $

The computer is integral to most of today's equipment offerings. Seamless integration of multiple computers or multiple systems into an environment is critical to those systems being used efficiently and successfully. Newsrooms are fast-paced, high-pressure environments that can benefit from computer networking technology. Last month, in Part 1, we discussed the basics of networking a newsroom. This month, we will examine some of the latest market offerings.

Who's offering what?

Sony is one of several manufacturers proposing a total integrated system. The Sony system inputs newsroom video from various sources, such as satellites and ENG cameras. Video is put into a daily server where it is stored in the MPEG 4:2:2 Studio Profile format and simultaneously recorded in a clip server. The clip server provides 1.5Mb/s video streams to journalist workstations for display in a quarter-screen format. The clip server video is not broadcast-quality, but it is sufficient for the journalists to work from and plan stories. From the workstations, edit decision lists can be made, which are sent to the daily server for final production cutting and pasting. In the Sony system, the daily server handles the video. The newsroom server handles the scripts, the rundown orders, the wire stories, the calendar, the E-mail and like material. It also downloads data for prompters, character generators and still-stores.

Journalist workstations are 120MHz Pentiums with at least 8MB of RAM and four open personal computer interface (PCI) slots for possible future ATM. The operating system can be Windows 95 or Windows NT. Oracle, who is working with Sony on this project, recommends Windows NT with its better performance and 32-bit net drivers that make it more responsive and able to handle video. Some Windows 95 drivers are 16-bit and use a 32-bit overlay, which slows performance.

Workstations are connected to the clip server though a 10BaseT switched Ethernet running about 6Mb/s on category five wiring. The clip server is an Oracle version 2.3 video server enhanced for the Sony system. The clip server used in this system is a Sun SPARC 2000E computer or its equivalent, running a UNIX operating system. The clip server is connected to the newsroom manager server and the daily server through an FDDI backbone. The system offers 50 journalist workstations with cuts-only capability, along with two full effects workstations connected to a daily server. Sony states that by the end of this year, all workstations will have access to archive video.

Avid has three network newsroom systems: Netstation, Newsview and the yet-to-be-delivered AvidNews. Netstation is the old Basys newsroom system purchased in 1994 by Avid. In this system, if the system is a small one, Pentiums are used with a 10Base2 network. In a larger system, the server is an SGI. Both systems use the UNIX 5 operating system. The SGI server is networked with a 10BaseFX backbone and uses a 10BaseT hub to network to the journalist workstations. The network protocol is TCP/IP and it uses the Novell 4.1 software application program. Avid recommends 486s or higher for the journalist workstations. The PC operating system can be Windows 3.1, Windows 95 or Windows NT.

The Avid Newsview system is the old Softech system that was also purchased in 1994 by Avid. This system is a Windows 3.11 or Windows 95 server operating system. AvidNews, the yet-to-be-delivered newsroom system, has expected delivery dates of December 1996. These deliveries will be beta test versions and will be Avid's first "homegrown" automation product. This system will use a 100BaseTX format with category five wiring and hardware. Video will be transmitted over the network in the MPEG-1 format with a data rate of approximately 1.5Mb/s.

NewsMaker has a new machine control system. This visual automation system will control the ins and outs of a Tektronix Profile or an ASC video server. This system will control character generators, robotic cameras, prompters, video servers and other like systems. Eventually, NewsMaker will offer some form of video desktop editing as part of its system, but this will be a part of NewsMaker's 1997 system. The current NewsMaker electronic newsroom uses personal computers as workstations on a Novell network running NetWare 3.12 or higher. This system is available with either Windows 95 or DOS at the journalist workstations.

NewStar's newest computer newsroom network release will feature Windows 95 at journalist workstations and Windows NT for its operating server. NewStar has an editing system called EditStar, which integrates with the NewStar computer network news system. NewStar can deliver EditStar non-linear editing software, which can provide cuts-only editing from the journalist workstations. At these stations, journalists can build stories by dragging and dropping selected video and audio clips onto highlighted script paragraphs. The system connects to the NewStar newsroom automation system and pulls files and inserts them into the newscast rundown.

Comprompter has revamped its newsroom computer network system in order to accommodate Windows 95. This system uses Novell NetWare and Windows NT for its server. It has interfaces to trigger playback from the Tektronix Profile and ASC servers.

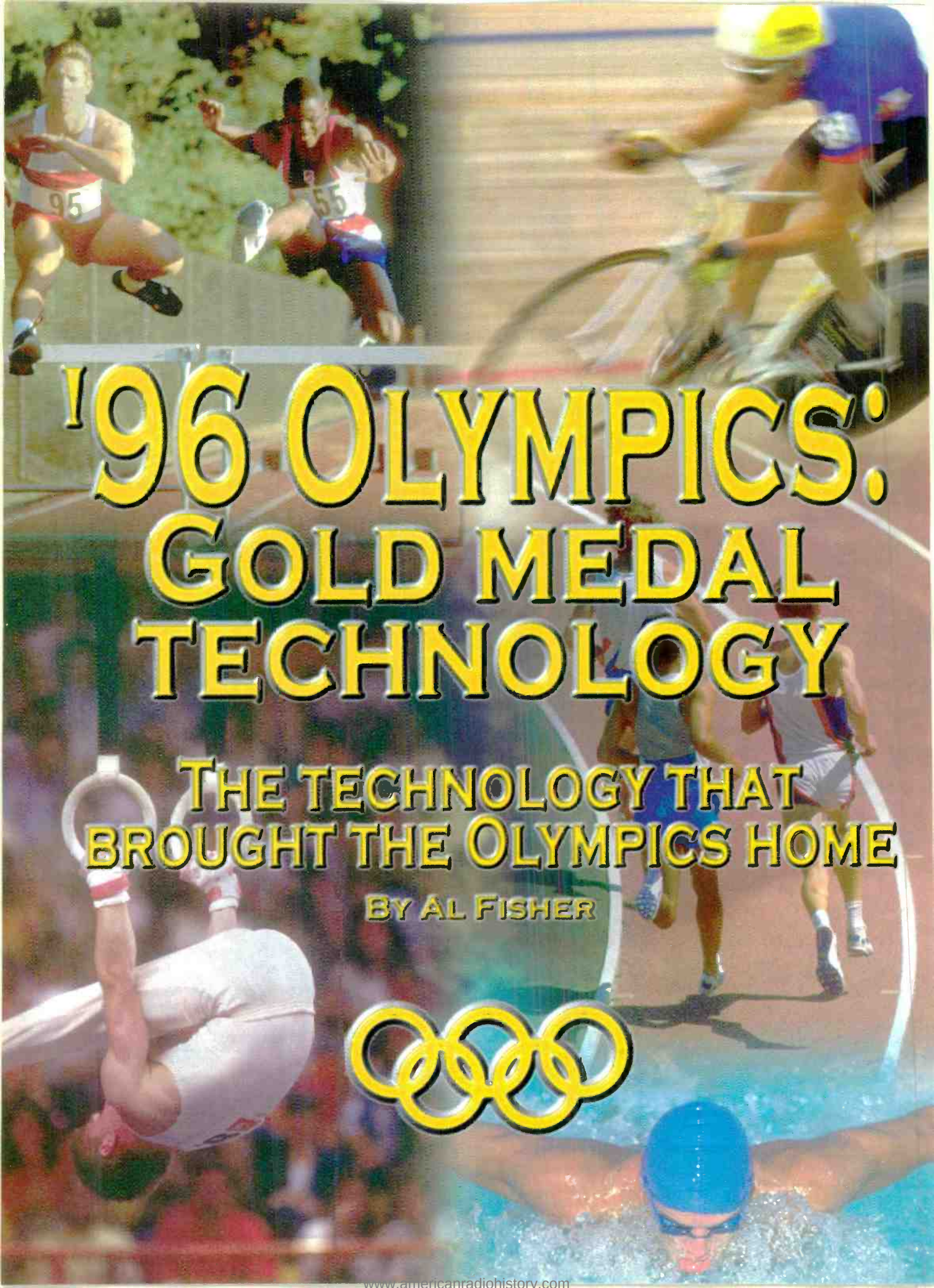
Panasonic has announced an agreement with Mercury computers on a joint venture to build a newsroom system that uses a multiplexed PCI bus technology from Mercury, combined with DVCPRO chipsets and transports. The system is projected for delivery in 1997 and will be capable of handling 20 workstations.

System support

As with any computer-based system, care must be taken to ensure system integrity and reliability. Manufacturers' recommendations and good engineering practices should be followed regarding sufficient clean power, cooling and a proper environment. In addition, steps must be taken to maintain data integrity. RAID storage, regular backups and system monitoring can all contribute to creating a fault-tolerant system that is easy to bring back to life with minimal data loss in the event of failure. In most cases, journalists are interested in journalism, not computers. Most view computers as tools that help them complete their assignments. As soon as the tool becomes a hindrance, their support will quickly diminish.

When looking at manufacturers' systems, make sure they support the tasks required now and in the near future (two to four years). Upgrade cycles are likely to force new purchases, however, by then, older operational workstations may be movable to less horsepower-intensive applications. Upgrade paths need to be carefully planned and reviewed to get the most out of older and newer technology. Technology has brought considerable innovation to the newsroom and is sure to bring even more changes in the future. One of the best ways to prepare for those changes is to understand the capabilities and limitations of today's technology, and how they are being overcome by new technologies. ■

John D. Weigand is director of engineering for Tribune Station KTTY, San Diego, CA, and owner/operator of BEC consulting services, JDW Enterprises, serving U.S.A. and China.



'96 Olympics: Gold Medal Technology

The technology that brought the Olympics home

By Al Fisher

Ever wonder what it must be like working on a team building something as special as an Olympic broadcast center? What engineer wouldn't give a lot to be a part of such a memorable effort?

I'll bet there were times the engineers on the Panasonic and NBC engineering teams felt, like the athletes, as though they too were running sprints and marathons. Completing the installation of the Atlanta Olympic broadcast facilities was a monumental challenge, most of which had to be done within a microscopic time frame.

Fortunately for billions, yes that's billions, of people, they were not only successful in meeting that challenge, but did so in great fashion.

This special Olympic report is dedicated to those individuals who spent as much as four years of their professional lives working on the project. They may not have been on the playing fields or on the courts, but these men and women deserve, and are certainly worthy, of our highest praise for technology well implemented.

So, as you recall the images from Atlanta that were broadcast to viewers around the world, don't forget those unseen heroes who made it all possible. Their efforts truly represent gold medal technology.

At the 1996 Summer Olympic Games in Atlanta, and other venues in the United States, from July 19 through Aug. 4, more than 10,000 athletes from nearly 200 countries competed for medals in 271 events. Atlanta Olympic Broadcasting (AOB), the host broadcaster and an arm of the Atlanta Committee for the Olympic Games (ACOG), was responsible for televising every event, providing some 3,000 hours of live TV coverage to broadcasters from around the world. A worldwide audience of 3.5 billion viewers was treated to a feast of sports coverage that will go unmatched — until next time.

Converging new technologies

Advances in production and broadcast technology are evident at every Olympics. One of the most interesting of these new technologies was the widespread use of fiber along with digital video to create truly remote production capability.

