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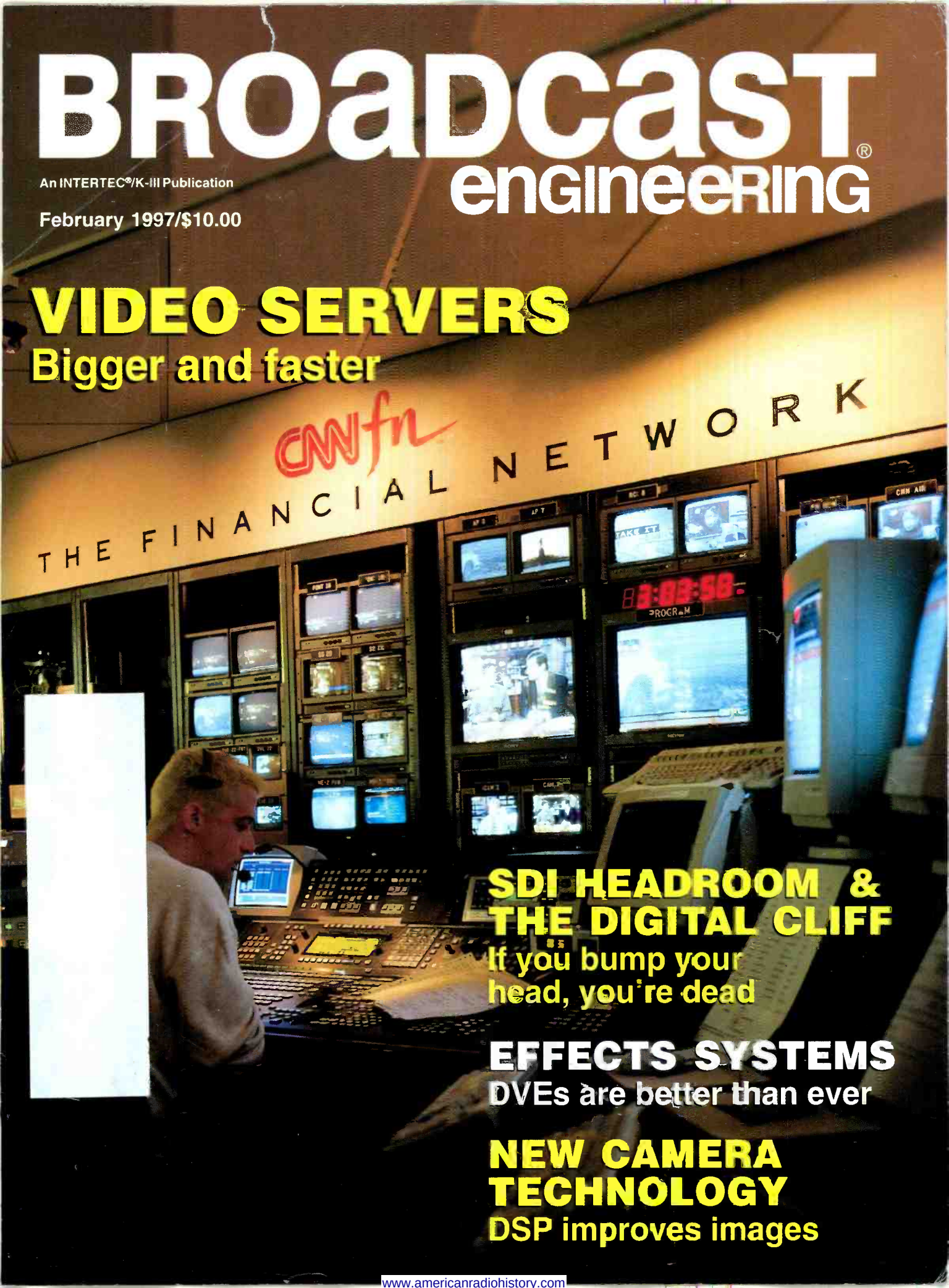

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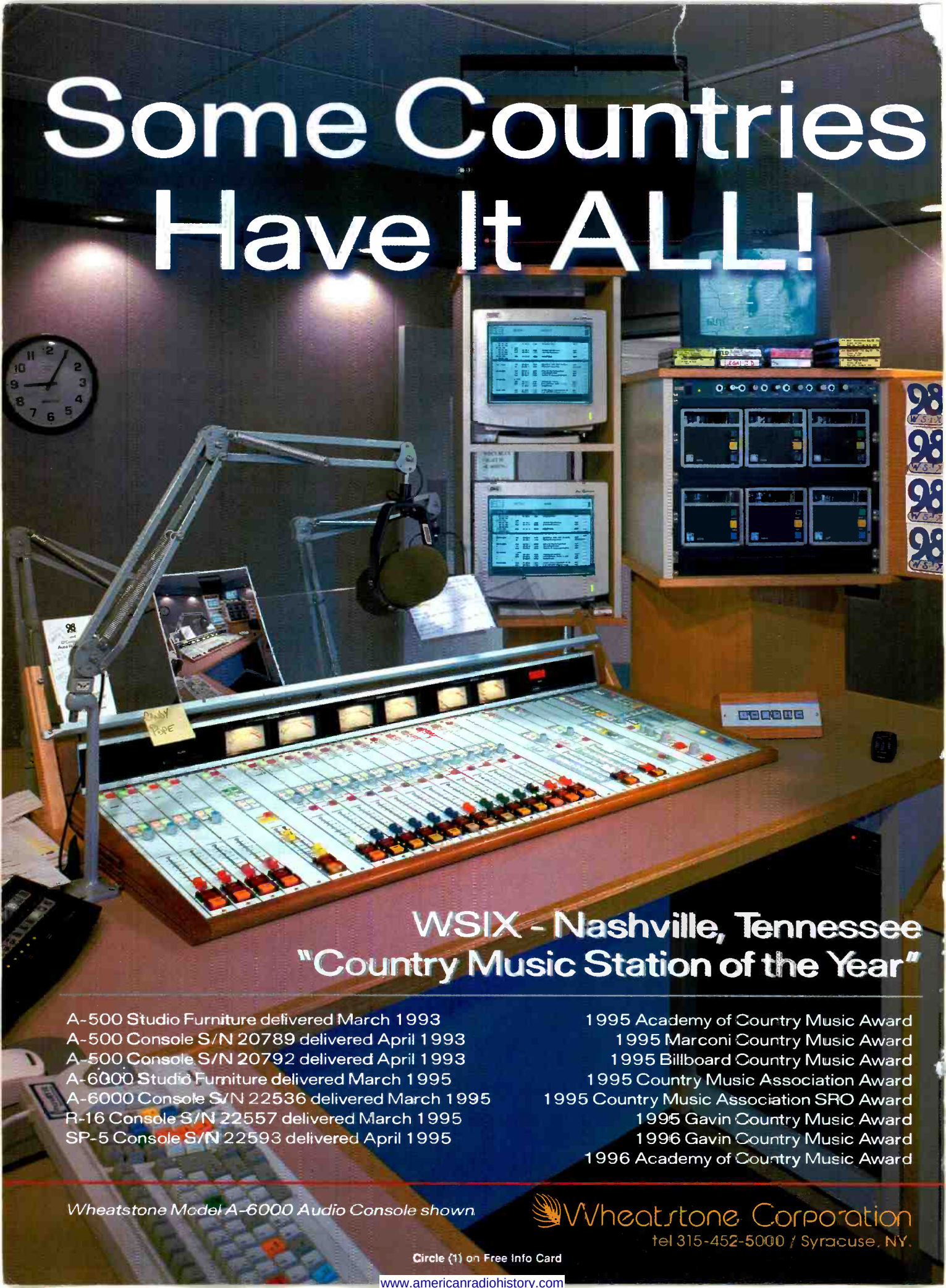

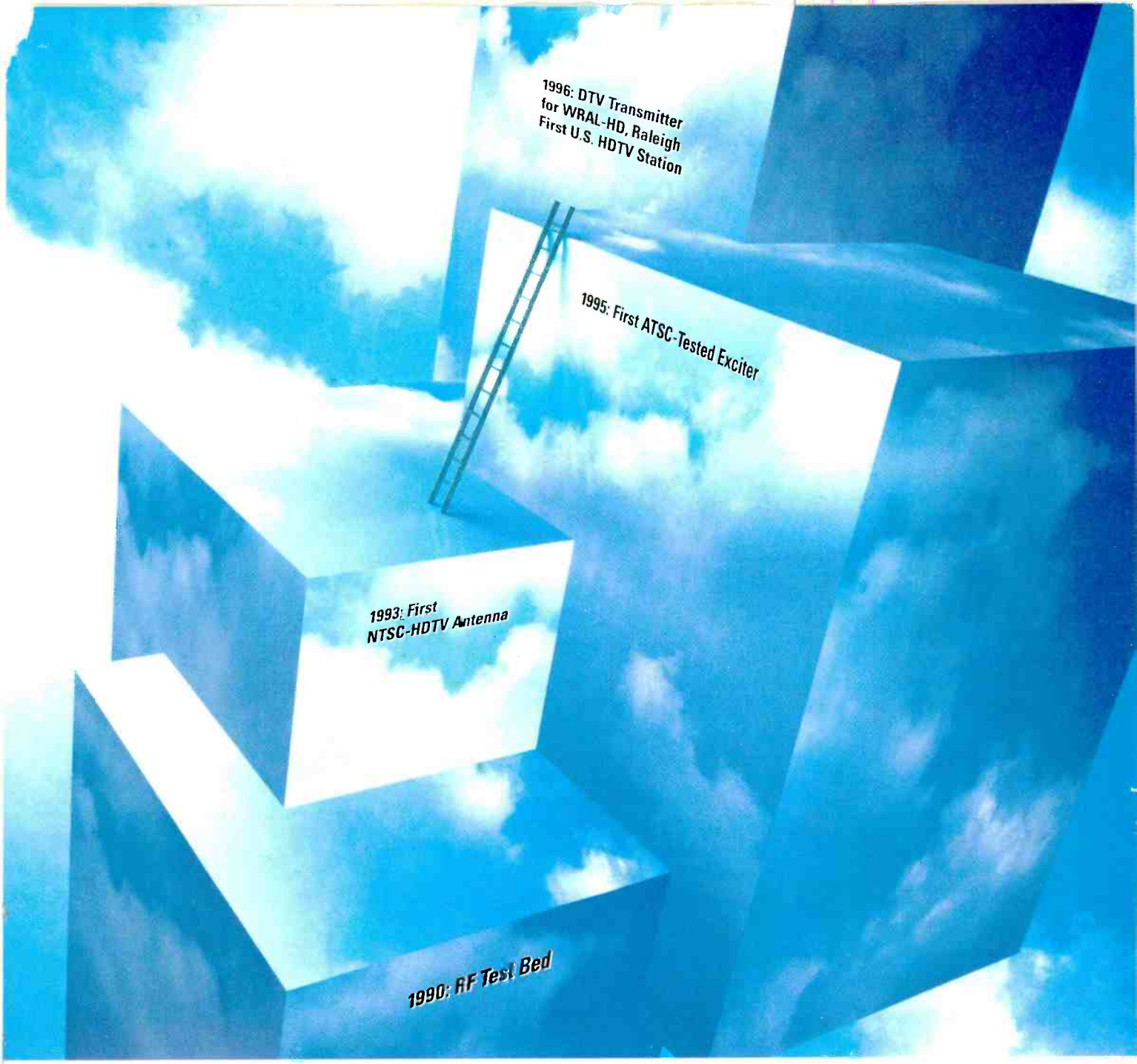

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features

columns

departments

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ON THE COVER: The new CNNfn control room provides a tightly integrated control system in a small space. Note that the studio set in the upper left corner is but a few feet away. Cover photography courtesy CNNfn, Doug Schwartz photography.

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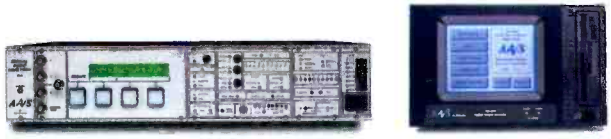

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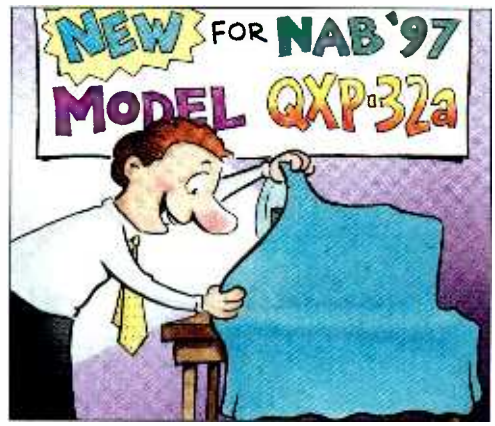
editorial

I'll see you there

It's about this time of year that the humongous task of preparing the March pre-NAB edition really gets under way. Although most readers probably haven't even booked hotel rooms yet, the editors at *BE* are already hard at work on our largest issue of the year.



This year's edition will have several surprises (they're surprises, so I can't tell you about them now) designed to make your travel to the bright lights of the gambling city even more fun and profitable. Heck, you might even win a prize.

Some companies have already held their pre-NAB press conferences to announce some of their new products and services that will be unveiled at the show. During my travels around the country to visit clients, there was real excitement about this year's event. Last year saw the second round of introductions of some new technology. The products were basically second versions of their original incantations. So far, it looks like some of the companies have skipped versions 3.11 to 6.0 of some products and are going to be able to deliver completely new technology, but with a tried-and-true history.

One advantage of being an editor is that I get to learn about these products before they're released to the public. Because I no longer work in a TV station, getting a one-on-one demonstration is about as close as I get to my old hardware days. It's great getting to see and touch some of the equipment. And trust me on this one, there is going to be some really neat stuff at this year's show.

It's not too early to make plans to attend the 1997 NAB. With two exhibition halls, more conferences than you could attend in a month and lots of new technology, it's going to be a hit. So get your act together and I'll see you there.

Brad Dick

Brad Dick, editor

At press time, the Clinton administration and some members of Congress have again proposed that broadcasters be charged for spectrum usage. I needn't remind *BE* readers of the importance that such "short-term," political-minded suggestions are not in the best interest of the American public.

While the NAB has already weighed in on the issue, stations shouldn't assume that will resolve the matter. With a lame-duck president, you might wonder how far the administration will go to look for quick money solutions to budget issues. It seems one of the first places both President Clinton and Congress have previously looked for money has been from broadcasters.

The transition to ATV will be expensive enough (more than enough) without having to also "buy a ticket" to spend that money. Contact your congressional representative now and let them know how a spectrum fee would impact your business — and their voters.

READER FEEDBACK

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letters to the editor

Regarding "Frankenstein TV"

From the point-of-view of the consumer (being an AV tech in a college for 22+ years, buying TV's for the classroom), I can't see educational institutions making any investment in digital TVs for a long time.

I find it highly unlikely that the broadcasters in our area will go digital for quite some time, seeing that they don't even want to go stereo while the market for stereo TVs must be booming. I don't see a lot of new 19-inch and larger TVs on the market today that are still mono, and still, we have stereo holdouts.

If a digital TV is going to cost $5,000, the public won't be going out to buy them too quick. Sheesh, don't the manufacturers of these things read the papers? With the average Joe having to work two or three part-time jobs just to get by (because his factory job was 'downsized') who's going to have the money?

Sure, there are those people who have to have the latest and greatest, but there aren't that many of them around. In the same vein, if the broadcasters go digital and no one buys an expensive digital TV, who loses?

PETER J. HOUGHTON,
SENIOR TECHNICAL ASSISTANT
BEGLEY LIBRARY
SCHENECTADY, NY

Editor responds:

If no one buys those expensive digital HDTV sets you mention, a LOT of people stand to loose. Billions — yes, billions, will be lost by set makers and broadcasters if the viewers don't quickly embrace ATV with their dollars.

What the set manufacturers don't want Congress, the FCC and broadcasters to remember is that new set technology has a history of being adopted v-e-r-y s-l-o-w-l-y by viewers.

For instance, once color TV was introduced, it took eight years for it to reach the minuscule 1% penetration level; even after 10 years, color TV-set penetration had barely reached 3%; and it took almost 20 years before 50% of the American homes had color TV sets!

Where's the proof that says HDTV will be any different? At these historical rates, if the FCC held to a 15-year cut-off point for NTSC, *two-thirds of America's viewers would be without any over-the-air broadcast service when NTSC went dark!*

Regarding "Choosing Batteries for Field Production"

Your article, "Choosing Batteries for Field Production," by Bennett Liles in December's issue was interesting, even if a bit misleading, particularly in Lithium Ion.

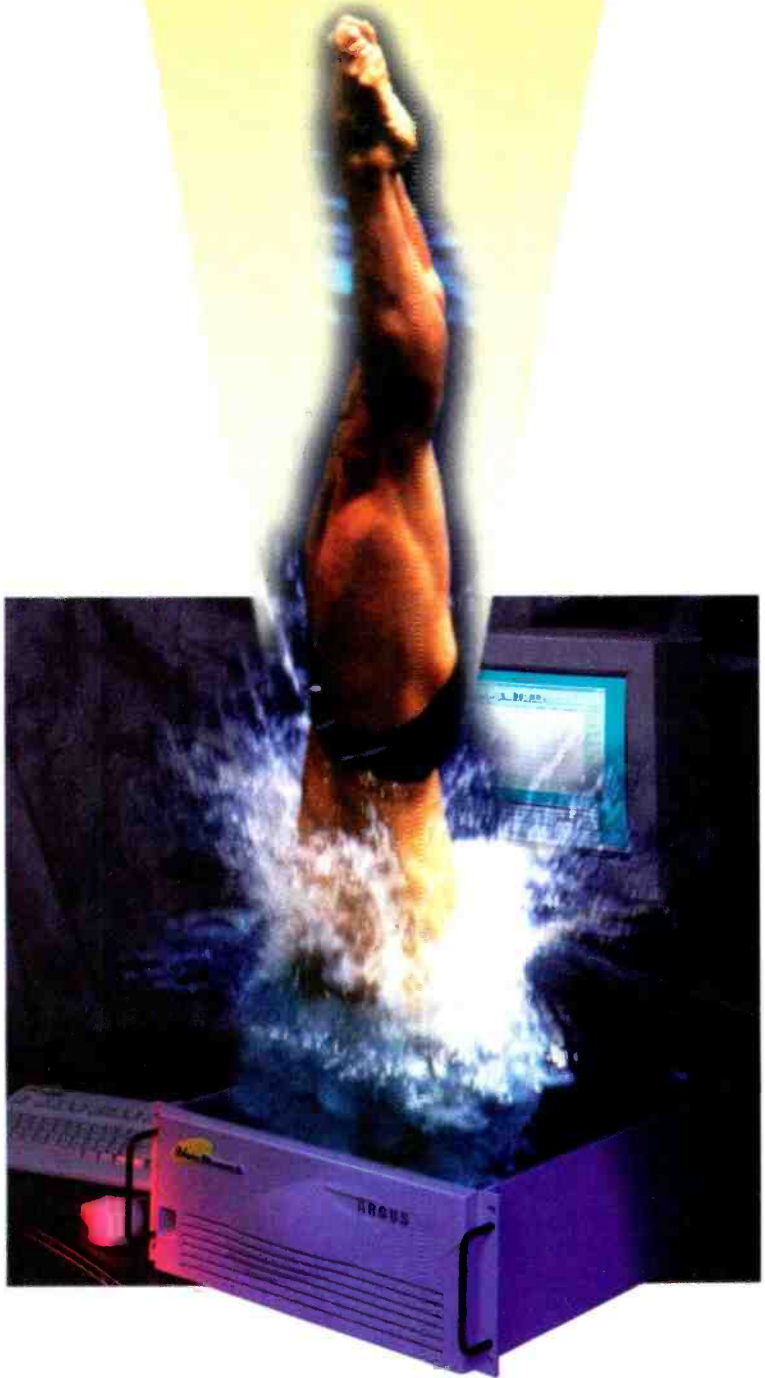
The chart you used, which was obtained I believe from Cadex Electronics, is actually incorrect when it states that Lithium Ion has a high self-discharge rate. We at IDX Technology verified this with Isidor Buchmann of Cadex. Mr. Buchmann E-mailed us on Jan. 3 and said, "You are correct in assuming that the self-discharge of the Li-Ion is low. We apologize for the error and we will correct it shortly." At a self-discharge rate of approximately 10% per month, it is probably one of the lowest.

The data on cycle life is also not correct. The point is not how many cycles the battery can withstand, but how many cycles the battery goes through before it loses its effectiveness as an energy source. This figure is usually around 80% of initial capacity for broadcast applications. In theory, both Lithium and NiCd cycle to 80% level after approximately 500 cycles. NiMH, on the other hand, levels at about 300 cycles. I say in theory, because unlike NiCd or NiMH, Li-Ion does not have memory effect. Consequently, as it does not require periodic deep discharge to prolong its life, Li-Ion should keep its effectiveness much longer. For more information on Lithium Ion and specifically the new IDX-NP-1 format Lithium Ion battery (NP-L40), we recommend that your readers check out our web site at www.idxtek.com.

PAT O'ROURKE
IDX TECHNOLOGY

Editor's note: For a more complete table listing these and other battery performance characteristics, see p. 62 of the January issue, the article "Preparing for Disaster," discusses the selection of batteries.

The Cost Of MPEG-2 AFF Encoding Is Taking A



So before you go off the deep end and pay for something you may not be getting, consider this: Argus... Vela's MPEG-2 encoding workstation ...answers the need for affordable clip encoding and storage for the broadcast professional. And at a cost that won't have you gasping for air. Look at the enhancements Argus supports:

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news

By Dawn Hightower, senior associate editor

NAB '97

NAB '97 expands technical conferences

This year's NAB will feature expanded technical sessions and events for Multimedia World and the 51st Broadcast Engineering Conference. An all-new NAB Communications and Connectivity Event and the NAB/Broadcast Designers Association (BDA) Designer's Conference will be added this year.

For up-to-date comprehensive information about NAB '97, use the fax-on-demand service at 301-216-1847; or browse the web site at www.nab.org.

ATSC DTV standard demo of HDTV to be featured

A special technology demo of the Advanced Television Systems Committee (ATSC) Digital TV standard based on the HDTV system will take place at the convention. It is an inter-industry effort sponsored by NAB, broadcast networks and equipment manufacturers under the aegis of the ATSC. The demo will feature over-the-air broadcasts from a local Las Vegas TV station with some of the broadcasts originating from WHD-TV, the Model HDTV Station in Washington, DC. The broadcasts from WHD-TV will be linked to Las Vegas via satellite.

Barbara Walters to receive NAB Distinguished Service Award

Barbara Walters, ABC News correspondent and anchor, will receive the NAB 1997 Distinguished Service Award April 7 at the conference's All-Industry Opening. The award recognizes a broadcaster who has made a significant and lasting contribution to the American system of broadcasting.

Walters recently marked her 20th anniversary at ABC, which she joined in 1976 as the first woman to co-anchor the network news.

Ellen Hancock keynotes NAB Multimedia World

Ellen Hancock, executive vice president of research and development and chief technology officer, Apple Computer, will keynote the 1997 NAB Multimedia World Conference on April 8 from 9 a.m. to 10 a.m. at the Sands Expo center.

Two international SCTE meeting groups formed

Two international meeting groups of the Society of Cable Telecommunications Engineers (SCTE) have formed, one in St. John's, Newfoundland in Canada and the other in Panama City, Panama.

Meeting groups are local organizations in the process of meeting all of the requirements necessary for full SCTE chapter status. This marks the first time in the society's 27-year history that SCTE meeting groups have been formed outside of the United States.

NDBC completes evaluation of DBS

In December, the National Data Broadcasting Committee (NDBC) completed its evaluation of high-speed data broadcasting systems. Digideck's system was found to be a viable candidate system for a data broadcasting service.

The NDBC conducted a comprehensive field test program on the Digideck system last fall. Tests were conducted in the Washington, DC, area and data was collected at 90 receiving sites, under several reception configurations. The test program used the facilities of WJLA-TV Channel 7 and WETA-TV Channel 26 for transmission. Data was gathered at distances up to 45 miles from the transmitter sites. On Channel 7, satisfactory reception of the Digideck system was found at 93% of the locations visited, compared to 82% for reception of satisfactory NTSC images. On Channel 26, satisfactory reception of the Digideck system was found at 74% of the locations compared to 62% for reception of satisfactory NTSC images.

The technical work of the committee, along with a final report, will be sent to the FCC for inclusion in its technical record on data broadcasting systems. The committee's work is now complete, and it is hoped that it will contribute to fostering new markets for disseminating data-based information services for business and consumer uses.

Course offered on error correcting codes

The University Consortium for Continuing Education (UCCE) is sponsoring a four-day course on error correcting codes with application to digital storage systems, in San Jose, CA. The course will feature PRML recording and Reed-Solomon Code error correction for DVD disks and next-generation hard disks. For more information, call Joleen Packman at 818-995-6335 or fax at 818-995-2932 or E-mail at info@ucce.edu.

A training course on fiber-optics

A training course for installers, maintenance personnel and engineer designers who want to learn how to install, test and design fiber-optic systems for voice, data and video applications is being offered by The Light Brigade. Classroom and workstations are set up for hands-on training in connectorization, splicing, cable preparation, OTDR and optical loss testing. Call 1-800-451-7128 for the 1997 training catalog and for dates and locations of the training course. ■

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By Harry C. Martin

Deadline for compliance with RF standards extended

The commission has extended to Sept. 1, 1997, the transition period for broadcast applicants and station licensees to comply with the new requirements for evaluating the environmental effects of radio-frequency (RF) electromagnetic fields from FCC-regulated transmitters.

Last August, the commission amended its rules governing such effects by establishing new guidelines and methods, and setting a transition period until Jan. 1, 1997, for applicants and stations to comply with the new requirements. Various industry groups sought extensions of the transition period, arguing that affected parties could not achieve compliance with the new rules by Jan. 1.

Harry Martin

The commission stated that, based on the petitions and comments it received, it is clear that most stations and applicants will need more time to determine that they comply with the new requirements. The commission noted that an extension of the transition period to Sept. 1 would:

1. Eliminate the need for the filing and granting of individual waiver requests;
2. Allow time for applicants and licensees to review the results of the decisions that will be taken in the near future addressing other issues raised in the petitions; and
3. Permit applicants to review the FCC's revised information bulletin and make the necessary measurements or calculations to determine that they are in compliance.

License terms extended

Section 203 of the Telecommunications Act of 1996 has been implemented by adopting rules, which extend the license terms for TV stations to eight years. The exception is for experimental broadcast station license terms, which will remain at one year.

Air-safety obligations reminder

The FCC has issued a notice reminding all licensees and tower owners of the importance of conforming with FCC-issued lighting and marking specifications for communications towers. The commission has received reports of aircraft collisions with unmarked or improperly lighted communications towers.

Reports on these accidents indicate that tower owners and FCC licensees need to be more aware of conforming to FCC obstruction marking and lighting specifications. Whenever a tower is greater than 200 feet in height and/or is located near an airport, the licensee using the tower or the owner must apply for FCC-issued obstruction marking and lighting specifications, in addition to any determination of no hazard obtained from the FAA. During construction of the structure, temporary warning lights must be installed at the top and at each level where permanent lights will be installed.

Licensees must make sure that their towers are marked and lighted according to the specifications listed on their permits. Licensees also must make daily inspections to ensure that the lights are on and operating properly. Any variance must be approved by the FCC.

If a light outage cannot be corrected within 30 minutes after it occurs, the licensee must immediately contact the local FAA Flight Service Station (FSS), which will issue a warning to pilots. The FSS must also be notified when the lights return to operation.

The FCC intends to continue its close scrutiny of radio towers. It will take appropriate action, including issuing fines and/or revoking the station license, against the user or owner of any unauthorized or improperly marked radio tower. ■

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

dateline

TV stations in Indiana, Kentucky and Tennessee must file their renewal applications on or before April 1. Commercial TV stations in the following states must file their annual ownership reports on or before April 1: Delaware, Indiana, Kentucky, Pennsylvania, Tennessee and Texas.

Tower owners in Iowa and Virginia must register their towers between March 1 and March 31, 1997.

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NEWS SOLUTIONS

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By Jerry Whitaker

Transform coding

As discussed in last month's column, virtually all applications of video and visual communication deal with enormous amounts of data. Because of this, compression is an integral part of many modern digital video applications. We examined the motion-JPEG (M-JPEG) format and introduced the concept of *transform coding* (TC). This month, we examine picture coding in detail, with an eye toward how it's used in M-JPEG and MPEG applications.

Jerry Whitaker

Transform coding

In technical literature, countless versions of different coding techniques can be found. One that crops up regularly during discussions about transmission standards is *transform coding* (TC).

Transform coding is a universal bit-rate reduction method well-suited for large and small bit rates. Furthermore, the subjective impression given by the resulting picture is frequently better than with other methods, because of several possibilities that it offers for exploiting human visual inadequacies. If the intended bit rate is insufficient, the effect is seen as a lack of sharpness, typically less disturbing (subjectively) than other coding errors, such as frayed edges or structured noise. Only at low bit rates does TC produce a particularly noticeable artifact: the *blocking effect*.

Because not all pictures have the same statistical characteristics, the optimum transform isn't constant, but depends on the momentary picture contents that have to be coded. We could, for example, recalculate the optimum transform matrix for every new frame to be transmitted, as is performed in the *Karhunen-Loeve transform* (KLT). Although the KLT is efficient in terms of ultimate performance, it isn't typically used in practice because it demands investigating each new picture and finding the best transform matrix. Furthermore, the matrix must be indicated to the receiver for each frame, because this must be used in decoding of the relevant inverse transform. A compromise is made with the *discrete cosine transform* (DCT). This transform matrix is constant, is suitable for a variety of pictures and is sometimes referred to as "quick KLT."

The DCT is a near relative of the *discrete Fourier transform* (DFT), which is widely used in signal analysis. Similar to DFT techniques, DCT offers a reliable algorithm for quick execution of matrix multiplication. The main advantage of DCT is that it *decorrelates* the pixels efficiently; put another way, it efficiently converts statistically dependent pixel values into independent coefficients. In so doing, DCT packs the signal energy of the image block onto a small number of coefficients. Another significant advantage of using DCT is that a number of fast implementations are available. A block diagram of a DCT-based codec is shown in Figure 1.

Planar transform

The similarities of neighboring pixels in a video image aren't only line- or column-oriented, but also area-oriented. To make use of these neighborhood relationships, it's understandable that we would not only like to transform in lines and columns, but also in areas. This can be achieved by a *planar transform*. In practice, *separable transforms* are used almost exclusively. A separable planar transform is nothing more than the repeated application of a simple transform. It's almost always applied to square picture segments of size $N \times N$, and progresses in two steps, as illustrated in Figure 2. First, all lines of the picture segments are transformed in succession, and then all rows of the segments calcu-

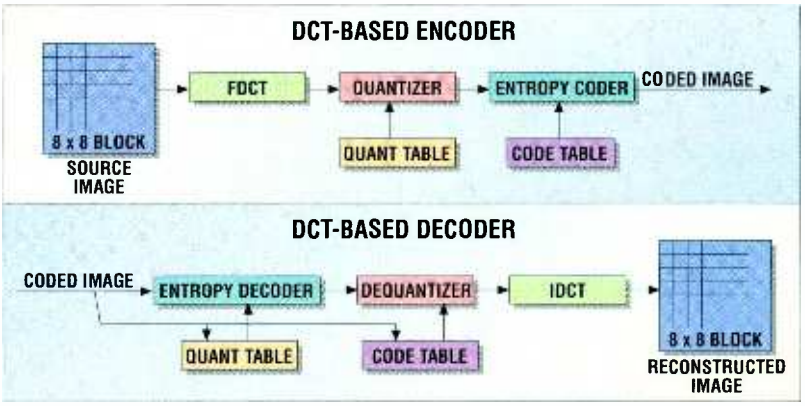


Figure 1. A block diagram of a DCT-based image compression system. Note how the 8x8 source image is processed through a *forward-DCT* encoder and related systems to the *inverse-DCT* decoder and reconstructed into an 8x8 image.

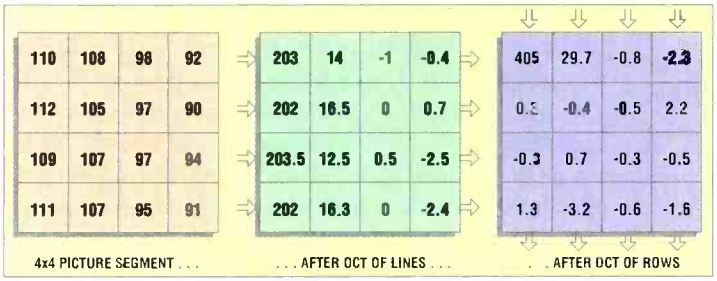


Figure 2. Processing of a planar DCT. Note how the information content decreases markedly after row and column processing.