Fiber played a major role in the success of the broadcast operations, particularly where NBC was concerned. Its "Virtual IBC" operation allowed the workload to be divided between locations 800 miles apart; production was handled at temporary facilities in Atlanta, while post-production was done at permanent edit suites in New York. The two operations were seamlessly linked by communications technology in such a way that distance was not an issue. How NBC made that decision on the basis of technology and economics, then made it work on a practical level, is discussed later.

Another example of converging technologies was SCARLET, a digital video cable TV network that distributed video and data from all televised events to venues, press centers and the Olympic Family Sites. It was a boon to journalists, allowing them to stay up-to-the-minute on events without having to run from venue to venue. As it turned out, Atlanta traffic would have prevented such travel.

International Broadcast Center

The hub of broadcast operations in Atlanta was the 550,000-square-foot International Broadcast Center (IBC), located in the Georgia Dome and run by AOB. Sharing space at the IBC were 164 broadcast organizations representing 74 countries. NBC was the largest tenant, occupying 45,000 square feet. Altogether, the center held 40 studios and required 1.5 million feet of video, audio, telephone and fiber-optics cable, 800 computer terminals and 3,000 telephone lines.

Buildup of the IBC started on March 1, 1996 and

The video feeds were monitored on the video wall in the AOB distribution center.

continued on a two-shift, 18-hour per day schedule until the official opening on July 1. If you think you've ever had a short construction time frame, just consider the immensity of this task.

To give you an idea of the size of the control rooms, the video wall at the distribution center contained 358 Panasonic monitors.

During the Games, feeds from the competition venues flowed into the center through a specially designed 288x1 Leitch routing switcher. Leitch also provided master clock systems and 40 digital time displays and universal digital clocks. Leitch DigiBus systems provided the majority of NTSC composite analog video frame synchronizers for the IBC, as well as for NBC's control center. The separate feeds were handled at the AOB transmission center.

The hub of the Games' broadcast operations center was the International Broadcast Center. The photo shows AOB's transmission center in the IBC. It features a video wall with 72 monitors.

For the most part, AOB passed the feeds along to the rights-holding broadcasters with minimum intervention, plus doing just enough editing to deliver "packages" of event coverage at the end of each day.

During the competitions, AOB master control delivered 42 video lines and 84 audio lines to another master control room set up for the international broadcasters. All the broadcasters had access to the same material, from which they edited programs and added commentary in their own languages for home-country viewing. Finished programs were then routed back through AOB master control and forwarded to satellite uplink providers designated by each broadcaster. AOB routed all programs in NTSC, with standards conversion done at the home country or an earth station.

A shot of an AOB edit room, one of seven identical edit rooms. Equipment included three D-3 VTRs and an edit controller.

Routing all the signals to the multiple satellite and fiber links was handled in this section of the BOC transmission center.

Lots of venues to cover

Although most of the 42 venues were concentrated within the Olympic Ring, some were located in outlying areas and neighboring states. Savannah, GA, 250 miles distant on the Atlantic coast, hosted the yachting events. Although there's nothing new about remote venues, this time the communications load between them and the IBC exceeded previous Olympics.

The solution to the dilemma was the use of BellSouth's Synchronous Optical Network (SONET) fiber-optic network to handle video, audio and data communications. The operation turned out to be the largest such operation to date.

Two communication systems were used: dedicated four-wire circuits for technical and production coordination, backed up by the ESSX telephone network by BellSouth.

Not only were distances a factor, but so were the number of sites concurrently active. According to Frank Grillo, head of broadcast operations for AOB, "On peak days we could expect feeds coming simultaneously from as many as 24 different venues. We had to continuously monitor and quality control all incoming feeds." Grillo said, "It made for a rather interesting work day."

Every venue had its own media center and production crew providing feeds for the IBC. AOB used 40 mobile units, most of them leased from NEP Supershooters, to cover all the venues except the track and field events at the Olympic Stadium and gymnastics, which was held in the Georgia Dome. The mobile units required more than 100 miles of video serial digital cable from GEPCO International, including triax and a new type of dual coax.

S.W.A.T. truck covers venues

For its coverage of short-term events, NBC leased a 53-foot tractor-trailer truck from NEP Supershooters, crammed it full of equipment and dubbed it the S.W.A.T. truck. (S.W.A.T. doesn't stand for anything, it only implies quick response.) Bill Lance, edit systems project manager for NBC Olympics, described the truck as a valuable complement to the Games' 15 permanent editing facilities (six at the IBC, nine at competition venues). "Many of the events, like whitewater canoeing, road cycling and equestrian competitions, are completed within a few days at far-flung sites," Lance explained. "The S.W.A.T. truck can move quickly from venue to venue, cable up, complete its editing tasks and move on to its next assignment, eliminating the expense of constructing a stationary facility."

The S.W.A.T. truck housed two component digital edit suites, each equipped with four Panasonic D-5 AJ-D580 component digital VTRs and four AT-H1905DP digital monitors; one Betacam SP VTR; one Panasonic M-II VTR; a four-channel Tektronix Profile digital video server for source material and layoffs; a Grass Valley 1200 component digital switcher; a Grass Valley VPE-351 edit controller and a Zaxcom DMX-1000 digital audio mixer.

Using production trailers resulted in cost- and space-efficient solutions to editing and control needs. Shown is one control room complete with production switcher and another trailer for distribution.

Each suite also had two channels of Abekas Dveous special effects and two channels of Chyron iNFiNiT!. For interfacing with

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the NTSC world, the edit rooms were equipped with Leitch DigiBus frame syncs and decoders, as well as line synchronizing encoders for transmissions to the IBC.

"We weren't maxing out the graphics capabilities of the D-5 VTRs because they were used for classic, fast-turnaround editing," Lance added, "but there was considerable advantage in keeping the edit suite all component digital, especially because a number of the other devices are intrinsically all component."

The other nine NBC edit rooms located at the venues were equipped as composite digital suites with Panasonic AJ-D360 VTRs, Grass Valley VPE-351 editors and Abekas Dveous DVEs. Switchers were either Grass Valley 3000s or Video GainesVille DX120s.

For playback to air of theme music and voice-overs, NBC installed 33 DigiCart/II hard-disk audio recorders from 360 Systems at venues and in remote trucks. 360 Systems also provided 36 Instant Replay units at venues to provide performance music and appropriate national anthems. Zaxcom consoles were also evident.

Panasonic supplied more than 200 digital video cameras in studio, portable and microhead versions, including the AQ-23W 16:9/4:3 aspect ratio camera and AJ-D300 camcorder. Canon and Fujinon supplied a

An NBC editor loading a D-3 tape onto the VTR in an NBC edit room in the IBC.

variety of lenses and Vinten/TSM provided Vector 70 pan and tilt heads, Osprey pedestals and HD-1 and VIN-10ST tripods.

D-3 composite digital was the standard recording format and Panasonic supplied more than 1,000 machines of that type, as well as 40 D-5 component VTRs and more than 100 DVCPRO units. For sports replay at the Georgia Dome, the AJ-A7 slow-motion controller was used to control multiple VTRs and the LQ-D5500 digital VDRs.

NBC and the "Virtual IBC"

NBC, as the official U.S. Olympic Games broadcaster, mounted a massive operation of its own in parallel with what AOB had organized. The network set up 32 unilateral feeds and took feeds from AOB for the remaining venues. Much of NBC's efforts were focused on track and field, aquatics and gymnastics, the three sports of most interest to U.S. audiences.

The most interesting aspect of NBC's Olympic Games operation was its decision to perform almost all its post-production operations in New York instead of building a temporary facility at the site of the Games, as had been done previously. The decision was a coup that gave NBC the edge in submitting the winning bid to the International Olympic Committee (IOC), it was also an impressive demonstration of broadcast and communications synergy.

Charlie Jablonski, NBC vice president of broadcast and network engineering and a member of the team that made up the bid, recalls that the network was looking for some way to gain an economic advantage. "All the networks use the same methodology

For sports taking place in the Georgia Dome, the AOB used six 60-foot fully equipped trailers. One trailer was devoted to camera control. Shown here is a Panasonic AQ-23W 16:9/4:3 camera and matching control unit. A total of 36 cameras were used inside the Georgia Dome.

for predicting ratings, and we all use basically the same cost structure," Jablonski says. "Given our sales projections, we asked ourselves, 'Being on the same continent and in the same time zone, how can we come up with more money to put in the envelope for the IOC?' Andy Falco (NBC president of broadcast network operations) came up with the concept of the split IBC, calculating that the network could save $10 million to $20 million by not having to set up full post-production facilities in Atlanta. Dick Ebersol, president of NBC Sports, took the leap of faith and decided to do it that way."

Knowing that the fiber net was in place and confident that they could make it work, NBC tasked Dave Mazza, director of engineering for the Olympics, with bringing it to reality. Mazza went through an exhaustive process of planning, installing and testing the equipment before system trials began in March with the broadcast of a number of news and sports events.

Bringing all this communications technology to bear not only saved NBC operating costs, it also meshed nicely with plans to upgrade facilities at 30 Rockefeller Center and install a digital infrastructure, which

For sports replay at the Georgia Dome, banks of D-3 VTRs and edit controllers were used. The equipment was located in a trailer, just outside the venue.

will be used for network distribution operations starting in 1997, according to Jablonski. Included in the upgrade project were orders for Leitch DigiBus equipment and frame synchronizers, as well as six Video GainesVille DX120 composite digital switchers.

With Atlanta as the control point, venue feeds were routed to New York, where pre- and post-production were done. NBC had a powerful array of equipment at both locations, including 22 dual-channel Chyron iNFiNiT!s distributed among the venues, the IBC in Atlanta and New York edit rooms; and a total of 25 Abekas Dveous special effects systems — six in New York and 19 in Atlanta.

NBC also installed a Quantel Clipbox video server, the first one in the United States to function as the hub for recording and playing back graphics to air. The Clipbox has six hours of non-compressed serial component digital storage. NBC also used two non-linear Editboxes, a Henry visual effects editor, a Hal Express graphics suite and multiple Picturebox and Paintbox Express systems.

A customized PC-compatible computer from Quantel controlled recording and playback of material through an IBIS automation package. "Together the complete system is flexible, a full edit suite plus a full playback system with immediate random access to and playback of all stored clips," said Phillip Paully, NBC director of engineering, Broadcast Creative Services.

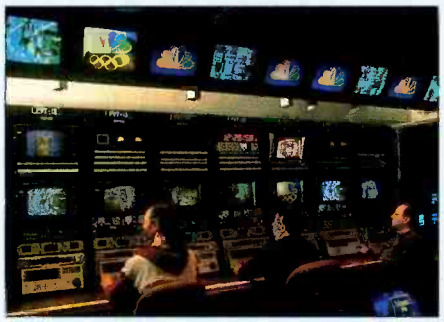
All graphics created in New York were sent via a 100Mb FDDI connection running on a 45Mb DS3 phone line to Atlanta. As Paully

explained, "We can transport graphics at 10 times greater speed than with the traditional Ethernet connection, which runs at 10Mb. We can transfer 1.2MB files in 0.7 seconds, compared to 15 to 35 seconds to transfer a picture on a standard 10Mb system."

Jablonski emphasized that the creative crews in New York had to place a lot of confidence in the communications system, separated from Atlanta as they were by 800 miles. "It's not like they could run down the hall to strangle someone. The creative staffs are the ones who have had to take the leap of faith to get this thing done." Engineering's job was to make the technology transparent to the post people and software played a major role.