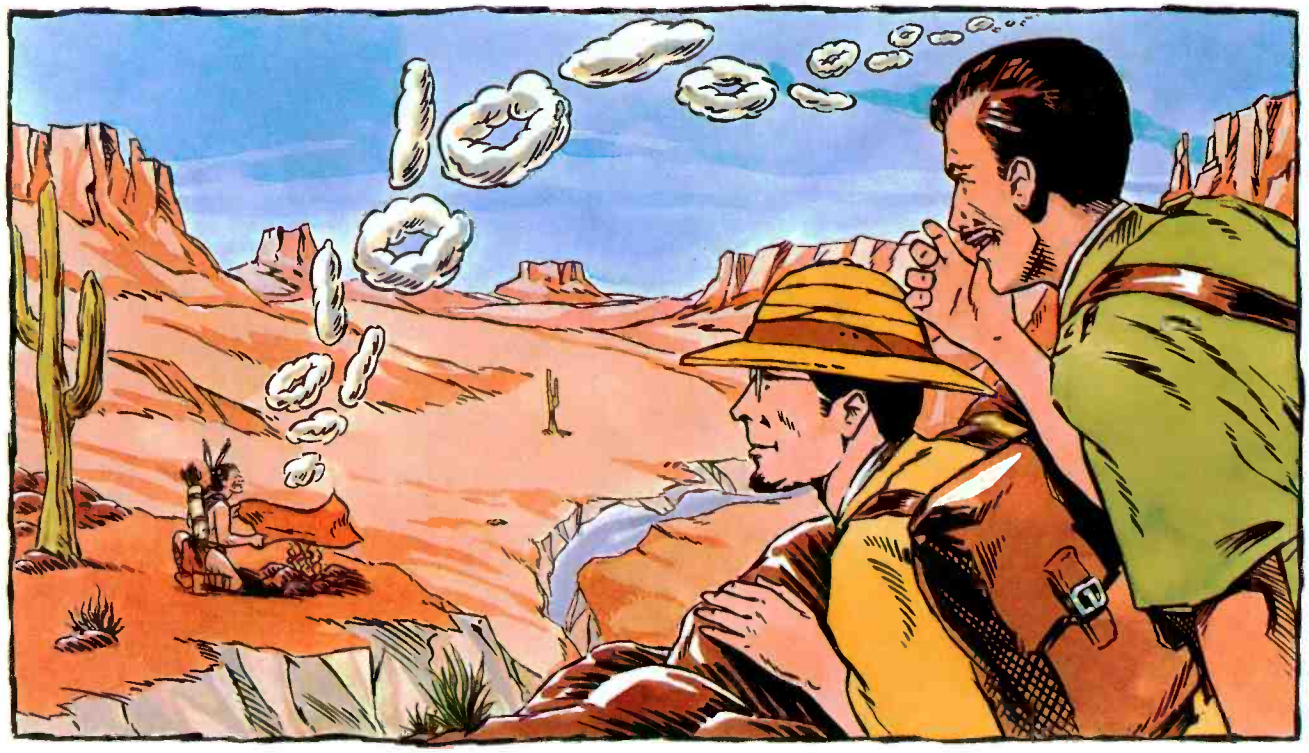
lated in the first step are transformed.

In text books, the planar transform is frequently called a *2D transform*. The transform is — in principle — possible for any segment forms and not just for square ones. For a segment of the size NxN, we consequently use $2N$ transforms. The coefficients are now no longer arranged as vectors, but as a matrix. The coefficients of the i lines and the j columns are called C_{ij} ($i, j = 1 \ldots N$). Each of these coefficients no longer represents a basic vector, but a *basic picture*. In this way, each NxN picture segment is composed of NxN different basic pictures, in which each coefficient gives the weighting of a particular basic picture. Figure 3 shows the basic pictures of the coefficients C_{11} and C_{23} for a planar 4x4 DCT. As we can see, C_{11} represents the DC part. We, therefore, call it the *DC coefficient*; the others are appropriately called the *AC coefficients*.

The planar transform of interlaced video is somewhat problematic. In moving regions of the picture, depending on the speed of motion, the similarities of vertically neighboring pixels of a frame are lost, because changes have occurred between the sampling of the two different picture halves. For this reason, the performance of the system (or *output concentration*) can be greatly weakened compared to progressively scanned pictures. Well-tuned algorithms, therefore, try to detect stronger movements and switch to a transform in one picture half (i.e., field) for these picture regions. But the coding in one picture half is less efficient due to the correlation of vertically neighboring pixels being weaker than in the full picture of a static scene. Simply stated, if the picture sequences are interlaced, the picture quality can be influenced by the motion content of the scene to be coded.

Interframe transform coding

With common algorithms, compression factors of approximately eight can be achieved, while maintaining good picture quality. Achieving higher factors requires exploiting similarities between successive frames. The nearest approach to this is the extension of



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

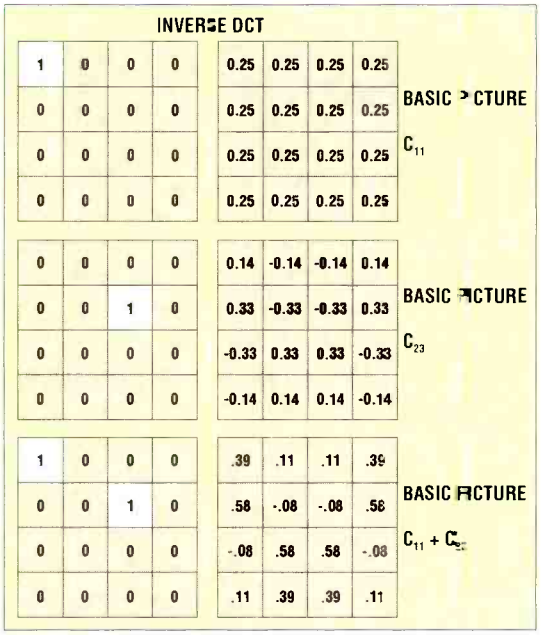


Figure 3. The pictures for a planar 4x4 DCT. Element C_{11} is located at row 1, column 1; element C_{23} is located at row 2, column 3. Note that picture C_{11} values are constant, referred to as *DC coefficients*. The changing values shown in picture C_{23} are known as *AC coefficients*.

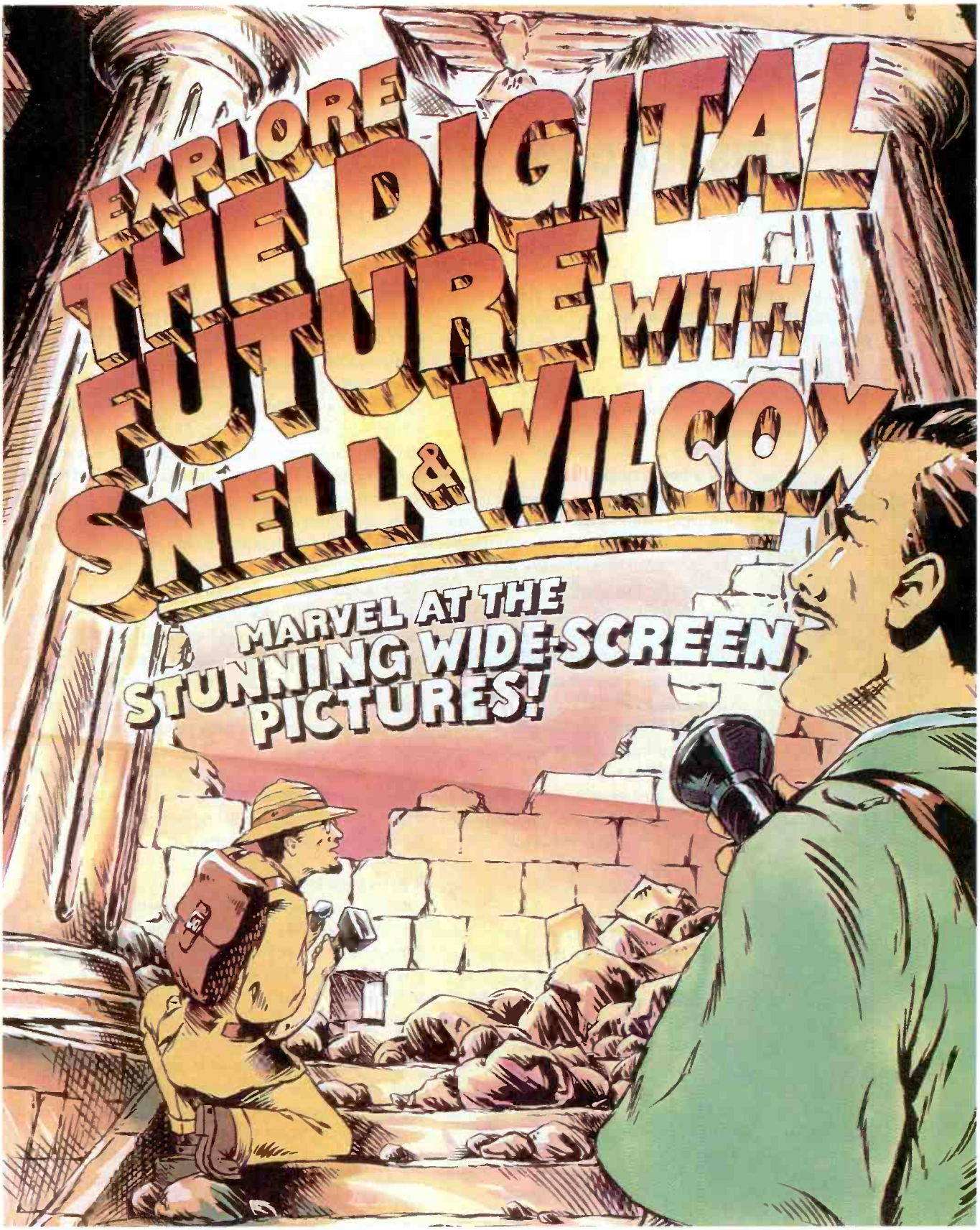
the DCT in the time dimension. One disadvantage of such *cubic* transforms is the increase in calculation effort. For video, the biggest disadvantage is the increased memory requirement: for an 8x8x8 DCT, at least seven frame memories are needed. Much simpler is the *hybrid DCT*, which also efficiently codes pictures with moving objects. This method comprises — almost exclusively — a motion-compensated *difference-pulse-code modulation* (DPCM) technique; instead of transferring each picture individually, the motion-compensated difference of two successive frames is coded.

DPCM is, in essence, predictive coding of sample differences. DPCM can be applied for *interframe coding*, which exploits the temporal redundancy of the input image and *intraframe coding*, which exploits the spatial redundancy of the image. In the intraframe mode, the difference is calculated using the values of two neighboring pixels of the same frame. In the interframe mode, the difference is calculated using the value of the same pixel on two consecutive frames. In either mode of operation, the value of the target pixel is predicted using the reconstructed values of the previously coded neighboring pixels, and this value is then subtracted from the original value to form the differential image value.

Having laid a basic foundation for compression technologies, next month we will examine MPEG-1 in detail. ■

Jerry Whitaker is a consulting editor for Broadcast Engineering *magazine.*

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



SNELL & WILCOX

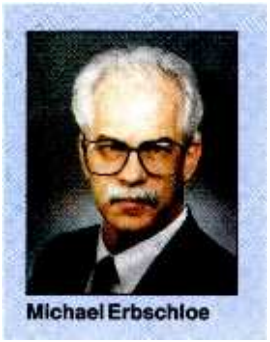
Engineering with Vision

Circle (6) on Free Info Card

By Michael Erbschloe

Tips for effective communication

Do you get frustrated about how well your staff is doing their job? Do you wonder why you aren't getting better performance from them and why they aren't meeting your expectations? Frustrations like these can make supervising even more difficult. Before you pack it up and move to the mountains, there is one thing that may help you improve your staff's performance.


Michael Erbschloe

It's a two-way street

Communication. It's more than telling your staff what to do. It's an ongoing two-way process between you and your staff. Following are a few tips that can help you effectively communicate your expectations, reduce your frustration, ease tensions and improve your staff's performance.

Make sure that what you're communicating, whether in speaking or writing, is being understood. It's essential that you have a feedback mechanism to verify that what you've said is understood.

The goal is to establish an ongoing dialogue about your expectations and your staff's understanding of your expectations. Be patient and persistent when communicating. Many obstacles can block communication, but recognizing what they are can help you neutralize them.

Recognize and deal with cultural differences in the use of language. You don't need to change the way people think or speak, but you do need to make sure that it's not getting in the way of communication. Cultural differences aren't an excuse for poor performance, they're merely potential blocks to effective communication.

The communication loop

1. Think about what you want to say. Does it make sense? Is it thoroughly stated?
2. Initiate the communication.
3. Have your staff explain to you what they feel is expected of them.
4. If there is any misunderstanding, clarify your points and have your staff explain to you what they feel is expected from them.
5. Follow up by checking back with your staff to see how things are going and if they need clarification or support to accomplish a task or goal.

Personal crisis crunch

If a staff member is experiencing personal difficulties, such as a divorce or a death in the family, his or her job performance may suffer. This is natural. Individual reactions to personal problems will vary, however.

During a personal crisis, some staff members may actually be more productive. They may be looking for an escape from pain, anger or frustration and may find it in their work. The important thing you need to watch for is burnout or depression that may hit days, weeks or even months after an incident.

Other staff members may have a moderate dip in their performance during a personal crisis and may just need some support and empathy.

Be careful when dealing with the employee that is having a severe reaction to a personal crisis. What may seem to be a desire for support can turn into a crisis for you as the supervisor. Don't get involved in drawn-out conversations about your staff's problems, 20 minutes is about the longest you can be effective in this situation.

If the depression and lack of performance goes on for several days, recommend that the employee take a few days of leave. It the situation persists, then refer him or her to professional counseling.

A pat on the back

People need positive reinforcement. Tell your staff they're doing well and when possible, do so publicly. Be consistent and give feedback often. Just because you're giving positive feedback doesn't mean that you cannot tell people what you don't want or what they need to do over or change.

If you're reviewing an employee's performance, give positive feedback for those tasks that have been done well. However, when an employee hasn't done a satisfactory job, be straightforward. If you have a solution that you want your employee to implement or if you know what you want him or her to change, just say so.

On the other hand, if don't have a solution, admit it and say that you need to think about it. Ask the employee to think of other possible options. By working together, the two of you may be able to solve a problem and do so without hurt feelings or conflict. ■

Michael Erbschloe is a management consultant, author and technical editor and teaches management courses at Oklahoma State University.

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The new Tektronix 764's Session Statistics Display records key digital audio parameters, while the WFM601i provides extended error checking, eye pattern testing, and a traditional analog display for serial digital video.

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TESTING THE CHANGING WORLD OF COMMUNICATIONS

Tektronix

By Brad Gilmer

Networks within networks

This month, I want to talk about one of our newest networks, Cartoon Brazil. This facility is all-digital and uses automation and file server technology.

When we built a previous network, Cartoon Latin America, we selected Louth Automation and Tektronix Profile video servers. With Cartoon Brazil, we expanded our knowledge of vendors and technology by selecting Pro-Bel automation and Hewlett-Packard video servers (BVS). We may be nuts to mix vendors, however, we hope to gain valuable experience working with multiple vendors in an environment where the systems have to talk together anyway.


Brad Gilmer

The three networks behind the Network

There are three computer networks involved at Cartoon Brazil. The first is a Thinnet Ethernet network used exclusively for communications in the Pro-Bel automation system. The second is a 10-BaseT/FDDI unshielded twisted pair/fiber network used for our business systems. These business systems are used for log generation, E-mail and Internet access. The third is an FDDI fiber-optic network used to exchange files between the two H-P servers. (The FDDI network will be changed to Fibre Channel sometime this spring.)

The Pro-Bel Thinnet network is the primary means of communications between different parts of the automation system. It uses a Windows NT 4.0 server and a client-server database application to support the collection and display of information about our commercial inventory. The network allows communications between all elements of the Pro-Bel system using Ethernet IEEE 802.3 protocol.

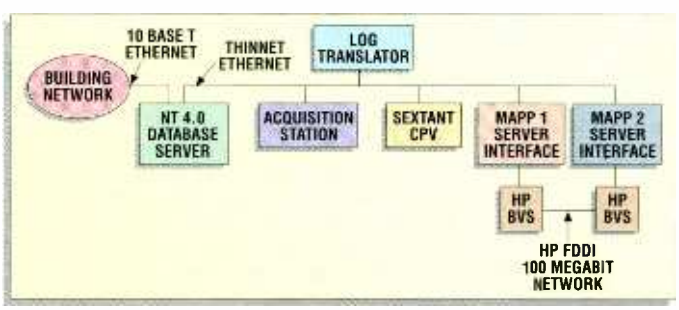
We chose Thinnet (RG-58) cabling to make it more difficult for someone to inadvertently connect a cable from our house network to the automation network. It's important that the automation network be constructed in functional segments that are isolated from the house network. This prevents having to explain to the boss how someone downloading a huge file from the Internet could keep a spot from playing on the air. We chose the Ethernet protocol because it works well in the PC environment. It's widely accepted and fits well with the other protocols in use at our facility.

The second network is our business systems network. It's comprised of 10Base-T twisted pair and FDDI backbone. This network carries our regular business traffic, including log systems, E-mail and other services, all communicating with desktop computers over this network. The network is connected to the Pro-Bel automation network through a separate Ethernet card in the Windows NT server. This is how the automation system gets logs from and returns "as run" logs to the traffic system.

As Kevin Binette, one of our network gurus explained, our building network is designed so that concentrators communicate between desktops within a work area using 10Mb twisted pair. When the traffic travels from one work area to another, we use 100Mb FDDI fiber-optic lines. This allows us to control costs to the desktop, while using high-speed communications between work groups to handle the load. The protocol on the desktop is Ethernet and the protocol on the fiber is FDDI. There are network switches in our system that perform the translation between the two protocols automatically. The protocols are designed so that the translation from one to another isn't difficult.

One thing is for sure — when it comes to networks and broadcasting, always leave yourself an out. If something can go wrong, it will, so sneakernet is worth considering. It's always connected, it's reasonably fast and the price is right. If the building network goes down, you can always get someone to make a log on diskette in the traffic system and carry it over to the automation system. Segment isolation is another tool you can use when things go wrong. If your network is designed properly, you should be able to isolate parts of the network so that a network problem in one area doesn't take down the whole operation.

The third network is an FDDI 100Mb dedicated link



The Pro-Bel Thinnet Network.

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between our two H-P BVS units. We run two BVS units in parallel — one as a main, the other as backup. We dub spots into the main and then they are copied to the backup over the FDDI connection. Our BVS servers are due to be changed out for the new Media Stream servers sometime early this year. The new servers will support Fibre Channel networking with data rates approaching 1Gb/s. This speed, combined with video compression technology, will allow groups of servers to be connected using a Fibre Channel network. Our hope is to interconnect H-P, Tektronix and other products using what I believe will become our video network of the future — Fibre Channel. If you're not up to speed on Fibre Channel, take a look at the Fibre Channel Association web page at http://amdahl.com/ext/CARP/FCA/FCA.html.

Let's talk terms

Before we get too far into the world of computers and networks, it would be a good time to talk terms — and I'm not talking automobile financing.

Every industry has its own buzz words. (I can remember when someone asked me to go clean an ACR-25, and I had no idea what it was.) As the computer and broadcast worlds come together, the chance for miscommunications is high. Sometimes, you can run into problems with terms you would not expect to cause trouble. An example is automation. If you say automation to a group of broadcasters, most would probably say it refers to the station automation that puts spots on the air. If you asked someone involved in the computer world, they might think you are referring to computer programs that make it easier to work in an office. I have found that it pays to ask questions any time you hear a new word or acronym you don't recognize. ■

Cartoon Network Brazil is exploring the limits of computers and networking technology. This operation employs traditional 10BaseT networks and FDDI fiber, moving video packets according to commands sent over the slower network. Photo by Mark Hill, TBS, Inc.

Brad Gilmer is director of advanced network operations & technology for Turner Entertainment Networks.

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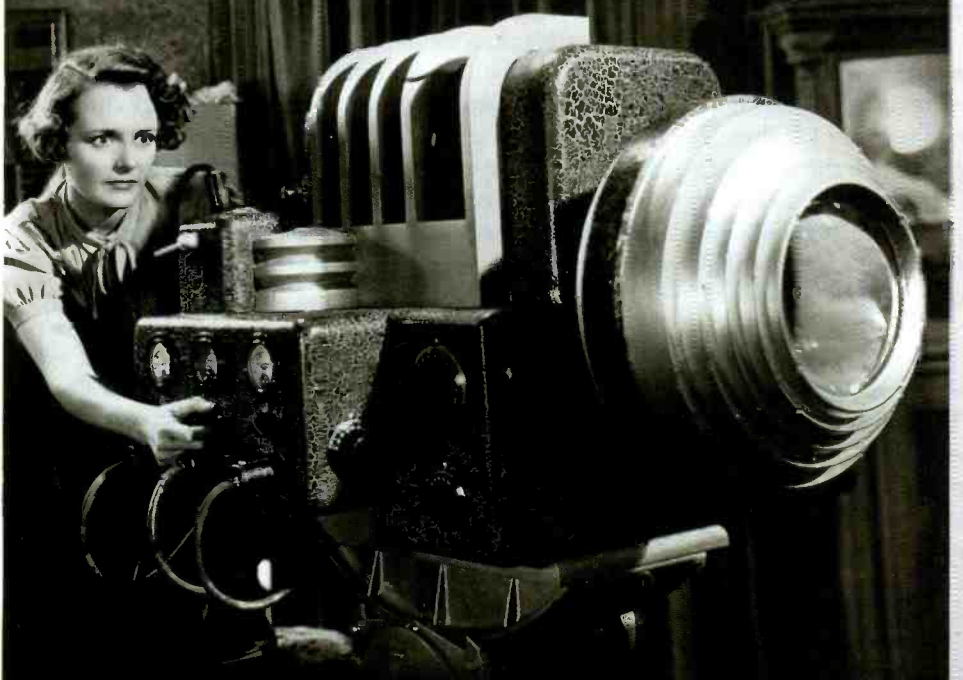

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Circle (14) on Free Info Card

By Bennett Liles

Portable power

Power generators come in an endless assortment of types, sizes and capacities, but those designed for remote broadcasts have certain distinguishing characteristics. First, they are generally insulated for acoustical noise reduction. In some cases, these generators are enclosed and insulated with heavy foil and foam, but the best noise reduction is provided by a thick layer of felt. Such insulation can double or even triple the cost of a portable generator, but exposed-engine generators are generally not welcome at remotes.

The capacity of this portable, diesel-powered generator is 166A, three-phase (500A total, single-phase). Its housing is felt-lined for quiet operation.

Second, broadcast generators are crystal-controlled for frequency and voltage. Power frequency is a function of engine speed (most generator engines run at 1,800rpm), which is maintained by sensing a spot on the flywheel, comparing it to the crystal oscillator and throttling the engine in minute increments to govern the rotation. This is particularly vital with HMI lighting for film and TV work. It requires the power frequency to be maintained within two-tenths of a cycle.

The third key parameter for broadcast generators is reliability. The better units have oversized fuel-filter/water separators, which are helpful in cases of extended, continuous use. Transparent sumps allow water and other heavier-than-fuel contaminants to sink to the bottom of the sump, where they can be detected and drained off before causing rough running or a shutdown.

Rules of the road

Another significant characteristic of most broadcast generators is the diesel engine. Diesels run slower and are generally quieter and more stable than gasoline engines. Diesel fuel is more prone to water contamination through condensation inside the tank, however, so generator operators tend to keep their tanks topped off, thereby limiting the amount of space for air in the tank. In either case, it's recommended to run the engine at least once per week.

Built-in metering on most generators will at least indicate volts, amps and frequency, although these are more accurately measured with a hand-held multimeter. The most fragile part of a mobile power unit is the gauges. After miles of bumps and vibration, these indicators typically become less accurate and eventually fail completely.

Camlock connectors are standard fare on all broadcast portable power units. It's a good idea to have camlock turnaround adapters with you at the remote site because some generators will have the neutral connector reversed.

When contracting for a generator, specify cable amount and type because the units don't always include power cable. The National Electrical Code now requires replacement of older welding cable. Its neoprene insulation is subject to cracking and damage by diesel fuel and ultraviolet light. Today's *entertainment cable* has a double layer of Hypalon insulation and is tougher and more flexible than welding cable.

All remote equipment should be grounded to one point. Multiple grounding usually means ground loops and hum. When arranging for power, always know the capacity and phase needed by the job. A 200A three-phase unit will provide 600A at 120V (split phase). Some companies will advertise their units' capacity in amps-per-phase, while others state total output current at 120V.

Don't learn the hard way

Although often violated, local codes usually require a licensed electrician to be present when a generator is used. An extinguisher for all types of fire is also essential.

Working with a reliable and experienced generator operator allows the broadcaster to worry about one less thing at the remote site. ■

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

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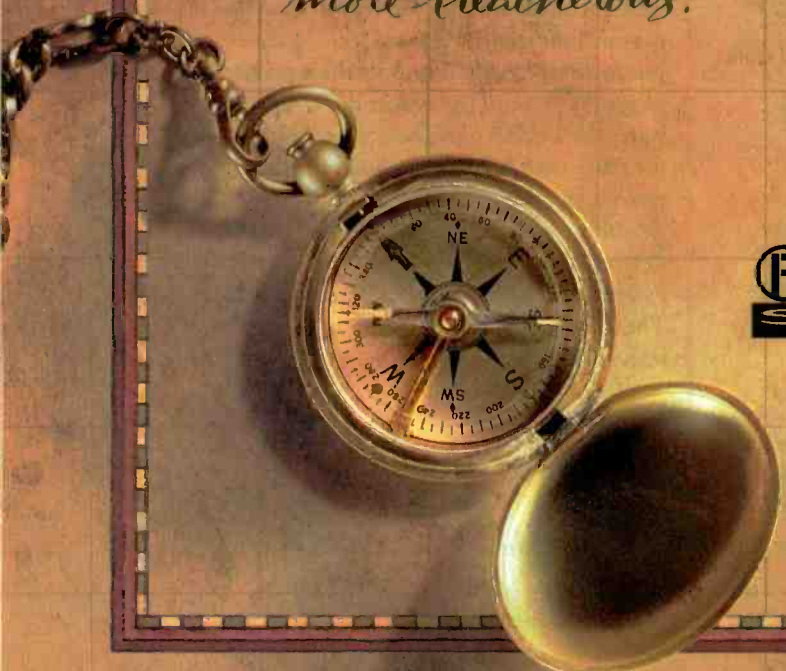
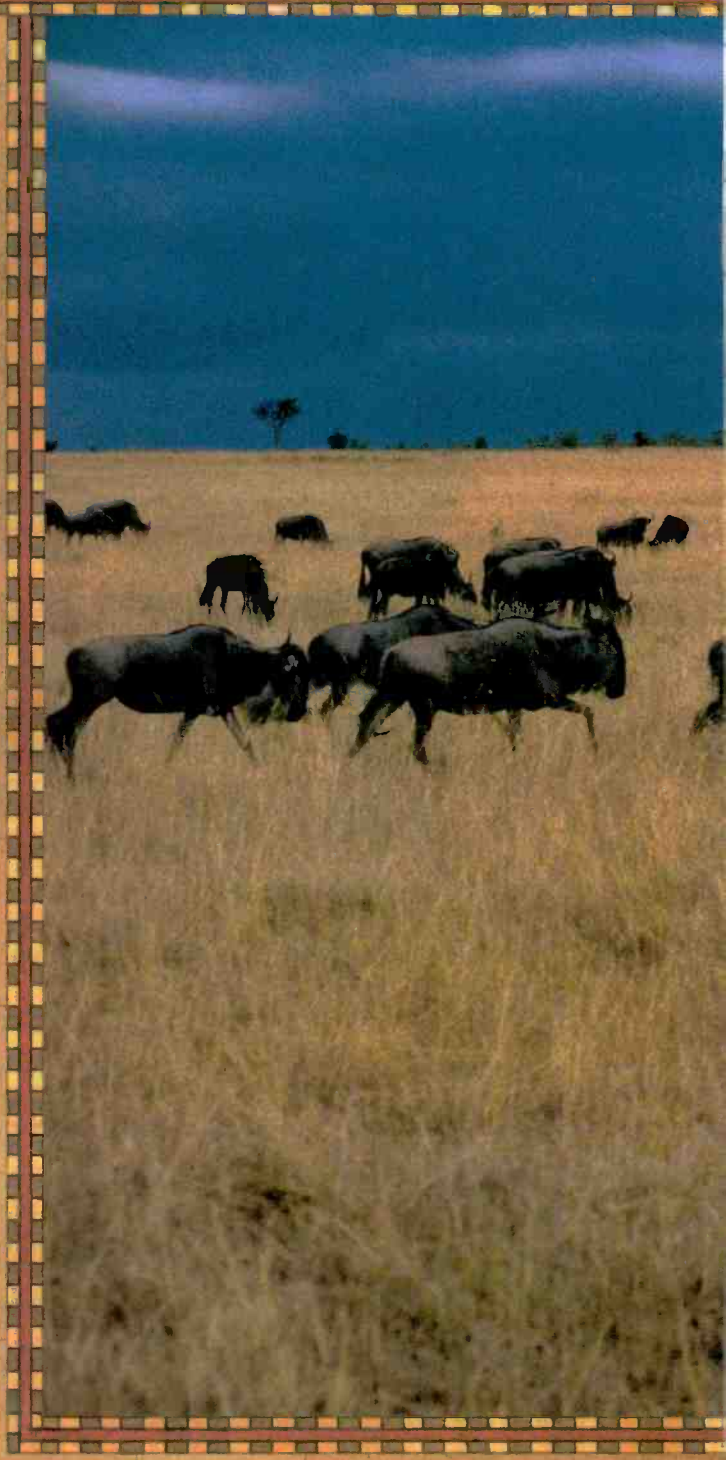
Braving extreme conditions and ravenous packs of wild hyenas, the African Wildebeest endures the second most difficult migration known to man. The broadcaster's journey to digital being slightly more treacherous.





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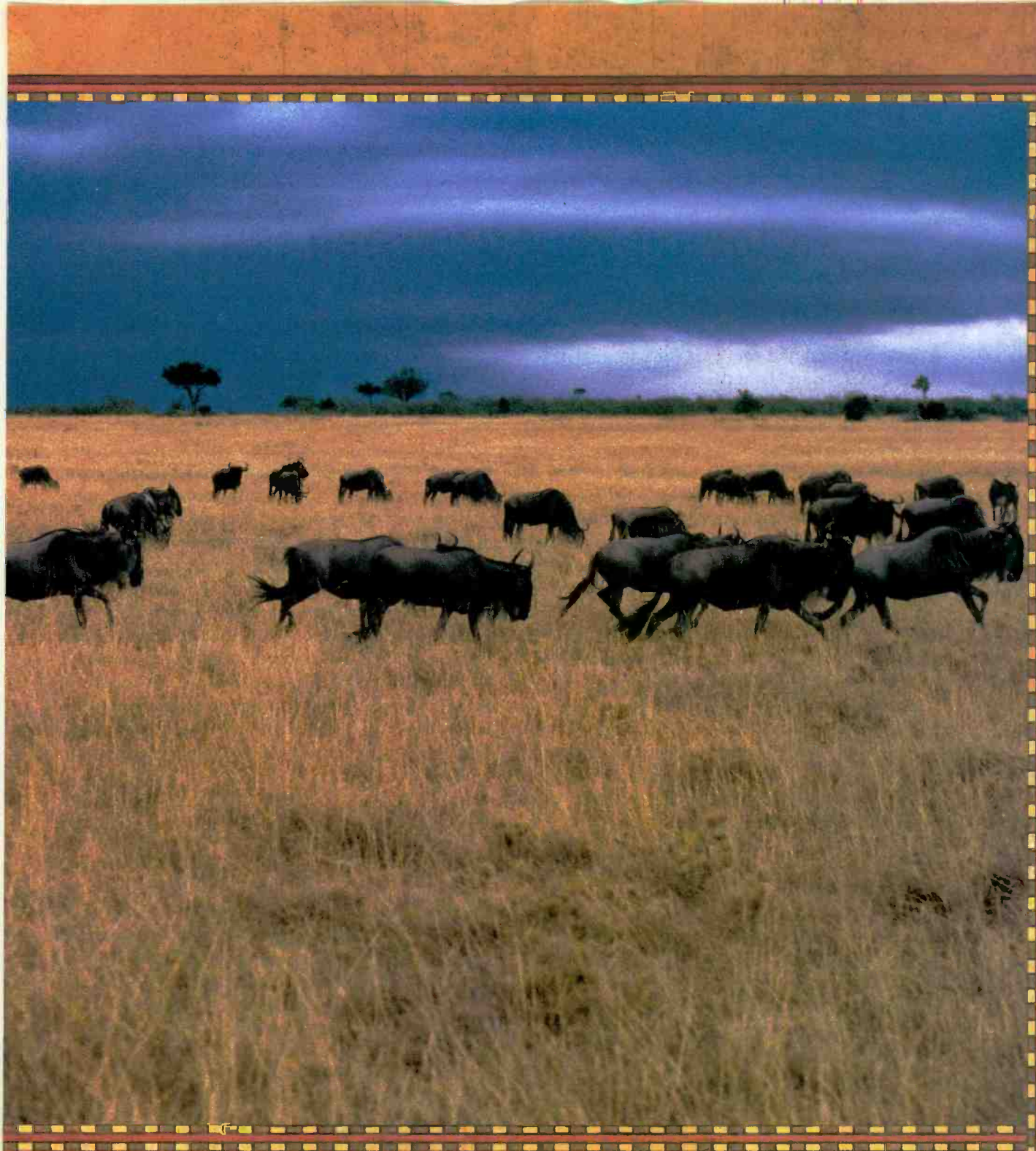

been looking for. The FlexSys system combines high quality MPEG-2 4:2:2 P @ ML compression and RAID disk storage with Sony's leading VTR and Flexicart® technology. And the familiar user interface ensures your transition will be as painless as possible. To find out what FlexSys system configuration is best for your transmission needs, just call 1-800-635-SONY, ext. FLEXSYS. We'll put you on the one path to digital transmission that leads to success.