The intercom systems

In addition to the video, audio and graphics traffic between Atlanta and New York, NBC had to manage a huge volume of intercom traffic. That job was handled by Telex RTS ADAM intercom systems located in the IBC and at other venues.



NBC's New York edit control room, located at 30 Rock.

Andy Morris, NBC project manager, communications, described the network's main ADAM system located at the network production center in the IBC, "It's a 400x400 matrix-type, all-digital system using a time-division multiplex scheme for distributing the audio within the frame itself. It's analog from within the mainframe out to the user panels."

"An interesting facet of our system was its trunking capability. At NBC in New York they have up to 14 intercoms and they talk to each other using a piece of equipment called the Trunk Master. Atlanta and New York intercoms can also talk to each other using the trunking system. We used four T1 links that are part of the DS3 to send the intercom audio and control data to the Trunk Master in New York. We had 40 trunks, 40 potential communications paths and 13 party lines. There's a panel at each venue, allowing the AD to talk to the producer or anyone in New York. We try to limit traffic on the trunking system, so we set up party lines for directors, control room producers, the tape room, etc. We tried to get everyone in New York and Atlanta to use party lines for all but the most important communications."

SCARLET lives on in Atlanta

The 15,000 journalists covering the Atlanta Games were able to access more information faster and more conveniently than at any previous Olympics, thanks to Synchronous Communications Accessing Live Event Television (SCARLET), a video distribution network and project jointly engineered by Scientific-Atlanta, BellSouth and Panasonic.

NBC's two main control rooms featured video walls consisting of 124 Panasonic monitors. All of the 171 plus hours of Olympic programming was handled by these two rooms.

"SCARLET is a unique broadband video distribution system designed especially for the 1996 Olympic Games," said Dr. H. Allen Ecker, chief technical officer for Scientific-Atlanta. "SCARLET simultaneously will distribute digital images of selected active sports contests, up-to-the-minute results from the IBM results system and other information via fiber and cable to broadcast commentators, journalists, athletes, officials and dignitaries."

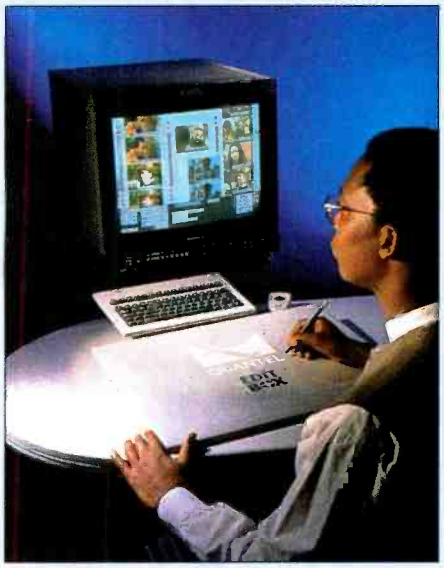
At the venues, Panasonic digital video cameras and VTRs recorded the images and transmitted them uncompressed and digitized over BellSouth's Synchronous Optical NETwork

NBC New York edit suite.

(SONET) fiber-optic network to the IBC. There, up to 48 video feeds were compressed and encoded at 6Mb/s using Scientific-Atlanta PowerVu and Digital Video Broadcasting (DVB) MPEG-2 encoders. Compressed video streams were then multiplexed onto three MPEG-2 transport streams and distributed to nine digital hubs by S-A's Broadband Integrated Gateway (BIG) and SONET. Transport streams were demultiplexed and decoded at each hub into individual programs, then sent to a digital receiver that decoded each program into baseband video and audio. Each hub was equipped with a Scientific-Atlanta cable system with head-end and distribution facilities.

To access programs, viewers used one of 6,600 Scientific-Atlanta 8600X set-top boxes and 10,000 Panasonic monitors to access any event or virtual-text channel. Up to 100 virtual channels provided athlete quotes, medal standings, starting line-ups and the results of selected sports supplied by IBM's token ring results network.

SCARLET has significance beyond its application at the Olympics, however. As a test bed for the commercial potential of compressed video over broadband networks, it may influence the distribution of television to homes into the next century, according to experts at Scientific-Atlanta.



Quantel provided a Clipbox server and two Editboxes for use in the NBC facility.

Next time. . .

It may be a while before we see another set of circumstances like those that gave birth to NBC's "Virtual IBC." On the other hand, a system similar to SCARLET might well appear at future Olympics. One thing is certain: the technology that brought the Atlanta Games to the world will be superseded by something better when the 2000 Games open in Sydney, Australia, and we'll all be looking for more superlatives to describe it. ■

Al Fisher is an industry technologist based in San Jose, CA.

Photos courtesy of Panasonic.

By Jerry Whitaker

World Media Expo heads "Toward the Digital Century"

The Society of Broadcast Engineers will present its eleventh annual national SBE Engineering Conference at World Media Expo (WME), Oct. 9-12, at the Los Angeles Convention Center. The conference and exposition will offer educational workshops, technical paper presentations and equipment exhibits. This year the exhibits split between a Radio/Audio Hall and a TV/Video/Film Hall and run from Thursday (Oct. 10) through Saturday (Oct. 12).

The goal of the separate TV and Radio halls is to make it easier for you to find the products that you want to see. Registrants will have access to both halls, and each will feature a special Internet exhibition area. Food service will also be offered in both halls during exhibit hours — 9:00 a.m. to 6:00 p.m. on Thursday and Friday and 9:00 a.m. to 4:00 p.m. on Saturday. The hours of 3:00 p.m. to 6:00 p.m. on Thursday and Friday and 3:00 p.m. until 4:00 p.m. on Saturday have been set aside as exclusive exhibit hours, with no competing technical papers or other activities outside the show floor.

Social events for attendees include:

- *The Welcome Reception*, Thursday evening from 7:00 p.m. to 10:00 p.m. at the Universal City Hilton Hotel, the host hotel for SBE attendees. Hors d'oeuvres and an open bar will be provided.
- *The Annual Ham Reception*, Friday from 4:00 p.m. to 5:30 p.m. in the activity area of the Radio/Audio Exhibit Hall at the convention center. Open to SBE conference registrants, the Ham Reception features a number of door prizes. Light food and beverages will be provided. Exhibit-only registrants and visitors will be able to purchase tickets to the Ham Reception for $5.00.
- *The Annual SBE Awards Reception and Banquet*, Saturday night will be held at the Sheraton Universal Hotel, located adjacent to the Universal Hilton in the Universal City Walk complex. The program will feature a meal, a special presentation by former Broadcast Electronics CEO Larry Cervon and recognition of outstanding achievements by members and SBE chapters.

The Ennes Program

The technical program will begin on Wednesday, Oct. 9, with the popular Ennes Workshops. This year's workshops will include presentations on digital audio, advanced television, making the Internet work at your station and TV facilities design. The half-day workshops will offer valuable education and training for attendees. In addition, a full-day workshop tour will be offered at the antenna farm at the top of Mt. Wilson, just northeast of the city. This tour was popular when SBE held its conference in Los Angeles two years ago, filling a 47-passenger motor coach for the trip. This year's tour will again include transportation and lunch.

Registration for all Ennes Workshops is limited, and is allocated on a first-come first-served basis.

World Media Expo returns to sunny Los Angeles, Oct. 9-12. (Photo courtesy of the Los Angeles Convention & Visitors Bureau/C 1991 Michele and Tom Grimm.)

Seminar series

The technical papers presentations open on Thursday with a general session on regulatory issues moderated by Dane Ericksen, P.E., of Hammett & Edison in San Francisco. The following papers will be presented:

- *Tower Registration: Eight States Later*, Robert Greenberg, FCC;
- *V-Chip Technology*, Dallas Hickerson, Link Electronics;
- *How the Telecom Bill Affects Broadcast Engineers*, SBE general counsel Chris Imlay;
- *The New FCC RFR Rules*, Dr. Robert Cleveland, FCC;
- *Proposed New Blanketing Rules for Broadcasters*, Robert Greenberg, FCC; and
- *The FCC's Privatization Plan for Broadcast Station Inspections*, James R. Zoulek, FCC.

The Thursday afternoon session will feature two papers on how individual stations are implementing the new Emergency Alert System; one each covering radio and television. These will be followed by the annual SBE Membership Meeting, which includes the installation of new officers and board members for the coming year.

The Friday and Saturday programs feature split audio/radio and video/TV sessions. On Friday morning, Bill Ruck of KNBR-AM/KFOG-FM in San Francisco will moderate the radio session dealing with a range of digital issues. Andy Butler from PBS will moderate the morning TV session, which includes a variety of papers covering current digital technology issues.

On Friday afternoon Milford Smith of Greater Media will moderate the radio session on Digital Audio Broadcasting. The afternoon TV session, moderated by Jerry Butler of WETA-TV, Washington DC, will cover advanced TV topics. The Saturday morning radio session titled "Storing and Networking Audio" will be moderated by the author, while the TV session on "Storing and Networking Video" will be moderated by Marvin Born of the Dispatch Broadcast Group in Columbus, OH.

On Saturday afternoon, a single joint radio/TV session will be held on building fault-tolerant facilities. This important program will be moderated by Dennis "Dutch" Doelitzsch of 3D Communications in Marion, IL.

A family affair

Consider bringing the family for an enjoyable vacation while you attend the annual SBE Conference. Special programs for spouses and guests are being planned for Thursday and Friday, including studio tours and a trip to Catalina Island.

Make your plans now to attend this important event in Southern California. Registration can be made through SBE, and reservations at World Media Expo hotels can be made through the official WME housing bureau, Rogal America. Contact SBE headquarters for more information. ■

Jerry Whitaker is SBE engineering conference committee chair.

CONTACT NUMBERS

SBE:
Voice: 317-253-1640
Fax: 317-253-0418
E-mail: http:\\www.sbe.org
Fax-on-demand: 301-216-1853

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The GALLERY

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Circle (56) on Action Card

By Saam Gabbay

TARGA 2000 makes the grade at Gadget School

When I started working in video production, I ran a Macintosh bay that fed titling, graphics and after-effects into giant, million-dollar editing suites. I thought this was the only way to produce high-quality video. There is a widely held myth that broadcast-quality video can only be produced using expensive, proprietary editing systems. Gadget School is not only proof that this perception is false, but that some things can be done better on the desktop.

We were anxious to upgrade our computers when Apple introduced its Power Macintoshes. But that's when we learned the first-generation videographics card we were using was not compatible with the Power Mac.

Fortunately, around the same time, we were selected as a beta test site for Truevision's TARGA 2000 videographics engine. At the time, the TARGA 2000 was the only solution for the Power Macintosh.

We gave the TARGA board a shot. It was easy to install and worked perfectly right out of the box. The TARGA 2000 delivers full-screen, full-motion video capture and playback at 30f/s (60 fields/s) and supports 16-bit 48kHz synched audio, 720x486 NTSC and 720x576 PAL output. It uses real-time variable Motion-JPEG compression with a dynamic quantization factor that delivers outstanding video quality and accelerated processing. The TARGA's AVS chip keeps audio and video in sync for up to 36 days, which is plenty of assurance for our 30-second commercials.

Quite frankly, one of the most important benefits of the TARGA 2000 was the drastic improvement it made in the quality of the video we produced. Clients started to take notice, as did the post house that did our finalizing.

Gadget School in action

Within three weeks after installing the TARGA 2000 in a Power Macintosh 8100, we cut three national spots for United Paramount Network (UPN). One of our UPN spots involved a mechanical hand that lifts a rock, revealing a bunch of 3-D bugs and beetles crawling around the UPN logo. After the bugs were animated, we captured their movement, frame by frame, using Adobe Premiere's stop motion feature and composited all the layers together using Adobe After Effect's superior moving matte properties.

To produce the bugs' voices, we captured a phone conversation using Premiere, sped up the recording and played it backward with Macromedia SoundEdit 16.

When our client looked at the spot, he asked us which parts were produced in-house. When we replied "everything," he was stunned. Like many, he wasn't used to seeing such high-quality video production done so quickly under one roof.

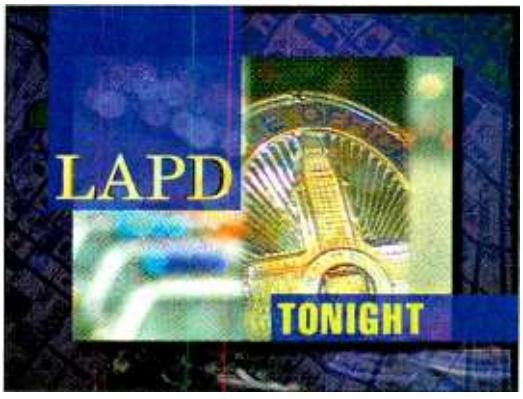
As the projects began to roll in, we decided to upgrade our system to a Power Mac 9500 with an ATTO Express PCi SC SCSI controller, an 8GB ProMax RAID array and the new TARGA 2000 Pro, which supports component video input and output. While the Power Mac 9500 doesn't have built-in video support, the TARGA 2000 Pro lets me run my 21-inch monitor and an NTSC monitor simultaneously.

Cross-platform solution

Gadget School has been using the TARGA 2000 for nearly a year, and we continue to be delighted by the throughput of the videographics engine and its ability to perfectly synchronize video and audio. Truevision is a true cross-platform, open systems vendor that works with all of the major players in the industry, including Apple, Microsoft, Macromedia, Adobe, Avid, Autodesk and in:sync to provide solutions that work.

The next version of the TARGA 2000 software will support several new features, including more accelerated transitions for Adobe Premiere, playback of an unlimited number of movies (which effectively breaks the 2GB file limit), and the ability to export previews directly from Premiere's construction window.

Not only is the TARGA technology an awesome way to work with video on the desktop, but the people at Truevision are knowledgeable and truly committed to digital video. The tech support people not only did a great job in helping us set up our system, they also advised us on which RAID controller to purchase, how to configure our drive arrays and provided a few other secrets that helped increase throughput.



The Henry and Flint on Graphics-type systems are great for people who want to spend big money (remembering, of course, that Henry does not do 3-D) and need to get the work done yesterday. Our clients are just as happy to save big money using the TARGA technology and get the work done today.

After more than two years of producing video on the desktop, Gadget School remains firmly committed to the TARGA 2000 on the Power Macintosh for one simple reason — we make money using the system. ■

Saam Gabbay is co-owner of Gadget School, a full-service video production and multimedia design studio based in Santa Monica, CA. Gadget School specializes in all aspects of video production, graphic design and interactive multimedia authoring. Gabbay can be reached via the Internet at GadgetYap@aol.com.

READER FEEDBACK

CompuServe: 74672,3124
Internet: be@intertec.com
FAXback: 913/967-1905

By Phil Paully

Quantel's Clipbox

Performance at a glance:

- Offers integrated and complete operation to transmission, news and post production
- Up to eight hours of non-compressed video; 160 hours of compressed video
- Unique true random access ensures unrestricted access to any frame, at anytime, in any order, at or faster than video rate
- Open connectivity to other TV equipment
- Easy, open remote control
- Management and archiving are clear, easy and fast to access

The Olympic Games are probably the world's most watched sports event. Thousands of people went to Atlanta this summer as spectators, but that was just a small fraction of the millions who watched NBC's TV coverage of the Games. The NBC Olympics broadcasts were filled with unique graphics effects, which took years to plan and months to produce. Phil Paully was in charge of building and operating the technical facility where NBC's producers and directors created those effects.

A technical challenge

Providing the production facilities for the Atlanta Olympic Games was the largest technical challenge that NBC's Broadcast and Network Operations Division ever faced: building a video production complex that was split between two separate locations hundreds of miles apart. When NBC broadcast the Seoul and Barcelona Olympics — thousands of miles and several time zones from North America — it had to build the equivalent of a large and expensive TV station, plus a few post-production houses on site in Korea and in Spain. As soon as the Games were over, it had to be torn down.

This time, the location of the Games in Atlanta, coupled with new, faster and more reliable technology — most of it digital — made it possible to take another approach. The bulk of NBC's Olympics video record/playback and edit facilities and almost all complex graphics effects for the Games were created at NBC's headquarters at Rockefeller Center in Manhattan, which was linked to Atlanta by fiber, copper and satellite.

The state-of-the-art technology NBC developed in New York for the Olympics fit smoothly into the master plan for the technical rebuild at Rockefeller Center. Thousands of hours of engineering and implementation time and a few dozen miles of cable did not become useless as soon as the Olympics closing ceremony ended. There were other savings as well — the producers and technical crew working in New York did not require hotel rooms, air travel, meals or transportation at the Olympic site.

Step-by-step planning

Planning for the graphics and special effects facility in New York began almost three years ago. Step one was to consolidate NBC's news, sports and entertainment graphics and design departments into a single broadcast creative services department on the ninth floor of the Rockefeller Plaza headquarters. Step two was to come up with a long range plan to bring the consolidated graphics department up to the most advanced technical level possible.

Providing the production facilities for the Atlanta Olympic Games was the largest technical challenge that NBC's Broadcast and Network Operations Division had ever faced.

The rebuilding program had been going on for the last two years. We lost count of how many walls had to be moved, how much air conditioning had to be added and how many miles of cable had to be pulled. The end result was that a 1980's analog graphics department had been converted to (virtually) all serial component digital. NBC added four machine rooms and built an advanced digital, hybrid control/edit facility.

Step three was to decide how to link the graphics creation facility in New York with the on-site operation in Atlanta. It was one thing to link a graphics creation operation with a room down the hall. It was another thing to link it with a control room and sports venues more than 700 miles away. The link had to work fast and reliably.

After reviewing a number of proposals, we worked with Quantel to develop a 100Mb customized Ethernet system using DS-3 circuits. The result was a major technological advance. It allowed us to turn around a picture between New York and Atlanta or the reverse in less than one second. As far as we knew, in terms of data file transport, the standard 10Mb system, let alone the 100, had never been used through DS-3 circuits to link this type of system and achieve this type of data delivery. The standard 10Mb system took anywhere between 15 to 35 seconds to transfer a picture. A stack of still frames could be mailed from New York to Atlanta faster than you could say this sentence.

The speed of the 100Mb system had important ramifications. Updates were practically immediate. Everything was fully transparent because all changes took place in the background and didn't interfere with the processing going on at the workstation.

The 100Mb system enabled background mailing, an additional built-in security feature. Everything that was sent was logged. Every venue received a picture mailed to them from New York, even if their still-store was disconnected at the time the picture was mailed.

The facility also had the ability to read from New York in real time the shared drive of a Picturebox still-store in Atlanta. It was actually being controlled from New York and could copy images from a New York Picturebox to a shared drive on the Atlanta system.

System integration

Another important issue was system integration, not only between New York and Atlanta, but between equipment at Rockefeller Plaza, as well. It was vital that all of our machines talked to each other and that many machines and operators had access to the same video material. A complete video server system was needed to accomplish this.

Two specific requirements were needed for system functionality:

1. The system had to have true random-access functionality, which gave faster delivery speed and meant that two boxes could work on the same type and amount of material simultaneously. It also allowed two different artists working on two different graphic animations to make two different versions of the same clip at the same time.
2. System integration was vital. It was all

very well to have a lot of drives that ran quickly, recorded a lot of information and played material back out to air. But the next questions were "How well did it integrate with all the other equipment?" and "How quickly and easily could information between the server and other equipment be transferred?"

The Clipbox

The Quantel Clipbox was chosen because it met our requirements and it provided an overall integrated systems approach. In April 1996, NBC took delivery of a fully configured Clipbox system, the first installed in the United States, to use as the central hub from which to record and play back graphics to air during the Olympics. After the Olympics, the Clipbox will play a central role in the production of *Dateline* prime-time news magazine, the 1996 election night broadcast and other news and sports productions.

Once we decided on the Clipbox, we had to have a way to play finished material to air in real time, on studio cue.

An important factor in the decision was the large number of other Quantel devices already installed in NBC Broadcast Creative Services: 19 Paintboxes, four Hals, one Henry, three Harriets, two Harrys, five Triplet Pictureboxes and four Picturebank Express units. The Clipbox provided add-on drives to increase the storage of individual devices and was relatively easy to integrate with our existing gear.

The Clipbox is a six-port system with six hours (with the option of going to eight hours and eight ports) of noncompressed, serial component digital storage. For the Olympics, it was a part of a team that included two Quantel nonlinear Editboxes, a Henry, a Hal Express, multiple Picturebox and Paintbox Express machines and a Playbox module through which the IBIS automation package controlled the recording and playback material. All systems shared the same Olympics clips and footage that Playbox was either recording in or playing out.

Full-bandwidth video was a must-have for Olympic graphics. Compression is not a problem in most areas of video production, but noncompressed operation is vital when dealing with graphics-based material. Quality and reliability are important. The Clipbox server has a parity drive so that if one drive goes down, there are 19 others to store the information.

Once we decided on the Clipbox, we had to have a way to play finished material to air in real time, on studio cue. This issue was presented to Paul Kellar of Quantel and his R&D team in Newbury, England, who came up with Playbox, a customized PC-compatible computer that controls the recording and playback of material. The complete system is a flexible full edit system, plus a full playback system with immediate random access to and playback of all stored clips. The playback order can be changed and segments re-ordered merely by calling up clips on the playlist.

Of the 20 northbound incoming video feeds from Atlanta, Olympic Graphics had control of feeds 16 through 20. Five individual source feeds enabled us to pre-pack clips with built-in black slugs. The slug was then filled in with the new footage that was just recorded by processing it in the Editbox. Next, the clip was titled, and Playbox then took it immediately to air. So when we went to commercial, there were already pre-built commercial setups.

The Olympics was the first test of the whole system. As soon as the events started in Atlanta, the new, all-digital production videotape department on the second floor of 30 Rockefeller Plaza, New York, received regular camera feeds and carried out real-time recording to videotape of all the different events at the various Atlanta venues. The clips were continuously scanned and used to build new opens and bumpers and to edit and update the most spectacular daily highlight shots for integration into the prime-time show at 7:00 p.m. By prime time, anywhere from one to 100 different clips were put into the Clipbox.

A component digital hybrid edit/control room, Control-C, was closely associated with the Clipbox/Editbox systems and staffed with a technical crew and Olympics producers. This was the editorial and communications hub of our operation. Material from this room could be loaded into the Clipbox or the Playbox could be called up by Control-C as a source for play to air. The results were as exciting on-air as they were for NBC to plan and build. ■

Phil Paully is director of engineering, Broadcast & Network Operations, Broadcast Creative Services, for NBC, NY.