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SONY

By Steven Blumenfeld and Mark Dillon

Spinning your own web (site)

It's the new year and your boss stops by your desk to make sure you will be at the staff meeting. He says he has had a brainstorm over the holiday. So you show up and take your place as he starts on his new idea. He says that over his vacation, he spent some time watching television and everywhere he turned all he saw was "www.www.www.www." So he exclaims it's time to move onto the Internet. As a matter of fact, he has put together a whole marketing and advertising plan that incorporates your new URL, and it will start in 30 days.

Mark Dillon and Steven M. Blumenfeld

Your face begins to turn red as he explains his grand plan and you remember the proposal you submitted last year. Remember the one where you asked for a budget for servers, a T-1 connection and additional support personnel? His answer had been a resounding no; why would anyone need to be on the Internet?

So now it's your responsibility to get your company on-line. You dig out the proposal from last year and reread it. The information in it still seems to be valid, but you decide to check on the assumptions you made on the costs and procedures for going on-line. It has been a year (at least four web years), and things change so rapidly that there might be a more cost-effective solution than the one you came up with a year ago. Remember, last year you proposed adding staff to manage your site — a network administrator and a web artist/HTML editor. You were going to retain the title of web master and add it to your many responsibilities — also to your resume.

> For a fee, your ISP will allow you to store your data and/or even create a whole site for you.

Let's start by looking at the cost associated with servers and connections. The proposal talks about three to four Unix-based servers, each costing about $20,000 and an $1,800-per-month T-1 line. That's more than $100,000. Today, you actually have a number of options. First, you can buy the Unix servers and all the software you need to get it running, as well as making sure you have a competent administrator to run the system, or you can go with a Windows NT system. The hardware is less expensive and the software is somewhat easier to use, but it still requires a competent administrator.

Other options include a Mac-based system. I'm told not only is this alternative less expensive, it's also easier to maintain and is intrinsically secure. While these options give you a good start, they also require a lot of work on your part to get this whole thing going.

With 30 days to get it up and running, there is another option now available — you can purchase "hosting" services from your Internet Service Provider (ISP). For a fee, your ISP will allow you to store your data and/or even create a whole site for you. This is a good alternative to hiring and maintaining your own site. As a matter of fact, I recommend this as a way to get started on the cheap. If you later decide to purchase the equipment, you will have already learned a lot and your purchases can be more informed.

What to look for

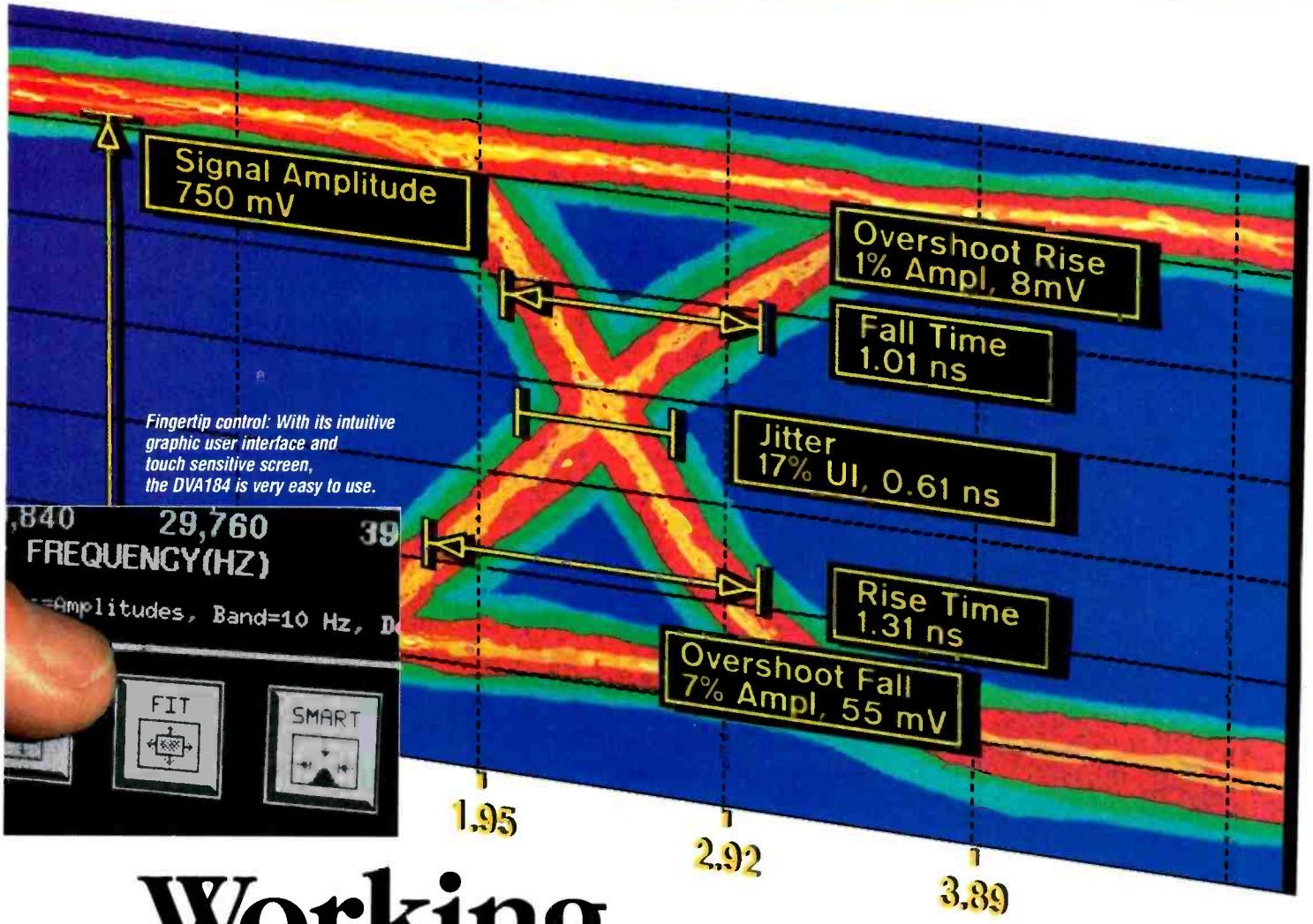
The hosting service does not have to be in your local vicinity, although a local group might offer you a more personalized service. It's more important to look for a group that knows about your business.

Recently, when GTE redesigned its corporate web site (www.gte.com), the company turned to a small group of Internet web/multimedia/interactive experts — that happens to be our group. We won out over other outside groups because of our knowledge of the GTE business environment and its specific needs. Another example is when Carnegie Hall (www.carnegiehall.org) chose Avalanche Productions because of the group's knowledge of the web and music.

Find a web "hosting and creative service" that you feel comfortable with. Show them your advertising and marketing plans and have them come up with storyboards and prototype pages. Get every content owner in your company involved because the Internet is a living and breathing entity. Remember, if you put up a site, then let it sit idle, it can get stale and may do more harm than good. ■

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

Stay tuned next month for. . .
helpful information on the care and feeding of your web site.



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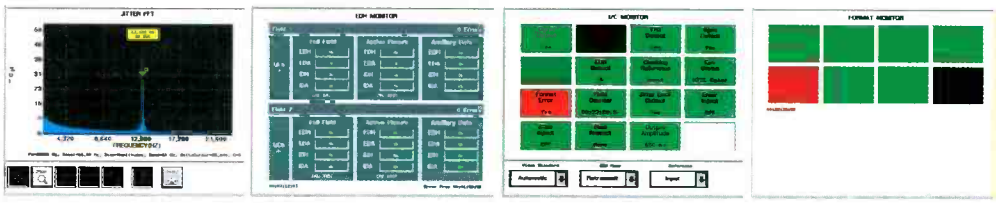

Jitter has frequency components which spectrum analysis can identify. Monitor displays give you complete link status.

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Patent Pending

Circle (16) on Free Info Card

By Louis Libin

Stop throwing stones, we all live in glass houses

A group of broadcasters, including ALTV, Sinclair and Viacom, are disgruntled by the specific station assignments from the Broadcasters Caucus plan and the FCC's assignment choice for their station. These broadcasters believe that "certain second-channel assignments, particularly those assigned to today's UHF stations, will be seriously disadvantaged in tomorrow's DTV world by their new assignments." They are not *too* concerned with the concept and the implementation of the "replication principle;" they are concerned with the disparities in powers between certain stations. Further, they believe that "in some cases, the disadvantages are so great that an argument can be made as to the future economic viability of the affected stations."


Louis Libin

Assignment basics

In each area of the country, the new DTV channels will be found among those TV channels that are not used for NTSC broadcasting in that area. The broadcast channels for NTSC were allotted to cities across the country by a complex set of rules based on providing for minimum separation distances between the use of certain pairs of channels. For instance, a UHF transmitter at maximum antenna height and power should not be located within 248.6km of another transmitter on that same channel. The intent was to minimize the potential for the broadcasts of a distant station to interfere with the reception of a local station. Possible channels for DTV in each area were found among the NTSC allotments that were never constructed and among the channels whose use for NTSC would cause objectionable interference to existing NTSC stations.

Generally, the FCC will allocate only UHF channels for DTV. Nationwide, this will not be entirely possible, but most of the new DTV assignments will be in the UHF band, except for in high-population urban areas where there is a scarcity of available UHF channels for DTV. The DTV system has been designed to minimize interference into NTSC broadcasts, and in turn, to be relatively immune to interference from other stations. However, the geographic distribution of NTSC channels across the country and the potential for interference between stations make it difficult to devise a nationwide set of DTV channel assignments that avoids all inequities among the channels assigned. The channel assignments have been carefully crafted for the major markets and for the nation as a whole.

The process today

A study of the 10-year process tells us that there is not, and never was, a conspiracy between any of the allotment/assignment program designers to skew the process and provide "better" assignments for certain stations. Enough safeguards were built into the system of channel allotment and assignment to preclude this. Additionally, the FCC has been developing its own assignment software, in parallel with the Broadcasters Caucus effort, and each development plan has been using the other plan's integrity and results.

The goal of the FCC and the Broadcasters Caucus allotment/assignment software is to replicate today's station coverage, by providing a second channel assignment that has a service area with the equivalent of today's Grade B service contour. Neither of the programs attempts to *correct disparities* between service areas. If, for whatever reason, a station has a Grade B service area that only covers a diameter of 15 miles, both the FCC program, as well as the Broadcasters Caucus program replicate today's actual contour. The broadcasters, as well as the FCC, have bought into the principle of "maximization." This means that a DTV contour is in parity with other stations in the market so long as the expanded, maximized station does not interfere with other stations in the market.

In addition, the FCC program, as well as the Broadcasters Caucus program, does not measure and assign stations based on relative power ratios of one station in the market vs. another station in the same market. Even in the NTSC-only world of today, UHF stations in the same market can have *service* areas of different *surface* areas.

The allotment table

An allotment table was formed by considering each city or area in turn across the country. A list of channels that are candidates for DTV assignment is prepared for each area. Channels that are used in this market or nearby cities are eliminated because their use for DTV would cause unacceptable interference to the reception

Continued on page 118

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First Compressions Count

SNELL & WILCOX

Engineering with Vision

By Ken Freed

QAM delivery

As broadcasters prepare to comply with the new digital TV standard promulgated by the Federal Communications Commission, the cable industry has other plans that may not be fully compatible. At the Western Cable Show in December, the cable industry announced plans to go with quadrature amplitude modulation (QAM), rather than adopt the Advanced Television Systems Committee (ATSC) plan for using digital vestigial sideband (DVSB). This may have long-range implications for broadcasters.


Ken Freed

QAM

QAM is a scheme for delivering digital signals in an RF channel by modulating the carrier wave with amplitude modulation and phase-shift keying for increased carriage capacity. Whether transmitted through a cable amplifier or a terrestrial antenna, the standard 64 QAM handles 27Mb/s with eight levels in quadrature (8 x 8 = 3D64), while 256 QAM operates at 40Mb/s in a 6MHz cable channel. The International Telecommunications Union (ITU) standard ITU-T J. 83 Annex B calls for 64 QAM and 256 QAM, with concatenated trellis coding and variable interleaving for delay-sensitive applications.

In contrast, the standard 8VSB approved for terrestrial HDTV broadcast is slower, around 19Mb/s, yet offers less risk of signal degradation. Vestigial sideband modulation will be implemented by all the major broadcast networks as they go digital. NBC in New York, for instance, will use VSB when it starts digital broadcasts next year from the tower atop the Empire State Building. (One can only hope no big ape comes along to monkey with the antenna.)

Deploying QAM

Deployment of QAM technologies in the cable industry, meanwhile, is moving ahead at an accelerating pace. According to Tom Williams, a senior member of the technical staff at CableLabs in Colorado, "Cable operators are starting to ramp up QAM in earnest. MCNS (Multimedia Cable Network System is a joint project of TCI, Time Warner Cable, Cox and Comcast) supports 64 QAM. In Canada, Rogers is testing 256 QAM with positive results and Shaw is talking about deploying 64 QAM on all their systems.

"Essentially, everybody in the cable industry plans to deploy QAM as quickly as possible for digital set-top boxes and cable modems. Most of the consumer electronics vendors also are adopting QAM for digital delivery."

"We'll deploy QAM in our top 100 cable systems this year," says Tom Elliot, senior vice president for engineering at TCI, "and we already have it in place at our system in Hartford, CT. We're basing our entire strategy on QPSK satellite delivery from HITS [the Head-end In The Sky facility in Colorado on the 105th meridian], with translation into QAM at the local head-end for QAM delivery to homes."

Why not go with DVSB like the broadcasters? "From our perspective," Elliot replies, "nothing has happened around VSB that's particularly persuasive technically. Another very important factor, in our view, is the general ubiquitousness of QAM since it's available in the public domain rather than being a proprietary process like VSB [owned by Zenith]. To the best of my knowledge, everybody in the world is adopting QAM except for the anomaly of ATSC."

Elliot voices disapproval of the recent FCC rule requiring VSB modulation in the digital TV specification, which essentially locks in licensing fees to Zenith. How did this happen? "I think they made a decision a long time ago to go with VSB and got stuck with it. They never found a way to gracefully exit from that commitment, and the result is that digital broadcasting with DVSB modulation will be the only island in the entire world that's not QAM. I think it's important for us to establish a scheme that is totally ubiquitous."

Deployment of QAM technologies in the cable industry is moving ahead at an accelerating pace.

The viewpoint of TCI apparently is shared by most others in the cable industry. Will this division over modulation schemes be yet one more rift widening the schism between cable and broadcast? As with so many of the uncertainties as we move into digital services, only time will tell. ■

Ken Freed is a media trade journalist specializing in cable and interactive television, and is based in Denver.

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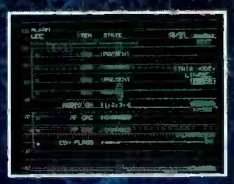

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Video servers

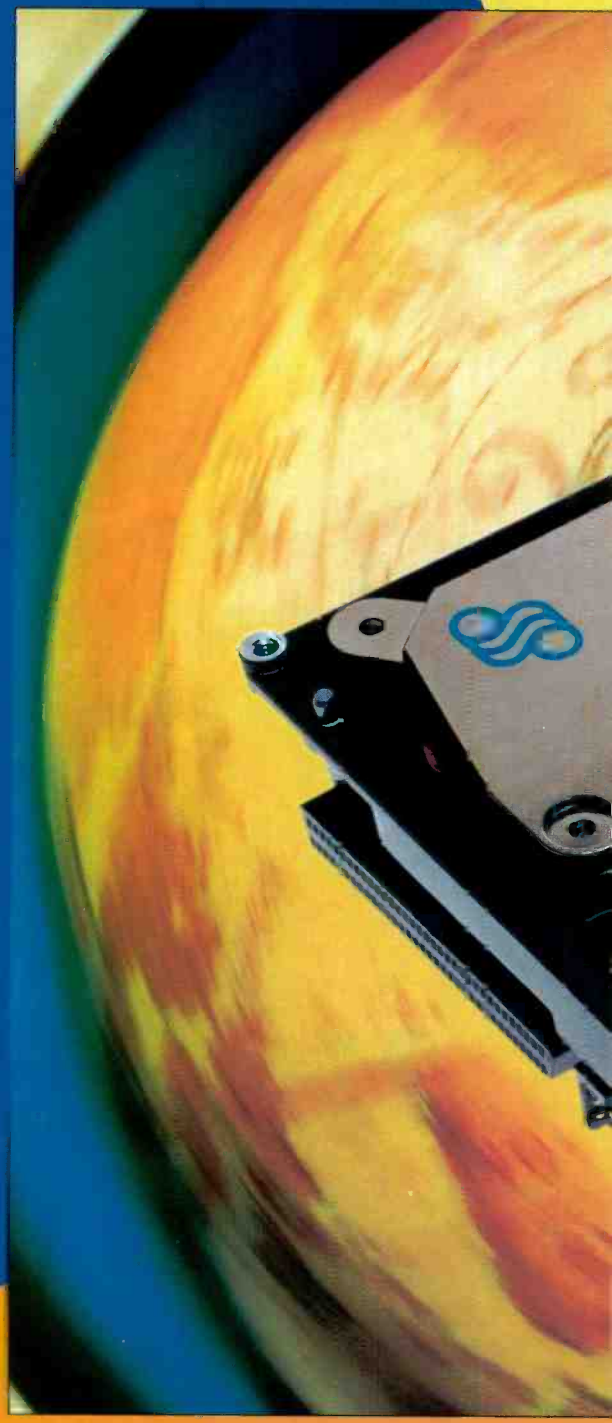
If you think the topic of servers was hot last year at NAB, just wait a few weeks. Early discussions with many of the companies reveal that the technology is developing fast, with new features and performance improvements taking place almost daily.

For a peek at what's available, *Broadcast Engineering* magazine issued a request for information on server products to major manufacturers of the technology. This comprehensive article was developed based on these responses. The article will provide detailed information on not only specific server products, but in many cases, the design and application philosophy practiced by the manufacturer. There is no single way to integrate servers within video facilities. Therefore, knowing how a server manufacturer views networking, file storage formats, media management and compression are integral in helping you make the right decision on a server for your facility. Looking behind the mere "specs" will go a long way toward better understanding how a particular company's product might integrate with your current and future plans.

So read on. The answers to your questions on video servers for broadcast, production and pay-per-view applications may be just a page turn away.

Brad Dick

Brad Dick, editor



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IBM Risc System 6000 R00 rack with R10, R20 drawer.

IBM MediaStreamer Solutions

By Teresa Golden

IBM recently introduced a set of tailored broadcast solutions focused on the storage, management and distribution of video. IBM's MediaStreamer Solutions provide broadcast-quality distribution of video and audio streams for television, cable, direct broadcast satellite and business environments. These solutions can be used for on-air play of news, weather and sports information; for video distribution on demand; as a replacement for cartridge management systems and for spot insertion of advertisements and programs.

IBM options

Based on industry standards, the flexible MediaStreamer Solutions provide multi-stream playout of video content to analog or digital networks. Four standard models are available that can be expanded to deliver from one to 42 streams of MPEG-decompressed video over NTSC and PAL interfaces or from one to 75 streams of MPEG-compressed video over ATM-OC3 fiber-optic interfaces. MPEG compression enables the cost-effective use of computer disks for video storage, providing rapid access to video data and high-quality video output. These servers can also be configured for analog and digital delivery. Video data files can be loaded in or staged out of a MediaStreamer without disrupting active streams.

A key design feature of IBM's MediaStreamer is its reliable RISC-based platform, the RS/6000, which allows the system to grow in hours of disk content and number of video streams. More than 1.2 terabytes of content (over 400 hours at 6Mb/s) can be stored. Leveraging its Serial Storage Architecture and RAID-5 hot-pluggable disks, the MediaStreamer is designed to minimize the disruption of real-time delivery or loss of video content in the event of a single disk failure. For broadcasters managing a large library of video assets, the MediaStreamer Archive provides up to six terabytes of automated non-helical tape storage.

System components

At the core of each MediaStreamer is an advanced media file system designed to move audio/video data between a storage pool and one or more input/output ports. The file system is architected into three basic components: a Control Server, a Data Exporter and a File/Storage Manager.

The Control Server is the control "bridge" between external clients/applications and the other components in the MediaStreamer Solutions' architecture. It manages sessions and helps ensure that one client doesn't disturb the activities of another.

The Data Exporter isolates and manages streaming and associated ports. It sets up and provides data to analog decoder ports and ATM virtual circuit ports. The Data Exporter ensures constant rate stream delivery and allows play, record and pipe (ATM to analog decoder) operations simultaneously.

The File/Storage Manager is the component responsible for distributing data throughout the disk pool in a way that allows scalable output streaming without data file replication. The File/Storage Manager supports file sizes greater than 2GB, and allows playout while the file is being loaded. Stored files may have a variety of MPEG attributes and formats, up to 12Mb/s, and may be played individually or as part of a concatenated sequence.

With its highly scalable RS/6000 video server platform and its open solutions design based on existing and emerging industry standards, IBM MediaStreamer Solutions are flexible offerings for broadcast and cross-industry applications. For more information, visit the IBM web site at http://www.rs6000.ibm.com/solutions/videoservers. ■

Teresa Golden is program director, Multimedia Server Offerings IBM RS/6000 Division, Somers, NY.

EMC Corporation Symmetrix Network Media Storage.

EMC Corporation Symmetrix Network Media Storage

By Gil Press

The market for video servers is dominated by suppliers who approach the unique challenges and issues faced by broadcasters and other video professionals from a CPU-centric tradition and who are trying to solve a serious I/O bottleneck by simply adding more CPU power. In contrast, EMC Corporation has developed its network storage-based solution from the ground up for this market, with superior I/O performance as the focal point.

New approach to storage

EMC's Symmetrix Network Media Storage (SNMS) presents an approach

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Looking for a broadcast server to get you on air today — and keep you there? You should give the HP MediaStream broadcast server a shot.

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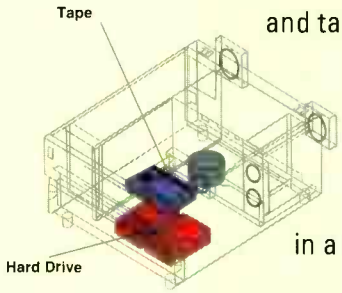

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Convenient drag-and-drop Graphic User Interface (GUI) editing with the DNE-50.

Add the DNE-50 Field Editor to the Hybrid Recorder for easy GUI drag-and-drop editing in a small, light package with features like time line editing with independent control of 4 channels of audio.

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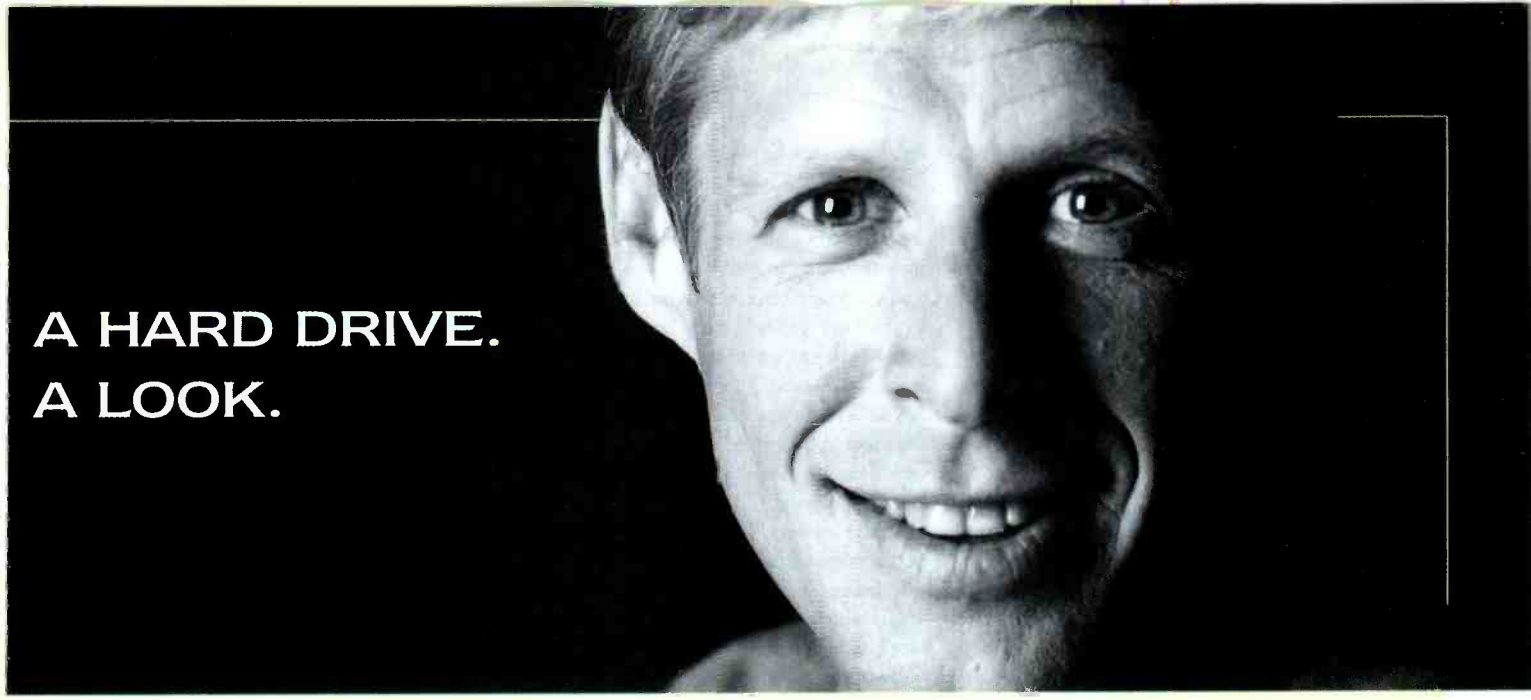

DLE-110 Live Edit Controller
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access to a complete copy of your original footage. While you're in the digital edit, you can mark highlights and output faster than real time. What's more, you can play back while you're still recording.

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SONY

digital DREAM Digital Dream Kids

to multimedia system design that overcomes many of the limitations of conventional servers for general-purpose applications, such as the inability to support sustained, high data transfer rates, poor tolerance for variance in signal quality, inability to ensure variable signal service levels and the ability to handle interactive and continuous data transfer requirements in the same subsystem.

SNMS is an open, highly scalable solution, easily adaptable to a range of video environments and applications. To buyers of video servers in a market characterized by constant change, evolving standards and rapid technological advances, flexibility becomes the paramount consideration. Their requirements include reliable high performance; high capacity; support for the bandwidth and video standards necessary for those services and applications.

The foundation of the SNMS is the Symmetrix Integrated Cached Disk Array. Its capacity scales from 72 to nearly 3,000GB, providing hundreds of hours of storage, and it incorporates significant amounts of cache memory — up to 4GB — for scalable performance. Symmetrix offers multiple levels of availability and reliability features to ensure delivery of video streams. Concurrent RAID levels of 0 and 1, plus EMC's exclusive RAID-S and combinations of these provide the most appropriate and cost-effective level of protection for the user's video application. RAID-S offers all the benefits of the traditional RAID levels 3, 4 and 5, but without their performance penalties.

To bring flexibility and a range of capacity, availability and performance options to network video services, EMC has developed a software/hardware system extension, the Symmetrix Network Storage Director (SNSD), which includes Data Movers and EMC's Data Access in Real Time (DART) operating system.

As an open system, based on industry standards, SNMS can be easily integrated into different environments, serving a variety of applications, such as video asset management, tapeless broadcasting, digital post-production and video-on-the-desktop.

In the emerging market for video servers, EMC's Symmetrix Network Media Storage provides users with a range of options that ensures their ability to adapt quickly to rapidly changing market requirements. The focus of SNMS on high-performance delivery of video and its flexibility provides broadcasters and video professionals with a high return on their investment in a solution that's tailored to their present and future needs. ■

Gil Press is manager, network storage marketing for EMC Corporation, Hopkinton, MA.

Sierra Design Labs' Quickframe.

Sierra Design Labs Quickframe

By Chris Romine

In developing high-quality content, whether for broadcast, film, video or multimedia distribution, it can be crucial to work in an uncompressed digital environment. With compression degrading images in the distribution process, it's often necessary to keep the initial production and post-production video processing in its pristine uncompressed state to maintain the integrity of the material. Developing an economical uncompressed video server for the production and post-production environment is the niche that Sierra Design Labs has been successfully addressing for more than three years.

Quickframe

Sierra's founders introduced Quickframe in 1993 as the building block for its complete video server solution. With up to 120 minutes of CCIR-601 video per storage unit, this digital disk recorder is the foundation of a well-developed server network.

Facilities don't operate solely in a video environment or a computer environment. They operate in both. Sierra Design Labs' server technology is fully integrated with computer interfaces that have direct device driver support from the major application vendors (including Discreet Logic, SoftImage, Parallax, Alias/Wavefront, Adobe, etc.) while simultaneously serving up uncompressed video and audio using industry-standard CCIR-601 video and RS-422 control protocol. What this means is that the server network can be understood by, and bridge, the computer and video worlds. Cross applications are managed transparently. Colorists and editors feel just as comfortable in Sierra's server world as do Flame and other computer graphics and effects professionals.

Networking flexibility

Because there is no single network fabric standard, today's facilities need flexibility in supporting the various fabrics. Ethernet, SCSI and ATM are addressed by Sierra, with Fibre Channel (FC-AL) support being added in mid-1997. For traditional video applications, CCIR-601 video, four channels of AES/EBU audio and RS-422 control are included so video professionals can plug and play with all leading edit controllers, telecines and color correction equipment. VITC is also supported, and Sierra offers the only server to include the presentation of source time code to editing environments.

The server has the ability to handle resolution-independent video images. Film resolution material can be stored on the server. By using Sierra's unique color space converter, these resolution-independent images can be served over the network and viewed on studio-grade video monitors.

Although the industry is not yet tapeless, Sierra Design Labs is prepared to help it make the jump, offering five to 120 minutes

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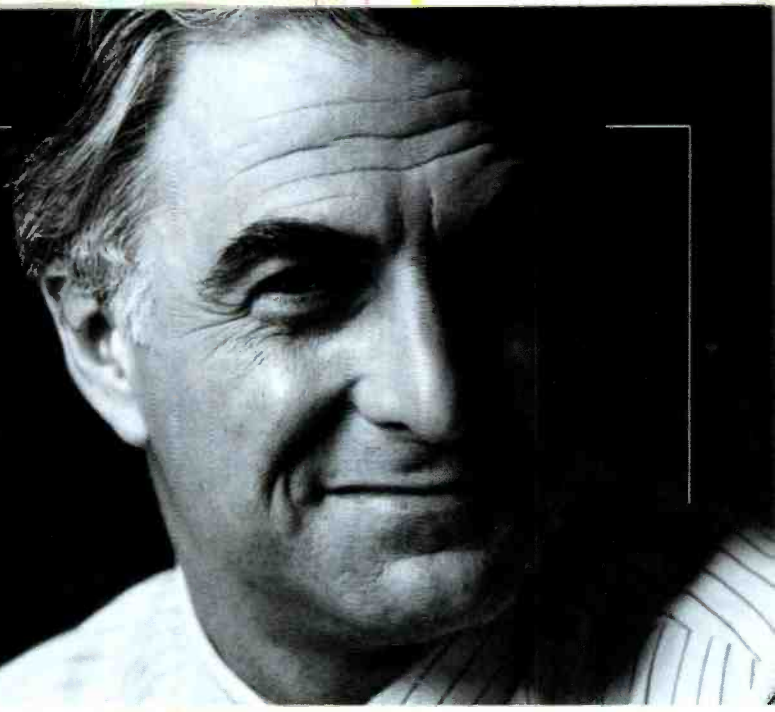

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of uncompressed video per unit. Whether a facility uses disk or tape, digital or analog technology, Sierra's server building blocks accommodate all facility configurations and can be distributed around the facility. Material can be worked on in one suite while simultaneously remaining a part of the server architecture.