Editor's note: Field Reports are an exclusive *Broadcast Engineering* feature for broadcasters. Each report is prepared by well-qualified staff at a broadcast, production or consulting company.

These reports are peformed by the industry, for the industry. Manufacturer's support is limited to providing loan equipment and to aiding the author if requested.

It is the responsibility of *Broadcast Engineering* to publish the results of any device tested, positive or negative. No reports should be considered an endorsement or disapproval by *Broadcast Engineering* magazine.

NEW PRODUCTS

By Deanna Rood, associate editor

Routing switchers
Sierra Video Systems

• 2010CP: a routing switcher designed for video presentation and graphics applications where the video format is non-composite RGB with sync on a separate channel; the unit features a 3RU design with RS-232 control.

• 44CPW: a routing switcher designed for the most demanding wideband RGBS routing applications; with a bandwidth of 120MHz, the routing switcher has more than three times the bandwidth of the best CRT; this model features a modular 1RU design with built-in RS-232 control.

Sierra Video Systems, P.O. Box 2462, Grass Valley, CA 95945; 916-478-1000; fax 916-478-1105
Circle (357) on Action Card

Measurement products catalog
Tektronix

• Measurement Products Catalog 1996: a 600-page, soft-cover catalog that includes a full-color new product section featuring a variety of new form-factor measurement solutions; nearly 100 new products are detailed offering extensive application and technical notes.

Tektronix Measurement Business Division, Literature Division, P.O. Box 1520, Pittsfield, MA 01202; 800-426-2200 (when prompted, press 3, ask for program 499); fax 503-627-5593; www.tek.com/mbd/w499
Circle (359) on Action Card

Software upgrades for Lightworks
Tektronix

• Version 4.0 for Lightworks & Lightworks Turbo: editing system upgrades with key features, such as auto synchronize, rendered and real-time effects packages, and full vertical interval time-code reading of film and video labels, such as keycodes and time codes; the upgrade also has a major expansion of supported storage, up to 350 hours instantly accessible.

Tektronix, P.O. Box 500, Beaverton, OR 97077-0001; 800-426-2200 or 503-627-4697; fax 503-627-5593; www.tek.com/measurement
Circle (365) on Action Card

Digital satellite news-gathering vehicle
California Microwave Satellite Transmission Systems

• NewsTrek: a go-anywhere, multifunction SNG truck that provides all the benefits of efficient digital satellite news gathering in a standard weight-class passenger vehicle that requires no special licenses; NewsTrek comes complete with everything you need to hit the road.

California Microwave Satellite Transmission Systems, 125 Kennedy Dr., Hauppauge, NY 11788; 516-272-5600; fax 516-272-5500
Circle (353) on Action Card

Character/graphics generator
Videonics

• PowerScript: a stand-alone character and graphics generator with animation and time base correction that can be connected to your network or to desktop equipment; you can unload fonts and EPS graphics generated on a variety of computer platforms and storage capability can be added using a plug-in PC card, RS-232 serial port or Ethernet.

Videonics, 1370 Dell Ave., Campbell, CA 95008-6604; 408-866-8300; fax 408-866-4859; www.videonics.com; info@videonics.com
Circle (350) on Action Card

Weatherproof camera robotics pan/tilt mechanisms
Telemetrics

• PT-CHD & PT-HD: the PT-CHD is a compact, heavy-duty pan/tilt mechanism designed for outdoor applications with a maximum load capacity of 26 pounds; it is available with either top or side camera mounts and provides 350° pan range, +20° to -90° tilt range from level position and end stop adjustments; the PT-HD is a high-performance pan/tilt mechanism with a maximum load capacity of 66 pounds; it features a pan travel range of 350° at 4.8°/s, adjustable tilt travel at 2.4°/s with adjustable end stops.

Telemetrics, 6 Leighton Place, Mahwah, NJ 07430; 201-848-9818; fax 201-848-9819
Circle (366) on Action Card

Serial digital DA
Videotek

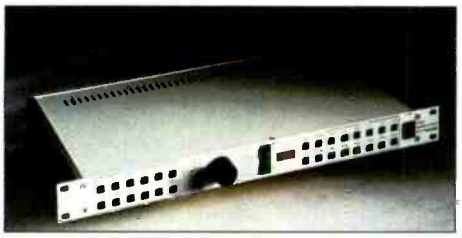
• DDA-144 & DDA-144F: distribution amplifiers that accept a component serial digital input and produce four serial digital outputs for any system application and four composite analog outputs for monitoring; these DAs reduce the need for additional equipment in a component serial digital environment by combining two important functions — signal distribution and transcoding for monitoring — into one compact package.

Videotek, 243 Shoemaker Rd., Pottstown, PA 19464-6433; 610-327-2292; fax 610-327-9295
Circle (354) on Action Card

Fast digital computer networks
Transoft Technology Corporation

• StudioBOSS FC product line: fast digital computer networks for high-speed PCI-based Macintosh computer systems; the networks are designed for graphics production, motion picture and TV studio production and post-production; based on the Fibre Channel network standard, the StudioBOSS FC networks can transmit data at 100MB/s; combining attributes of a channel and a network, Fibre Channel offers a single standard interface capable of simultaneously supporting both connections using multiple protocols.

Transoft, 425 E. Cota St., Santa Barbara, CA 93101-1662; 805-697-3350; fax 805-897-3355; www.transoft.com
Circle (351) on Action Card



Compact standards converter
Vistek

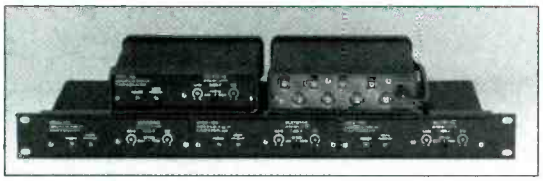
• **Vega:** a TV standards converter that provides bidirectional conversion of NTSC and PAL, as well as other international TV standards; the Vega's versatility extends to features that include synchronization, video correction and noise reduction capabilities; it also features a 270Mb/s seria. digital interface, plus an integral audio delay.

Vistek, #C Wessex Rd., Bourne End, Buckinghamshire, England SL8 5DT; +44(0)1628 531221; fax +44(0)1628 530980; CompuServe 100270,3322
Circle (355) on Action Card

Four-input image resizing, positioning & display device
Feral Industries

• **QUAD SPLIT:** a device that combines four video inputs into one video input; each input is independently scalable, allowing for horizontal and vertical resizing and positioning of each image with aspect ratio control; features include composite and Y/C inputs and outputs, as well as NTSC and PAL video standards; the QUAD SPLIT automatically detects and transcodes between formats.

Feral Industries, 9204 Bond St., Overland Park, KS 66214; 913-492-4666; fax 913-492-5556
Circle (368) on Action Card



Hand-held video DA
Multidyne

• **VPDA-100:** a video, pulse, subcarrier distribution amplifier and clamper; the unit equalizes 0-1,500 feet of 8281, RG-59U and another cable of choice by adjusting a single knob; a fast AC/DC feedback clamping circuit samples the error voltage on the video back porch and will actually extract any hum present in the video picture on a line-by-line basis; the VPDA-100 is ideal for field and studio applications where hum, ground differences and cable attenuation degrade the video signal.

Multidyne, 191 Forest Ave., Locust Valley NY 11560-2132; 800-4TV-TEST or 516-671-7278; fax 516-628-1496
Circle (356) on Action Card

Storage cards for slides
Leitch

• **Flash Multislides:** single- and dual-channel cards that allow storage of two to 16 slides, depending on memory configuration; the two-channel card is available with or without genlock circuitry; one gen-lockable card (or 1302GL) is required per frame; when used with the 1302FK linear keyer and control panel, the multislide can reposition images that are smaller than full screen, adjust fade rate and adjust keyer settings for offset, gain and transparency.

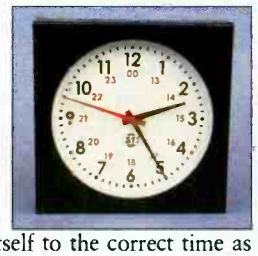
Leitch, 920 Corporate Lane, Chesapeake, VA 23320; 800-231-9673; 804-548-2300; fax 804-548-4088
Circle (360) on Action Card

Video synchronizer/time base corrector
Prime Image

• **Compon:** a video synchronizer/time base corrector that allows seamless mixing of component and composite signals for switcher effects and other processing that requires mixing video signals of various types from different sources; the rack-mounted unit meets or exceeds all technical specifications for broadcast and since it is fully digital, video signals maintain their quality throughout the process.

Prime Image, 19943 Via Escuela, Saratoga, CA 95070; 408-867-6519; fax 408-926-7294
Circle (358) on Action Card

Self-setting analog clock
ESE



• LX-5112: a wall-mount analog clock with a 12-inch viewing diameter; the unit is designed to operate as a time-code reader, a stand-alone clock or an impulse clock; it can read, decode and display time information from most any master clock or other source of time code; the LX-5112 is capable of automatically setting itself to the correct time as received via SMPTE/EBU, ASCII or ESE time-code inputs.

ESE, 142 Sierra St., El Segundo, CA 90245; 310-322-2136; fax 310-322-8127
Circle (363) on Action Card

Routing switchers
Pro-Bel

• XD series: a generation of large-scale digital routing switchers that offer total control compatibility with all current Pro-Bel routers and control systems; the XD series features unrivaled field expansion capability together with advanced system facilities.

Pro-Bel, 4480 N. Shallowford Rd., Suite 102, Dunwoody, GA 30338-6410; 770-396-1971; fax 770-396-0595; pro-bel@ix.netcom.com; www.pro-bel.com
Circle (370) on Action Card

Sliding computer keyboard shelf
Ergo 2000

• E2CKS-1: a rack-mount kit that allows you to mount a full-size 101 key keyboard into a standard 19-inch rack; the kit includes a right-handed or left-handed mouse pad/rollerball adapter and takes up three rack units of space; a black powder-coated front panel covers the keyboard when not in use.

Ergo 2000, 1624 Orangethorpe Way, Anaheim, CA 92801; 800-635-9297 or 714-992-0874; fax 714-992-2131; eii@gnn.com; www.ergoind.com
Circle (369) on Action Card

Balanced power system for hard-wired AC installations
Equi=Tech

• Line of turnkey, balanced AC power systems: systems designed for AC hard-wiring in facilities requiring 5kVA (50 amps) or more technical power; the system is easy to install by an electrical installer requiring only a single 208V or 240V feeder and an isolated ground wire; the outputs are then connected to branch circuitry wires feeding outlets in the studio or production facility.

Equi=Tech, P.O. Box 249, Selma, OR 97538; 541-597-4448; fax 541-597-4099
Circle (361) on Action Card

Digital stereo STL/TSL
Intraplex

• 4200 STL PLUS system: a digital stereo STL/TSL that employs no digital compression, providing the highest possible audio quality at either 15kHz or 7.5kHz bandwidth; the STL PLUS incorporates Intraplex's extraordinary error mitigation circuitry, using digital signal processors (DSPs) to eliminate noise, clicks and pops caused by transmission line errors; the absence of digital compression makes the STL PLUS an ideal choice for use where compression may occur at other stages of the audio chain.