As video industry demands increase, real-time can be too slow. Although all of Sierra's equipment can be run at video rates (30f/s), the architecture is designed for internal rates of up to 80MB/s. With real-time uncompressed rates being approximately 22MB. By exceeding the speed requirements, Sierra provides non-linear capabilities including seamlessly concatenating randomly accessed single frames. Depending on the network fabric, transferring material around the facility will be handled through the server at much faster than real-time rates. For example, using Fibre Channel, a one-hour program could be copied in less than 20 minutes.

With the enormous capital expenditure demands on production and post-production facilities, Sierra believes in removing the issue of obsolescence. Users don't have to trade in the old to get the new. The company's server products rely on industry-standard interfaces and are designed with a true open architecture. Customers who have been using Sierra's products for the past three years can use those same products in implementing newly introduced and future interfaces. Because the Sierra line is designed in a modular fashion, everything is field-upgradable for changing user requirements or new industry developments.

Sierra's technology is based on RAID level 0. Few of today's applications require complete fault tolerance with the associated expense of unnecessary redundancy. Because current disk drives are approximately 50 times more reliable than when RAID was first introduced, the majority of requirements for total redundancy have been eliminated. In the future, Sierra plans to add RAID level 3.

Real-world solutions

Built into the design of the server are quality assurances for data security. If a flaw should occur or a disk fail, Sierra's server is designed to recover the material in virtually all circumstances. The technology allows users to play through the bad spot so all the unflawed material is retrieved.

Because equipment is not always kept in a pristine machine room, Sierra's equipment is built to withstand real-world applications. Over the past three years, Sierra's products have been flung from truck to truck in remote locations by networks and broadcasters around the world without breakdown. If service is necessary, the modular design allows for easy maintenance right in the field.

Sierra's production and post-production server is here and now. Prominent broadcasters and facilities in 42 countries have already successfully embraced Sierra's technology. Facilities including R/Greenberg, ILM (Industrial Light & Magic) and Pixar have developed distributed server environments with Sierra as their foundation, and broadcasters are working on applying Sierra's building blocks to distribute signals via satellite to download images in field operations. ■

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

Avid MediaServer.

Avid MediaServer

By Stevan Vigneaux

In all the discussions about server-centered production systems a key point is often lost, what the user wants is an integrated production system and not just a server.

It's a system, not just a server

That distinction is a critical one. A news production system requires more than just a server, it also requires companion workstations for recording, playback, editing, database management, journalist script writing and media archiving.

Most broadcasters describe server-centered production as providing shared simultaneous multi-user access to a digital audio/video library. Multiple recorders concurrently store incoming feeds onto the server's RAID drives. Nonlinear editors simultaneously access that material and edit new material from tape directly onto those arrays. Playback systems have access to the finished stories and the database provides catalog and search capabilities. These market needs are what guided the development of Avid's Digital News Gathering (DNG) system.

Intelligent client workstations

The intelligent self-contained client workstations of Avid's DNG system use the existing NewsCutter, AirPlay MP and Media Recorders; allow individual client upgrades without disrupting the entire system; and provide continued operation in the unlikely event of a server failure.

Each workstation contains audio/video I/O and a compression system. Avid added server connectivity using an internal ATM network card for media data traffic. AvidNet software manages the workstation's end of the network and provides the network interface. The workstation views the server as another read/write logical volume. The client's Avid Media Stream Manager software directs the read/write requests either to local SCSI storage or the ATM network interface.

Networking

Two separate networks connect the workstations to the server: fiber-optic ATM for media transfer and Ethernet for database

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and communications transactions. ATM guarantees 155Mb/s (~20MB/s) bandwidth to each workstation. Avid uses a high-speed, lightweight protocol to guarantee media data delivery with extremely low latency. The Ethernet database network handles media file information (bin) transfers between the workstations and the server. The use of two networks reduces data traffic on the fiber network and ensures that the media datastream will not be disrupted by contention on the network.

The server itself

While the term "server" has been applied to products that are little more than disk recorders sharing common storage, Avid's MediaServer provides shared simultaneous access to media for up to 12 users. The MediaServer stores, organizes, catalogs and retrieves the media data and the composition information, called bins, for real-time playback of edited material.

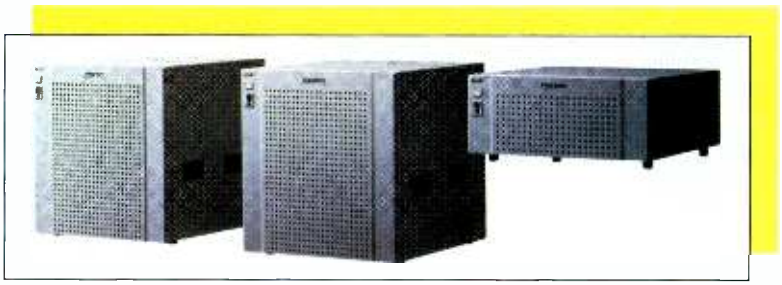
A Silicon Graphics (SGI) UNIX-based server was selected because its architecture allowed scaling up to 12 clients using as many as eight 250MHz CPUs. Furthermore, the multiprocessor design allows segregation of computational tasks to optimize performance. The server receives record/play requests from the production workstations. It maps these requests into the system and the file system calls and delivers the data to and from disk over the ATM network. JPEG-compressed video and up to four channels of 48kHz are delivered to and from each of the clients at real-time rates of 3.5 to 4MB/s through the 155Mb/s ATM network channel.

The database

Avid selected a standard Informix relational database whose architecture supports multiple CPU platforms. The MediaServer database allows users to catalog and retrieve media based on date, time, name, key words and other common classifications. All media recorded to the server is automatically cataloged into the database. All workstations have immediate access to the media as it's being cataloged. The database operates on a separate UNIX or Windows-NT CPU. Because Informix supports standard query language (SQL) interfaces, system managers can create their own applications.

The market requirement for simultaneous access to shared storage defined the architecture for Avid's DNG system — independent workstations networked to a production server. The DNG architecture provides productivity, scalability and flexibility and accommodates future advancements, while working today with existing systems. Avid's DNG system is also designed as part of a Digital News Production process that connects newsroom computing with digital video production. Using Avid's NewsView, NetStation and forthcoming AvidNews newsroom computer systems and Avid's DNG system, editors and journalists can share information on wires, scripts and rundowns, and producers can control show playback electronically. Ultimately, journalists and editors will share access to the same library of digital media, where journalists will be able to view and edit low-resolution video prior to finishing in high-resolution edit bays. ■

Stevan Vigneaux is director of broadcast industry marketing for the Broadcast Group within Avid Technology, Inc. of Tewksbury, MA.



The Sony Videostore.

Sony Electronics BitStream and VideoStore multichannel video file server system

By Jerry Berger

In response to the shift from analog to digital video distribution, Sony has applied its expertise and technology to the MPEG-2 format in the high-performance BitStream MPEG-2 encoding unit and VideoStore multichannel video file server system.

Designed for digital ad insertion use in broadcast and cable markets, as well as a host of other applications, Sony's BitStream and VideoStore multichannel video file server system delivers outstanding video quality, scalable system architecture and reliability.

The BitStream and VideoStore systems combine to form a multichannel video file server system that can provide up to 60 hours of on-line audio or video clips, and can non-linearly feed 12 independent simultaneous output channels at 5Mb/s. The system also allows six independent gen-locked channels at five or 10Mb/s with individual clip durations ranging from four seconds to eight hours and 40 minutes.

VideoStore systems may also be linked to build systems that can output hundreds of channels with thousands of hours of storage. When linked, all systems operate as one unit, giving the user quick random access to data on any channel. The ultimate benefit of HD storage for video is quick random access enabling any clip to be output at any time to any channel, regardless of the amount of storage or the number of channels. Access to any clip is less than one second when scheduled and less than four seconds when unscheduled, such as in a video-on-demand application. The VideoStore system also enables the user to change video program segments at random, as well as make last-minute changes in output order without tape dubbing or recording.

Another feature of the VideoStore system's virtually instant recall is the ability to perform back-to-back playback of programs without black in between by performing full switching operations in the MPEG-2 format. This is a distinct advantage for broadcast television and other multichannel applications.

MPEG-2 encoding

The Sony BitStream MPEG-2 encoding unit (VST-1000) incorporates Sony's MPEG-2 chips (Main Profile at Main Level) to deliver the full-performance capability of

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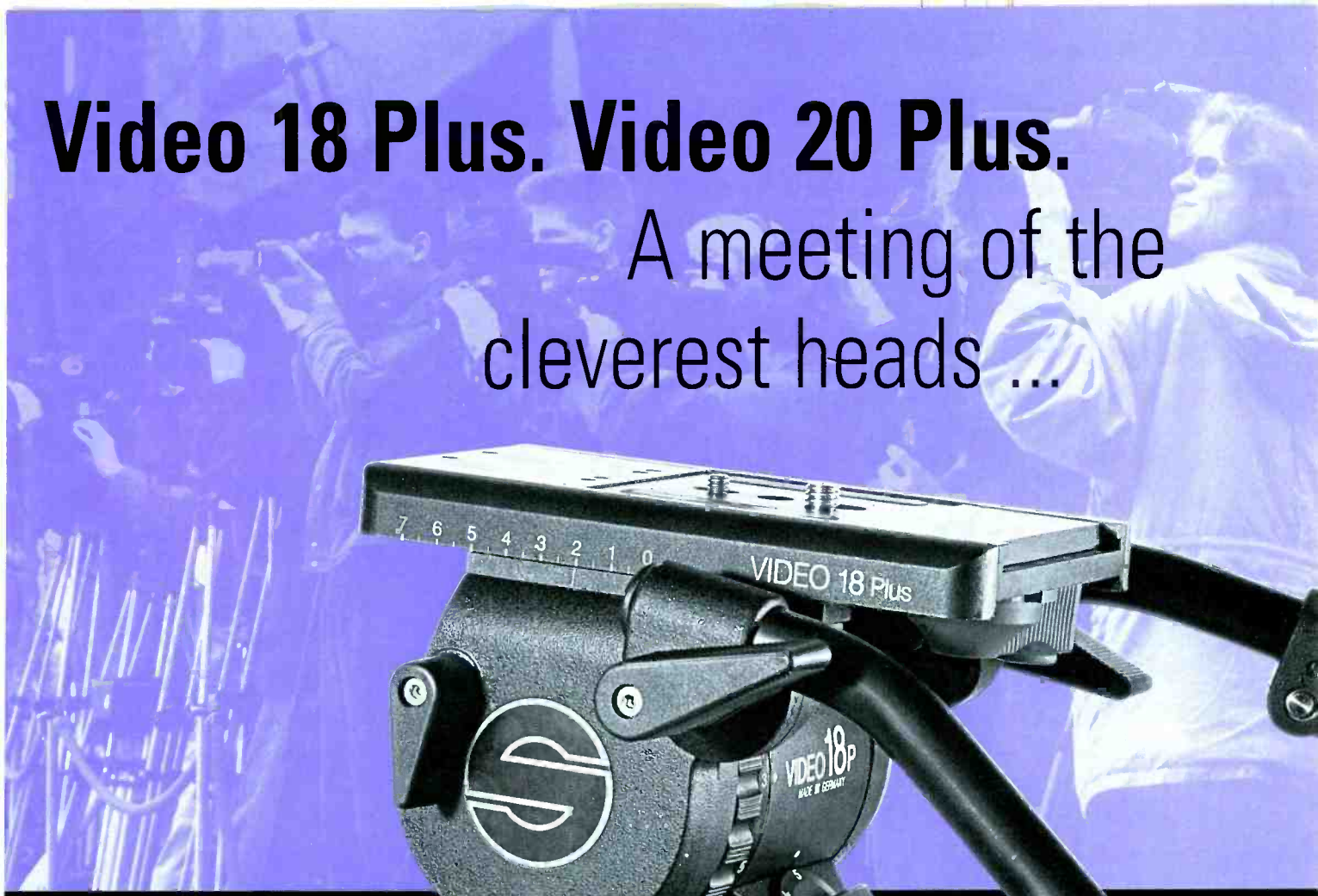

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the MPEG-2 compression standard. This feature, along with the VST-1000's wide window of motion estimation and compensation, as well as advanced discrete cosine transformation (DCT) and variable length coding (VLC), produces an extremely high video reproduction capability, even with highly active program material.

A built-in frame synchronizer assures compatibility with a wide array of video input sources, including U-matic and S-VHS without external time base correctors. A built-in machine control feature controls the video source device. Additionally, the system's built-in decoder board eliminates the need to occupy one channel of the VideoStore system just to monitor the encoding process.

Outstanding image quality is produced during 5Mb/s operation with an MPEG-2 compression ratio of approximately 36:1. Compression at approximately 18:1 for a 10Mb/s output rate is also available for even higher image quality. Verification of ad insertion is aided through the VST-1000's embedded Clip ID feature, which allows the user to identify each encoded clip through the application software.

VideoStore Media Control Unit

Once encoded, data is sent from the BitStream MPEG-2 encoding unit to the VSR-1000 Media Control Unit, which performs all of the control functions of the VideoStore system. Up to 12 discrete output channels may be installed in each Media Control Unit for 5Mb/s operation, with simultaneous two-channel loading possible. Up to six discrete channels may be installed with single-channel loading at 10Mb/s.

Predictive Maintenance/fault-tolerant architecture

The VSR-1000 Media Control Unit is designed with Sony's Predictive Maintenance system, which continuously monitors fan speed, power supply, voltages and all hard-disk drives. When a given statistical threshold has been exceeded, the user is warned through the Windows-based software interface. The VideoStore system is also designed with "hot swappability," the ability to replace key systems with no downtime. The VSR-1000's automatic data rebuild feature allows the user to maintain full operation in the event of a total system failure. Even if systems, including fans, power supply and HDDs fail simultaneously, data is automatically rebuilt, without operator intervention, as a background task with no interruption to system performance. If diagnostics are required, the VideoStore system can be remotely or locally accessed for a complete system check down to the board and block level. Even during operation, the VideoStore system can be remotely or locally accessed for a system status check through an RS-232C or RS-422A remote interface port.

Media Unit

Users can expand the capacity of their systems by connecting up to seven Media Units (VSH1000) to each Media Control Unit (VSR-10000). In this configuration, up to 60 hours of video programming can be stored with the use of optional 4GB HDD units. Each Media Unit is made up of six standard hard-disk drives in a RAID-3 configuration. ■

Jerry Berger is manager of video server technology for Sony Electronics Business and Professional Group, Montvale, NJ.

Hewlett-Packard MediaStream.

Hewlett-Packard MediaStream broadcast server

By Chris Bennett

Video servers are the new fundamental building block for broadcast facilities. Not long ago, these devices didn't even exist. In the near future, they will be as commonplace as tape machines, but servers are more than just a replacement for tape decks. These devices open up many new revenue and productivity opportunities for broadcasters. For example, the seemingly contradictory feat of streamlining operations while adding on-air channels is now increasingly common.

Broadcasters should assess servers along at least four dimensions: functionality (channels, storage, etc.), reliability, interoperability and scalability. The latter two are less obvious, but still crucial. Designed specifically for broadcasters, Hewlett-Packard's MediaStream broadcast server architecture excels in each of these areas.

Server architecture

The H-P server features two to six independent video channels, seven to 50 hours of on-line storage, 5x file transfers via Fibre Channel, award-winning video quality and unsurpassed reliability. The underlying architecture features independent elements with common databus access. The I/O interfaces convert all video into 'generic' data. This building block approach makes enhancement and expansion easy for H-P and our customers.

System control

A streamlined, dedicated CPU handles system control. I/O data doesn't pass through the CPU, which functions solely as a 'traffic cop.' The controller sets up transactions between the I/O cards, which then independently handles transactions with a single

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pass over the bus. This arrangement provides high channel capacity and extremely reliable performance: the controller is not overstressed, and the bus is far from saturation. The controller runs a real-time operating system with no-compromise multitasking capabilities. This provides guaranteed frame-accurate control, no pic freezes (hiccups in video), and also offers independent channel operation. Unlike Windows-based systems, any problems in one channel have no effect on the other channels. This is crucial for reliable on-air performance.

Video transfer engine

A streamlined file system, designed by H-P specifically for video I/O, handles the data flow. With a low-overhead protocol and hardware implementation, this video transfer engine manages direct data transfers between all devices on the bus. Looking to the future, the file system is also completely format-independent. This will enable straightforward migration to new video formats. This high-performance file system enables the H-P server to simultaneously play/record all video channels; transfer files to/from another server over a Fibre Channel link; transfer files to/from an archive; and recover from a failed disk drive — all without a single pic freeze.

The file system also features As Fast As Possible (AFAP) file transfers. AFAP transfers capitalize on intermittent idle bandwidth to greatly accelerate file movement between servers (or to archives), without impacting on-air performance.