Intraplex, 3 Lyberty Way, Westford, MA 01886-3636; 508-692-9000; fax 508-692-2200
Circle (362) on Action Card

Digital ad insertion system
Texscan MSI

• 3200DS: a digital ad insertion system featuring video server technology that minimizes system hardware and improves reliability; the 3200DS video server architecture does not require dedicated PCs per channel, has no spot length restrictions and requires the least amount of rack space of any available system; digital benefits include superior picture quality, reduced copy turnaround time and less chance of playback error.

Texscan, 124 N. Charles Lindbergh Dr., Salt Lake City, UT 84116; 801-359-0077; fax 801-359-0216; www.texscan-msi.com
Circle (352) on Action Card

Expansive Video Toaster upgrade
NewTek

• Video Toaster 4.1: new release that includes major upgrades to all nine software applications in the video production suite; a new clipboard-like functionality allows users to more productively integrate actions, such as accessing live video frames and adding text; a key individual software application includes LightWave 3-D 4.0, an animation tool for creating 3-D photo-realistic graphics.

NewTek, 1200 SW Executive Dr., Topeka, KS 66615; 800-847-6111 or 913-228-8000; fax 913-228-8001
Circle (364) on Action Card

TRUEVISION TARGA1000/2000

Digital Video Capture Boards for Windows, Windows NT and Macintosh PCI

The TARGA 1000 and 2000 are an easy and affordable way to transform your computer into a powerful digital editing system. Along with their high-speed PCI interface, both the TARGA 1000/2000 incorporate all the functions you need to create spectacular multimedia content. They support NTSC and PAL video standards and let you capture, edit and playback full-motion, full-resolution digital video with fully synchronized CD or DAT quality audio. Designed for high performance IBM compatibles and Power Macintoshes their advanced architecture provides incredible processing speed for video and audio effects, titling and compositing.

TARGA 1000/2000 PCI for Mac is the premier open systems (QuickTime 2.1 Native) video capture/playback and effects acceleration board on the market today. It provides a flexible off the shelf "plug-and-play" solution for video authoring, 3D animation and multimedia applications. With the Mac OS and TARGA's open architecture you can work on an animation project in the morning with software like Strata Studio Pro or Specular Infinit-D and switch to video or CD-ROM authoring in the afternoon with Adobe Premiere or After Effects 3.0. Spend the next day desktop publishing with Quark Express or Photoshop. The TARGA 1000/2000 is a complete solution for those tired of being locked into expensive closed architectures, tired of paying for upgrades that never come and frustrated at the lack of creative flexibility.

Advanced DVR (Digital Video Recording) Technology:

The TARGA 1000/2000 employ advanced DVR technology to provide superior video performance. Rather than treating each frame of video as a block of data tied to a specific order of steps such as decompression-resize -compress-write to disk, DVR writes an entire frame of uncompressed video to the huge on-board RAM buffer of the TARGA 2000 (and to a lesser extent on the TARGA 1000).

This is a "memory-centric" approach, in which all board functions share access to the video buffer. For example, a DSP (digital signal processing) chip can scan for additional data, such as matching audio samples to video frames to help maintain lip sync. Transitions, filters, effects and/or resizing can also be applied while the uncompressed frame is in TARGA memory. The final output is then compressed and written to disk. This means that the video data only crosses the bus twice, both times in compressed form.

On other systems, the video data path is longer and more complicated. The video board reads the video data from the AVI/QT memory buffer on the CPU motherboard, decompress it, then send the uncompressed data back to motherboard memory for rendering. Once the render is complete the uncompressed data is once again sent back to the video board to be recompressed. Finally once recompressed, the video data is sent back to down to the CPU motherboard memory to be written to disk. Video is crossing the bus twice uncompressed and twice compressed data.

The DVR architecture can access information in its memory buffer at a speed of 230MB per second. Video runs only at 2 to 7 MB per second ,so the TARGA boards have all the time needed to decide what to do with each frame.

And because the uncompressed data is never sent across the bus, bottlenecks that plague other systems are eliminated.

TARGA 1000 for Windows or Macintosh PCI (specify)	2595.00
TARGA 2000 for Windows or Macintosh PCI (specify)	3995.00
TARGA 2000 RTX for Windows or Macintosh PCI (specify)	CALL
Special! TARGA 2000 for EISA (PC) or Nubus (Macintosh) (specify)	2495.00

TARGA2000 RTX

Truevision's most advanced digital solution, tthe new TARGA 2000 RTX features a breakthrough architecture to deliver broadcast quality video and real-time effects processing on the desktop. It provides input and output connections through an advanced breakout box, works in Windows NT or Mac OS environments and can drive an 21-inch RGB monitor at 24-bit color. It also supports full-motion previewing on both RGB and video monitors. The 2000 RTX installs in a single PCI slot and the breakout box plugs directly into the TARGA. The box can be rackmounted or utilized as a stand-alone device on your desktop. It allows for easy connection to your input and output cables for composite, component and S-video as well as XLR balanced audio, genlock and alpha channel.

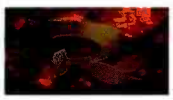
- QuickTime and Video for Windows Native lets it work with a large number of off-the-shelf video applications
- Dual Motion JPEG Codec Architecture processes 2D digital effects in real-time
- Breakout box allows for easyentegration into post-production environments
- Alpha Channel output supports downstream luminance and chrominance keying
- CD and DAT quality audio via XLR connectors
- Delivers near lossless broadcast quality video to your desktop (up to 9 MB's per second (300KB per frame)
- CCIR 601 and Square Pixel support

TARGA 1000/2000 Windows NT 3.51 Turnkey Systems:

- Video capture board (specify) • 220-watt, 6-bay midtower case
- PCI motherboard with 512K pipelined burst cache
- Pentium 166 MHz processor
- 9FX Motion 771 2MB VRAM PCI display card (TARGA 2000 Systems only)
- 9FX Motion 771 4MB VRAM PCI display card (DPS and TARGA 1000 Systems only)
- 32MB of EDO (Extended Data Out) RAM (Premiere systems only)
- 64MB of EDO RAM (Real Impact and Speed Razor systems only)
- Quantum 1.28GB IDE system drive
- Seagate (Barracuda) 4.2GB SCSI-2 FAST/Wide hard drive
- Adaptec AHA-2940UW FAST/Wide SCSI-2 controller card
- MediaTRIX AudioTRIX Pro DSP-equipped 16-bit audio card (for DPS systems only)
- 3.5" floppy drive • Teac CD-58e 8X EIDE internal CD-ROM drive
- Altec-Lansing 300.1 three-piece deluxe speaker system
- Princeton Ultra 17+high resolution 17-inch multiscan monitor
- Focus 2001A keyboard • Microsoft MS mouse • Windows NT 3.51 operating system software.

TARGA 1000 Turnkey System with Adobe Premiere 4.2	$7495
TARGA 1000 PRO Turnkey System with Adobe Premiere 4.2	$7795
TARGA 1000 Turnkey System with in:sync Speed-Razor MACH III	$8995
TARGA 1000 PRO Turnkey NT System with in:sync Speed-Razor MACH III	$9295
TARGA 2000 Turnkey System with in:sync Speed-Razor MACH III	$10,695
TARGA 2000 PRO Turnkey System with in:sync Speed-Razor MACH III	$11,395
TARGA 2000 Turnkey System with AVID Real Impact	$10,995
TARGA 2000 Turnkey PRO System with AVID Real Impact	$11,695

in:sync SPEED RAZOR MACH III



Digital Video Editor for Windows NT

The ultimate digital video editing software, Speed-Razor MACH III allows you to edit full screen, 60 fields per second, CCIR 601 broadcast-quality video. Designed for the DPS PAR DR-2100/ Perception PVR-2500 and Truevision's TARGA 1000/2000 video capture cards, Speed-Razor MACH III is the fastest and most powerful tool for editing and compositing video clips, animations, stills, music and sound effects. Experience straight cut editing in real time and effects which fly on the fastest machines out there: Alpha,Intel, MiPs-based and PowerPC-based workstations, making this the fastest, most flexible software you've ever seen. Running under Windows NT, it offers three times faster than Windows 3.1 on the same machine and up to ten faster when used on Alpha-based systems.

Speed-Razor features infinite video, audio, transition and effects tracks and comes with Razor Blades—transitions and effects to enhance your production. There are preset tumbles, fades and wipes which you can easily customize and save as new presets. In addition, there are special image effects which are unquestionably the highest quality of any system—analog or digital. Speed-Razor sports anti-aliased 3D DVEs, an infinite channel chroma keyer and an excellent character generator. Use the effects or transitions which come with the package, layer them to create new ones, make your own grayscale bitmaps to use as transitions, or use third party plug-in effects—the flexibility is yours.

EDITING FEATURES:
- Real-time straight cut editing (this does NOT require a new file to be made and requires less space onthe hard drive to edit)
- The only video editor with the ability to cut to the field
- Work in Thumbnail or Final Output resolution mode (you set the resolution for each)

COMPOSITING:
- Infinite number of layers of video clips, still and animations can be composited together
- Handles any resolution from Betacam (720 X 480) up to Omnimax film (4000 X 4000)
- Video clips can be combined using an alpha channel, key color transparency, still or traviling mattes

FILE FORMATS:
- Reads and writes ANI files (created by DPS' PAR), PVD files (Perception), DVM files (TARGA 1000 and 2000) and sequences of TARGA files
- Convert files between any of the following formats: ANI, PVD, DVM, AVI, BMP, TGA, FLC, FLI, WAV
- Project-based Library for organizing your work

There are two user definable resolution modes (thumbnail and final) to facilitate editing. The thumbnail mode allows you to use Speed Razor in the field on a laptop computer then transfer the project file back at the edit suite and automatically recapture and re-render the entire project at final resolution. Speed-Razor also features RS-422 control and even does batch capture (new batch capture module allows you to automate video capture via SMPTE time code), so digitizing video and audio is simple and painless. In fact, with the innovative "Virtual Editing" function you can actually edit your project, complete with effects and transitions—before you've digitized a single frame of video.

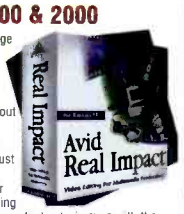
AUDIO:
- Handles audio up to DAT (48 kHz) quality
- Infinite number of audio tracks for multi-layer audio mixing

EFFECTS:
- Blur (circular, gaussian, fast), tint, brightness adjustment, chroma key, crop, displacement, emboss, freeze frame, glass texture, greyscale, invert, loop, matte, pixelate, repeat fields, scale, transparency, strobe, turn red/green/blue
- 3D DVE (translates and/or rotates an image in three dimensions on the X, Y and Z axis)
- Sets a color channel to an assignable value)
- Titles (full blown CG using any Windows font in any color with automatic drop shadow)
- Sub-pixel rendering for incredibly smooth motion
- Effects can be applied to infinite sources

TRANSITIONS:
- Includes over 100 grayscale image transitions, crossfades, luminance fades, fade to/from black, fade to/from white, push, twirl, twist in/out tumbles, flip, turn, scale (zoom)
- Transitions can be applied between infinite inputs.

Real Impact

Windows NT-based Video Editor f/TARGA 1000 & 2000



With the introduction of Real Impact, Avid provides Windows users with the same professional image quality, intuitive cut/copy/paste editing, and instant random access capabilities that have won 2 Emmy awards—for thousands of dollars less than outsourcing an average video. Designed exclusively for Truevision's TARGA 2000, Real Impact lets you create professional-quality video with audio, graphics, animations, special effects and titles—with the speed, flexibility and creative freedom you need. Create sales, training and product videos right on your PC quickly and easily—without compromising quality. Produce video in 24-bit color, with CD-quality sound and perfect lip sync.

Easy to Use: A true 32-bit application (Windows NT 3.51), Real Impact's intuitive Interface and extensive on-line help get you productive right away. It's powerful editing features let you work with video, audio, graphics, animations and titles with the simplicity of cut, copy and paste.

Video Capture: Digitize video and audio—without dropping a frame. Your video is full-screen, full-motion, 60 fields-per-second and your audio in sync. With its Dial-a-Quality image feature, Real Impact allows you to adjust image quality for differing system, storage and delivery requirements.

Create a Storyboard: Extensive media management with built-in media library and database let you easily find the video and audio clips that you want. Instant access makes previewing edits simple and immediate. And, with timeline editing, you just click and drag to experiment with different cuts, rearrange clips and assemble your story. There are 32 levels of undo/redo.

Add Graphics, Titles and Special Effects: Create and seamlessly incorporate audio, graphics and animations into your video using popular Windows-based applications. Real Impact supports AVI video files, WAV audio files, FLC animation files as well as BMP, JPEG, PCX, TGA and TIFF graphics files.

Add Audio: Polish your audio with music and narration. Adjust pan and volume in real time. Simultaneous playback of four audio tracks makes audio editing quick and easy. View your four audio tracks in sync with the video immediately, no waiting for tracks to compile.

Digital Media Interchange: Compatible with the Open Media Framework (OMF) Interchange, a file format for the seamless integration of digital data among applications and across platforms. Through OMF, you can import video and audio files from other OMF-compatible applications like Avid's Media Composer.

Output to Tape, CD-ROM or Over a Network: Gives complete control over video distribution. There's no long rendering process, creating professional quality tape is a snap. Embedding video in multimedia presentations for distribution on disk or CD-ROM is as simple as the click of a mouse. Supports third-party MPEG tools to create MPEG files for network distribution.

Avid's Support Advantage: Real Impact is backed by Avid's world-class customer service. Toll-free telephone support and bulletin board service are just some of the benefits.

Includes free upgrade to AVID MCXpress ($2000 Value)

Video
- Real-time JPEG compression / decompression and playback at 60 fields per second
- Supports RS-422 control protocol and SMPTE time code.
- Edit two tracks of video for layered effects.

Audio
- Edit up to four tracks of 44.1 KHz, 16-bit CD-quality audio.
- Real-time pan and volume adjustments, digital audio scrub.
- Waveform for precise audio editing.

Import/Export
- AVI video files, WAV audio files, FLC animation files.
- OMF interchange files.
- BMP, JPEG, PCX, TGA and TIFF graphics files.

Special Effects
- Filter effects with previews and adjustable parameters.
- Transition effects include wipes, dissolves, zooms, pushes and squeezes.
- Layered effects include picture-in-picture, luminance and chroma key.

Integrated Title Generator
- 32-bit processing (24-bit color and 8-bit alpha channel).
- Support for TrueType fonts and international character sets.
- Drop shadows, transparency and color blends.
- NTSC and PAL-safe color palettes.

Media Management
- Media library for organizing digital clips.
- Database with search capabilities.
- Customized views for easy clip access and retrieval.

A note about our turnkey systems:

In addition to the systems listed on this page, we can further customize any system to fit particular needs. We carry a large variety of 2X and 4X CD-ROM recorders (HP SureStore 4020I, Sony Spressa, FWB Hammer CD-Rs), RAID subsystems (ATTO, FWB) and portable storage devices (Iomega, Syquest) to name a few. Tell us what you need and our salespeople will custom design a system for you. And if you happen to be in NewYork, please come and . . .

Visit our newly expanded Video Store & Digital Video Showroom

INDUSTRY BRIEFS

BUSINESS

Leitch Inc., Chesapeake, VA, announced the purchase of **Tekniche Ltd.,** Northvale, NJ. Both companies will continue to operate autonomously and there are no nameplate changes scheduled for either company's products.

Leitch also has designed and installed a configurable and expandable distributed routing switcher system for **New Brunswick Telephone,** New Brunswick province, Canada.

CNN, Atlanta, recently purchased five new TV-600 on-air consoles from **Wheatstone Corporation,** Syracuse, NY, for its various news operations.

Harris Corporation, Quincy, IL, has been selected by WRAL-TV, Raleigh-Durham, NC, to provide the digital transmitter system for its experimental high-definition TV station.

Harris also announced that **Capital Cities/ABC, Inc.** will purchase ATV transmitter equipment for its 10 owned TV stations from Harris in exchange for priority delivery and quantity pricing.

Wegener Corporation, Duluth, GA, has delivered its series DV2000 MPEG-2 digital video products to **Turner Broadcasting System, Inc.,** Atlanta.

Editing Technologies has moved to a new location at 950 Enchanted Way, #106, Simi Valley, CA 93065; 805-584-9442; fax 805-584-1082; etcedit@aol.com.

Thomson Broadcast Systems (France) has won two contracts from RTM, the Malaysian State Television, to supply seven 1657 ENG cameras and a still-store system designed around nine Pixtore 3300s. In addition, the Hong Kong company **Ideal Systems** ordered a presentation system for the new K-TV network based in Singapore, and another presentation system for a broadcaster in Bangkok.

PEOPLE

Robert P. McAlpine has been promoted to senior vice president, sales and marketing, for PESA Switching, Huntsville, AL.

Mark Gray has been appointed CEO of Pluto Technologies International, Boulder, CO. Other appointments include **Jim Duca,** chief technology officer; **Art Rancis,** vice president, sales and marketing; and **Peter Lance,** vice president, operations. ■

Congratulations to our winners!

Broadcast Engineering* is proud to announce the winners of our T-shirt contest. These 10 lucky people were drawn from the many entries received by filling out a survey that ran in the *Broadcast Engineering Product Source.

Rob Goluck
Kathy Johanson
George McDonald
B. Andreola
Phillipe C. Trolliet
Frank DiCiero
Greg Miller
Terry Borders
Peter Zawistowski
James Allred

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SCR-4X8 (Serial Machine Control Router) Input/Output: Twelve rear mounted DB9-F connectors (four controllers, eight devices). EIA RS-422 send and receive. Controls: Twelve lighted push-buttons for channel assignment. **$980**

SCP-10 (Serial 422 Patch Panel) 10x10 passive non-normalling serial data patch panel. Two rack units high. Legend strips and 10 patch cords included. **$350**

VU2-P (VU/Peak Meter with Phase Indicator) Simultaneous peak and VU display. Solid state phase indication. Highly readable LED arrays. Adjustable headphone output. Hi-impedance looping inputs. **$890**

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Forward cover letter and resume to: Eugene Williams, Station Manager, WYCC-TV, 7500 S. Pulaski, Chicago, IL 60652. Chicago residency is required within six months. EEO/AA/M/F/D/V

VACATION-RELIEF MAINTENANCE ENGINEER: Responsibilities include the maintenance of Studio, Video, Tape and Electronic News Gathering equipment, including cameras, video tape recorders, video switchers, editing and transmission equipment. Experience with broadcast graphics equipment, including Character Generators and Paint Systems a plus. FCC license or SBE certification preferred. Candidates must have Broadcast Station or related experience. Please send resume to: Bill Beam, WABC-TV, 7 Lincoln Square-6th Floor, New York, NY 10023-0217. No telephone calls or faxes please. We are an Equal Opportunity Employer.

BROADCAST MAINTENANCE TECHNICIAN: TRIBUNE Company's CLTV News, a 24-hour regional news cable channel, has an immediate opening for a maintenance technician with at least five years experience in troubleshooting and repair of audio, video, RF systems and related equipment. Prefer computer literacy including various LANs, AutoCad, Database, MS-DOS, and computer station automation. ENG, master control and studio experience desirable. Must be able to work varying shifts in our state-of-the-art facility located in suburban Chicago. Fax resume to 708-571-0489, or mail to CLTV News, Attn: Linda, 2000 York, Suite 114, Oak Brook, IL 60521.

CHIEF ENGINEER KETA-TV, Oklahoma City, is seeking a hands on leader with a strong maintenance background. Supervisory and organizational skills will be essential in guiding our technical team in planning and implementing projects. Please send your resume and salary history to the Personnel Department, Oklahoma Educational Television Authority, P.O. Box 14190, Oklahoma City, Oklahoma 73113. AA/EEO.

SENIOR TECHNICIAN for growing broadcast TV station. Minimum 10 years broadcast engineering experience, and General Class FCC license required. Must have extensive knowledge of UHF transmitters, VTR repair, microwave, studio maintenance, and satellite. Able to train and supervise staff. Send resumes to Director of Operations, P.O. Box 410472, San Francisco, CA 94141-0472. All resumes must be received by August 30, 1996. EOE.

KFXK FOX 51 is seeking an assistant chief engineer. Duties include chief operator transmitter, Studio, microwave. Associate or equivalent degree in electronics, FCC LGRT or SBE CBETV preferred. Send or Fax resume to Ted Small, DOE, 701 N. Access Road, Longview, Texas 75602, 903-753-6637.

STUDIO MAINTENANCE ENGINEER Engineering department in a major market, state of the art digital broadcast facility seeks motivated, hard working addition to our team. A subsidiary of the A.H. Belo Corporation, we offer a comprehensive benefits package, competitive salary structure and the chance to demonstrate your skills. Seeking candidate with a minimum of three years of television maintenance experience with a thorough knowledge of the electronics of television. Responsibilities include design of technical systems, creation of documentation to put design into practice, installation of equipment and performance of corrective and preventive maintenance. Prefer a candidate with experience in UNIX, programming in C++, and Visual Basic. Send resume to David Carr, Director of Engineering, KHOU-TV, 1945 Allen Parkway, Houston, TX 77019. Equal Opportunity Employer.

ASSISTANT CHIEF ENGINEER: WRDW-TV looking for highly-motivated individual with extensive electronic/TV broadcasting background. Must be energetic, self-starter experienced in component level troubleshooting and maintenance of video, audio & RF equipment. U-matic/Ampex 1" a must, Beta/SVHA, RF and microwave experience a plus. Some weekends/nights required. Minorities/women encouraged to apply. Send resume to Human Resources Officer, WRDW-TV, P.O. Box 1212, Augusta, GA 30903-1212. EOE.

MAINTENANCE ENGINEER KNXV-TV, Phoenix, Arizona seeks an individual with repair and installation skills of television broadcast and computer equipment. Should have three years experience in maintaining audio, video, computer and RF broadcast equipment and systems. This position requires a two year electronic technical degree or equivalent, and experience with Beta and CCD ENG camera equipment. Fax resume to Engineering Manager at (602) 304-3000 or send to KNXV-TV, 4625 S. 33rd Place, Phoenix, Arizona 85040. EOE.

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BROADCAST MAINTENANCE ENGINEER: WTVY-TV, a Benedek Broadcasting station and CBS affiliate for Dothan, Alabama and Panama City, Florida, has an immediate opening for an experienced Broadcast Engineer. FCC General Class or SBE certification preferred. Salary negotiable. Send resume to: Chief Engineer, WTVY-TV, P.O. Box 1089, Dothan, AL 36302. Fax #334-793-3947. Benedek Broadcasting Corporation/ WTVY-TV is an Equal Opportunity Employer.

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QVC has initiated one of the most ambitious expansions in our history. If you fit the above description and are a self-starter, you owe it to yourself to contact us.

We offer a compensation plan befitting a company of our stature by including a very competitive salary and a comprehensive benefits package. QVC is located in West Chester, Pennsylvania, a thriving suburb just 30 miles outside of Philadelphia. To apply, please forward your resume to: **QVC, Inc, Human Resources - JB/BE/BE, 1365 Enterprise Drive, West Chester, PA 19380-0844. Fax: (610) 701-1368.** Equal Opportunity Employer.

KBMT-TV ENGINEERING: ABC affiliate in southeast Texas is looking for a studio engineer with a minimum of 3 yrs. experience with Sony Betacart, Beta SP, 3/4" and Sony Betacam, Ampex AVC switcher, ESS 5 still store, ADO 100, and DCT 500 Editor. Harris transmitter experience a plus. Send resume to EEOC Officer, KBMT-TV, P.O. Box 1550, Beaumont, TX 77706. An Equal Opportunity Employer.

CHIEF ENGINEER Fast growing post-production facility seeks experienced engineer to help guide us through the future. GVG, Ampex, Sony D1, D2, D3, Digital Beta, Paintbox, Macintosh knowledge a must. Please fax resume and salary requirements to Eric at (212) 838-0853.

CHIEF ENGINEER A Northeast radio station is looking for an organized & detailed-oriented engineering manager. Salary commensurate with experience. Requirements: Radio engineer SBE certification. 3 years experience as assistant or chief engineer. Ability to work on AM & FM transmitters & equipment. Computer literate. Knowledge of digital & telecommunications technology. We are an EOE. Send resume to: Classified Ad Coordinator, Broadcast Engineering, Dept. 779, 9800 Metcalf, Overland Park, KS 66212-2215.

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Call Matt Tusken, Classified Sales Manager at 1-800-896-9939 or fax 913-967-1735.

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SUBSCRIPTIONS: Non-qualified persons may subscribe at the following rates: United States and Canada: one year, $55.00. Qualified and non-qualified persons in all other countries: one year, $70.00 (surface mail); $130.00 (air mail). Subscription information: P.O. Box 12937, Overland Park, KS 66282-2937.

INTERTEC PUBLISHING

By Paul McGoldrick

The MPEG toolbox

Two things seem to be little understood about MPEG-2. The first is the fact that simply because a bitstream is MPEG-2, there is no implied standard of quality. The second is that MPEG-2 is not a single standard; it is a "toolbox" of standards, a generic coding system capable of supporting a wide variety of applications. Putting all the possible features in a single decoder would be unnecessarily expensive, complicated and bandwidth-hungry. Instead, a small number of subset standards are defined called *profiles* and *levels*. (The standard does not forbid other possible uses of features, but they would be considered proprietary and would have no general support without going back to committee to be identified as another profile and level.) Level is a set of constraints, such as bit rate and picture size, whereas profile is a defined subset of the algorithms used in compression.

MPEG-1 was designed for coding progressively scanned video at bit rates up to about 1.5Mb/s. MPEG-2 extends that coding to interlaced video and adds a larger range of bit rates. Scaleable coding is available with MPEG-2, which allows for the reconstruction of video from pieces of the whole bitstream. MPEG-2 bitstreams can be built as layered structures with a base layer and then refinement layers, which can improve resolution or reduce the distortion caused by quantization. The base layer can, in its own right, be decoded.

The scaleable profiles are SNR, spatial and high. The SNR profile uses a signal-to-noise ratio scaleability tool defined by the standard. It is suggested that this profile will have considerable benefit in terrestrial broadcasting, allowing for a more graceful collapse of quality as degradation takes place.

The spatial profile allows, using the standard's "spatial scaleability tool," for the refinement layers to be at different resolutions; the decoded pictures from a lower layer can be used as a prediction in a higher layer. The application for spatial profile is expected to be for the transmission of a high-definition signal and a standard-definition signal simultaneously. The high profile includes the tools for SNR and spatial scaleability, plus the support for coding a 4:2:2 signal.

Level is a set of constraints, such as bit rate and picture size, whereas profile is a defined subset of the algorithms used in compression.

Two nonscaleable profiles are *simple* and *main*. Simple profile uses no backward or predictive assistance, i.e., no B-frames, and is probably the most suitable for teleconferencing and desk-to-desk video. Main profile adds support for B-frames and is the most commonly used profile. Main profile decoders will also decode MPEG-1 video signals.

The other part of the definition, the parameter constraints of levels, has four varieties:

1. low;
2. main;
3. high-1440; and
4. high.

The level parameters are detailed in Table 1. It is important to note that all of the parameters are maximums and codecs will always operate at the lower levels. From a broadcaster's perspective, the important level is main, while all of the proposed HDTV standards require high-1440.

The interest to date has centered on the main profile at main level for broadcasting applications — abbreviated as MP@ML — while a few non-U.S. trials have taken place for terrestrial broadcasting of SNRP@ML and SP@ML. The general trend also applies to servers using MP@ML, as has been the case with most of the chips for decoder solutions.

Do you remember the sentence that started this piece: "The first is the fact that simply because a bitstream is MPEG-2, there is no implied standard of quality." The standard defines the bitstream; it in no way suggests to the manufacturer of the coder chipset or the decoder chip exactly how compression is done. To be MPEG-2-compliant, encoders only require the ability to encode a legitimate bitstream and likewise, decoders only need to be able to decode legitimate bitstreams. Are they all the same? Absolutely not!

Wide variations in the chipsets are available in the encoder. Differences include the way motion vectors are handled and the way the quantizer adapts to different picture content. In addition, there are differences in the way that prediction systems are chosen and implemented and differences in the way bit rate is controlled, and, often tied to the motion-vector decisions. There are also differences in the video pre-processing (pre-distortion?) that is applied. On the decoder side, there are major differences in the way the chip design copes with transmission channel errors: the lower-end products basically ignore the situation, while advanced decoders have error-concealment systems. Failure modes, too, can be catastrophic in their effects on the picture, but they can also be made to be more graceful and far less objectionable as degradation sets in.

If you are in the business of choosing either an encoder or decoder for a system, it is vital that you are happy with the performance when seeing your range of material passing through the system. Test equipment is getting there. We already have ways of verifying the bitstream and what is happening inside the process. The next major jump must be for the user to be able to identify a digital problem and link it to the probable effect on the final pictures — as we are used to with analog measurements. ■

Paul McGoldrick is a technical writer and consultant based on the West Coast.

MPEG-2 LEVELS

LEVEL	MAXIMUM FRAME RATE (Hz)	MAXIMUM BIT RATE (Mb/s)	MAXIMUM FRAME HEIGHT (Lines)	MAXIMUM FRAME WIDTH (Pixels)	APPROX. BUFFER SIZE (Mbits)
HIGH	60	80	1152	1920	9.8
HIGH-1440	60	60	1152	1440	7.3
MAIN	30	15	576	720	1.8
LOW	30	4	288	352	0.5

Table 1. The levels (constraining parameters) in the MPEG-2 toolkit.

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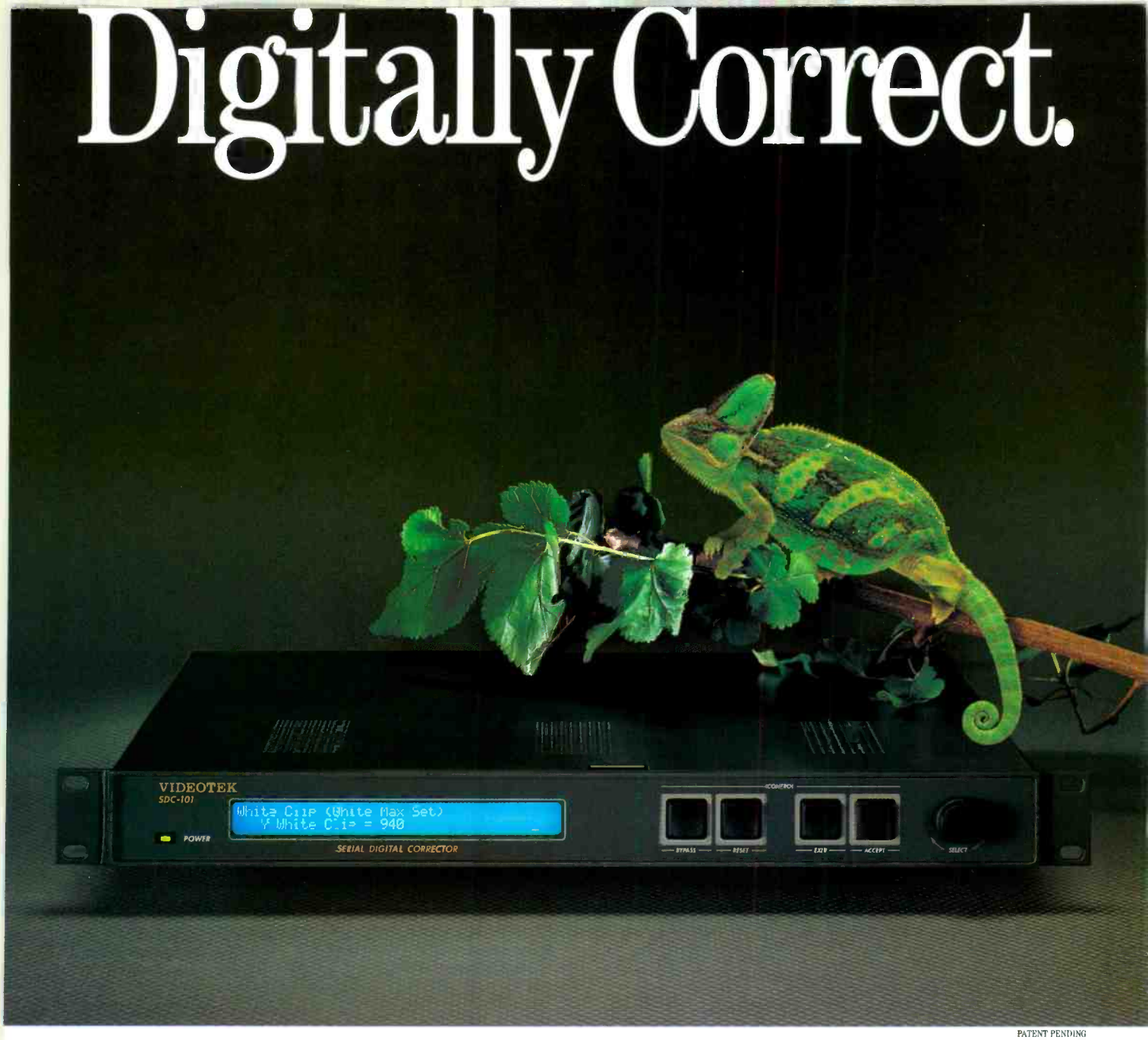

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