MPEG-2

While other suppliers continue to talk about delivering MPEG, H-P has been delivering reliable MPEG-based broadcast servers for three years. MPEG-2 offers many benefits: increased server I/O capacity, significantly reduced storage costs, higher- speed networking and better archive access. Equally important, MPEG-2 is the only open, interoperable video standard. This enables H-P's servers to offer lossless (no re-encoding) file transfers with non-H-P equipment, something not available with JPEG or quasi-MPEG implementations.

Reliability

Hewlett-Packard takes a multipronged approach to hardware reliability. Starting with an extremely robust system design (offering >9,000-hour MTBF), H-P adds integrated RAID with hot-swappable drives, power supplies, redundant fans and transparent re-build. Clustered networking provides 100% reliability more cost-effectively than brute-force mirroring. With readily accessible file content and transparent operation, the high-performance bidirectional Fibre Channel transfers ensure file access and redundancy at all times. Networked systems also offer the ability to easily scale-up a facility to handle virtually any channel expansion requirements. ■

Chris Bennett is product planning manager for Hewlett-Packard, Santa Clara, CA.

The Tektronix Profile disk recorder.

Tektronix Profile

By Steven Craig Bilow

Typically, the term "server" implies a centralized device, shared by many users. There are several excellent applications of such devices in video. Yet, there are also a myriad of compelling reasons for choosing a distributed, virtual server architecture rather than centralizing. The topology enables multivendor interoperability, extensibility, expandability and the capacity to build effective media management systems encompassing on-, near- and off-line storage. Ultimately, resources exist where needed and are allowed to interoperate as appropriate. In effect, the network itself becomes the server.

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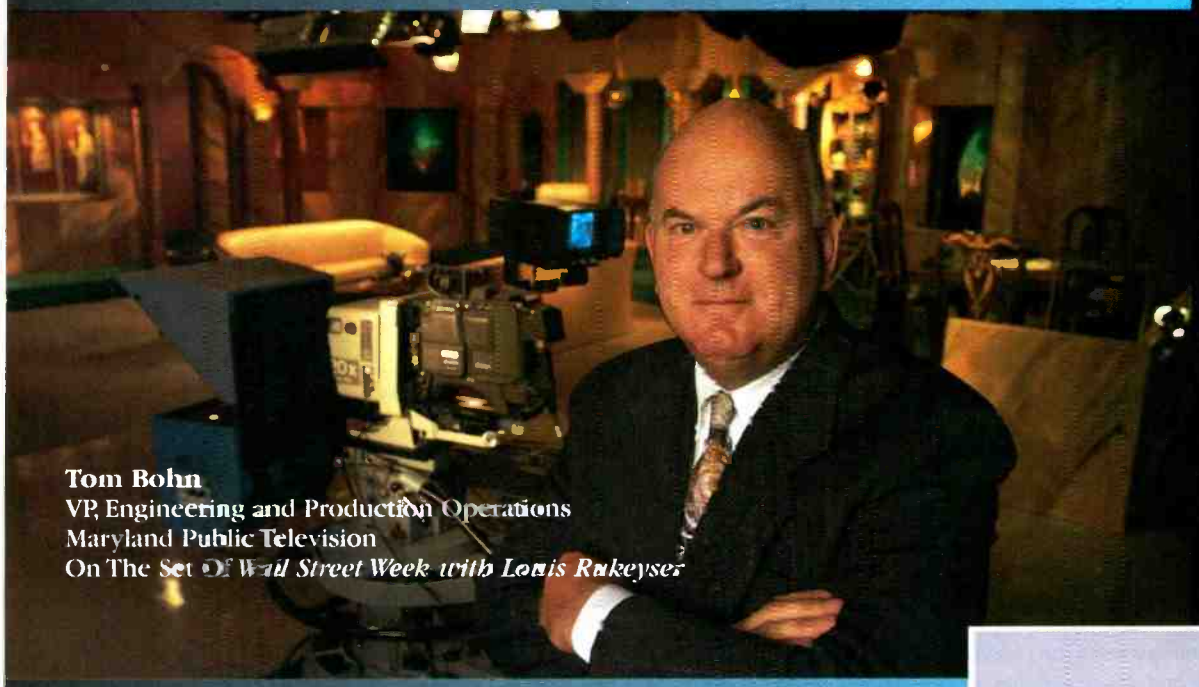

Tom Bohn
VP, Engineering and Production Operations
Maryland Public Television
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Tom Bohn feels the change from 4:3 analog to 16:9 digital technology "will be a revolution every bit as big as black-and-white to color. And since we don't know what the standards will ultimately be, we must start to future-proof now."

As he invests in new technology, Bohn looks for upgradeability on each piece of equipment. That's one reason he purchased eight Hitachi digital cameras. The SK-2000 Series has four built-in upgrade paths, from the single LSI processor, and A/D converter, to the newest CCD block technology.

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Distributed video networks

Centralized servers provide large amounts of storage, but have obvious limits on the granularity and extent of their scalability. They don't discriminate between functions requiring many resources and those requiring few. Failures may have a widespread impact because one point of failure can affect many users. These traits imply a potential for indeterminacy when a single system is employed in multiple uses. For example, it would be extremely unwise to risk the integrity of a commercial spot playout system by employing its play-to-air cache device in other simultaneous uses. Furthermore, regardless of capacity, a central server does not provide infinite storage. Off-line devices and tape vaults are still required, so centralization does not alleviate the need for adequate media management.

The storage pyramid

Optimally, a video storage architecture should be tiered. It *could* include central servers, but *must* be constructed from a heterogeneous array of distributed storage devices; preferably interconnected via some high-speed network. The operative word is *network*, because only through networking can we achieve heterogeneous interoperability, extensibility and the possibility of interfacing over long distances using traditional telecommunications infrastructure.

To understand the fundamental necessity for a networked architecture we must fully comprehend this storage hierarchy. In selecting the mechanism used for storing a given video segment, the cost of storage, the capacity of the storage device and the frequency of access must be considered. In a broadcast facility there are essentially four levels of storage. On-line storage is used for the few hours of video that must be immediately played to air; it's relatively expensive and requires high-performance disk arrays. Near-line storage involves media servers, which also use fixed disk devices, but have neither the access time requirements nor the level of redundancy. Off-line storage uses video or datatapes to provide greater cost efficiency at the expense of access time. Archival storage is what we typically refer to as the "vault;" or a room where tapes are stored. This is the least-expensive storage method.

This model suggests that when a system is not limited to a central device there is a far greater level of flexibility in balancing access requirements and cost. This alone is a compelling argument in favor of distributed architectures.

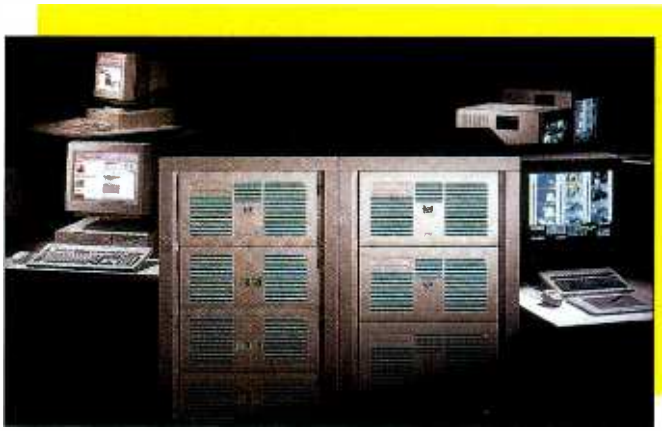
The video network

A Fibre Channel Arbitrated Loop network is used to perform high-speed video transfers while an Ethernet network provides transaction control. A network topology is used instead of a bus-oriented one because it simplifies extensibility, provides greater flexibility and allows reasonably straightforward interconnection over long distances via worldwide telecommunications infrastructures like ATM. In essence, this choice allows Fibre Channel to serve as the method for interconnection within a facility, while making possible the movement of video between facilities using established networks with standardized protocols. In this scenario, Fibre Channel runs network-oriented protocols and gateways can be easily built to move video between it and various other network topologies. The enabling technology is not just Fibre Channel, but *Networked* Fibre Channel.

Balancing parameters

System performance, storage cost, load balance, reliability, expandability and interoperability can all be optimized by understanding storage and access time requirements. Centralized servers provide adequate storage, but limit flexibility. They are, thus, expensive and difficult to expand. Alternately, the Fibre Channel networking of small- to medium-sized storage devices has the potential to provide highly flexible, distributed architectures. Networking provides the means to construct virtual servers, which allow distribution, ease of expansion, low cost and the potential of interoperating with other networks. In the broadcast environment, this allows the optimum balance between cost and capacity. It provides an easily expandable architecture with the flexibility to rapidly change according to the facility requirements. ■

Steven Craig Bilow is a marketing manager in the video and networking division at Tektronix, Inc, Beaverton, OR.



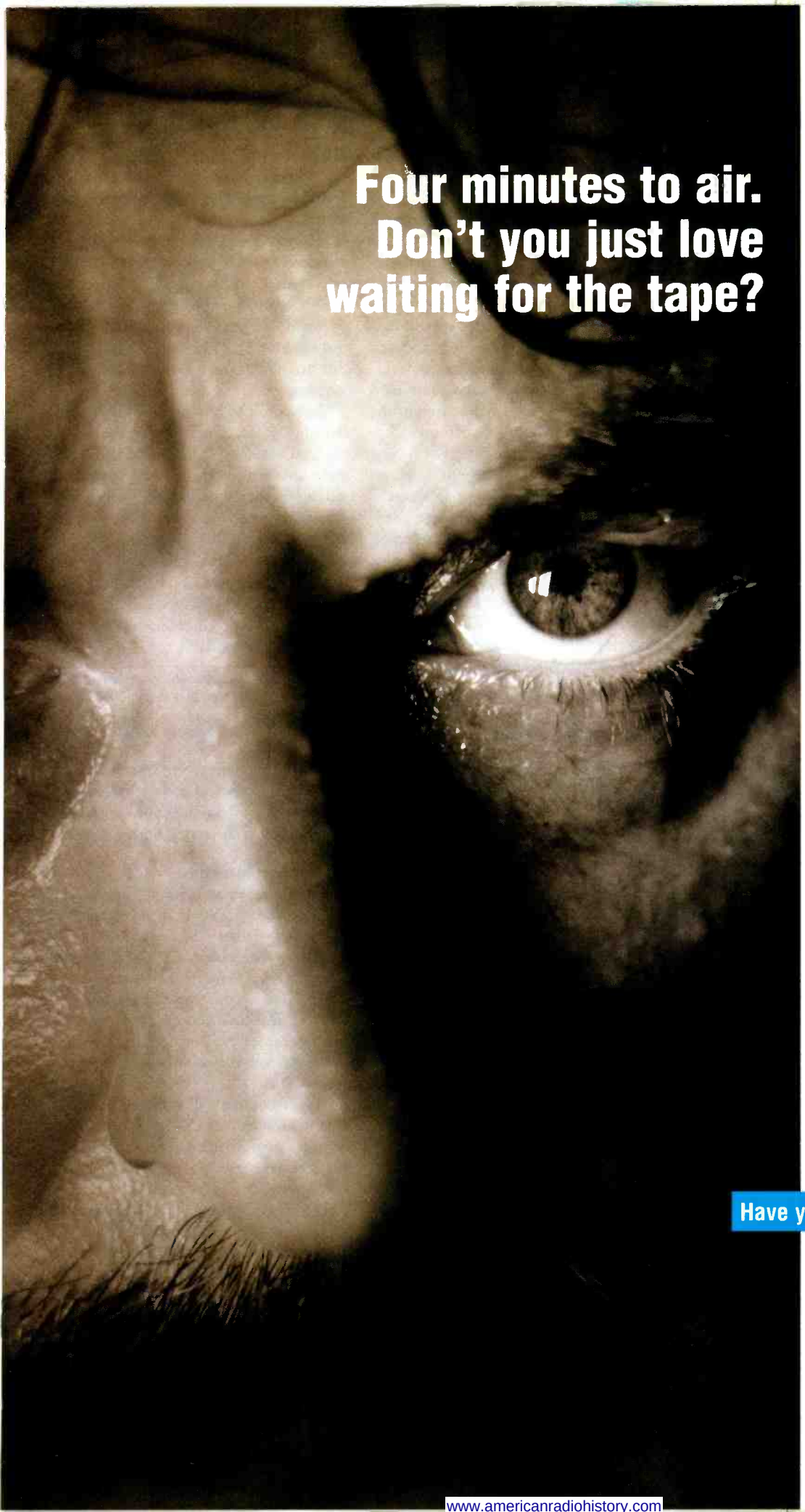
The Quantel Clipbox.

Quantel Clipbox video server

By Bob Pank

Applying computer disks to video storage presents many challenges far beyond those of normal computer operation. The non-compressed signal requires a continuous data rate of 21Mb/s or 75Gb/h. While the vital cost-per-megabyte factor allows the economic grouping of disks to provide stores of several hours, multichannel TV operation has yet more demands. Protection against loss of data, speed of access and ease of system integration are also important and were all factors in the design of Quantel's Clipbox video server.

Dylan disks provide the storage blocks for Clipbox. These provide an hour's capacity from 19 individual disk drives — plus one used for error checking and correction, so that full operation is maintained should any disk fail. The configuration is arranged for handling large files, which pictures are, rather than the small files normally associated with general data processing. Each Dylan provides a continuous data rate well in excess of 21Mb/s and can continuously randomly access stored frames in any order at video rate. Known as true random access, this makes a tremendous contribution to system performance. For example, unlike any other store,



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defragmentation is never required, allowing uninterrupted full operation.

It's the job of Clipbox management system to pass on the benefits of true random access to the users while keeping the interface simple and easy to use. Internally, the filing system directly addresses every stored frame. Because any degree of fragmentation is allowed, the frames of a clip may be scattered anywhere around the store. Although this gives great flexibility, it severely complicates play and record operations. So, rather than asking each system using the server to address individual frames, Clipbox reduces their interface complexity by resolving access to far more manageable whole video clips.

Our aim has always been to make maximum use of servers — a target that has only been accomplished through more specialized engineering. While today huge capacities and high data rates are relatively easy to achieve, enabling any server port to access any frame in any order at video rate, regardless of the activities of other ports (simultaneous true random access) is a technical breakthrough that greatly extends server applications.

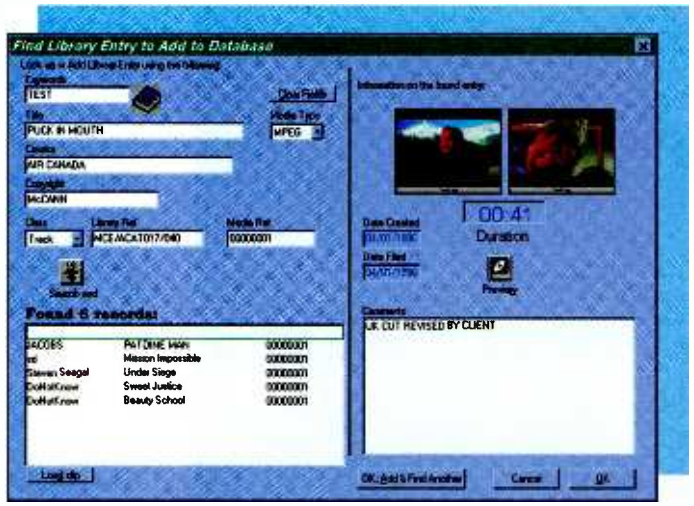
So Clipbox has the basic benefits of continuous operation, (no defragmentation or moving of material), as well as instant availability of all recording space. Also, every port can access any frame at any time — even the same frame can be read onto all ports simultaneously. For transmission this eliminates the huge overheads usually involved with guaranteeing access. Output can be cut together live according to the playlist — accepting updates to within a heartbeat of air time. Thus, one port can totally support one transmission channel.

Every port is independent and has its own remote control and each may be supporting a different application, which allows Clipbox to be at the center of operations. New material can be recorded via a port operating as a virtual VTR while another serves as a virtual disk store for an on-line non-linear edit station, such as Editbox or Newsbox directly editing on the server. At the same time, finished pieces can play direct to air or play out to tape. Or, a port can interface to a newsroom computer allowing journalists to edit video and audio alongside their text. The result can go straight to air, via Clipbox, at broadcast quality.

Much of the design has centered on the need for ease of interface. The many post-production, transmission and news applications already implemented point to the effectiveness of this policy. Each port provides direct I/O connections for video (no interface box required) and audio via industry-standard serial digital interfaces (SDI), as well as an RS-422 serial interface operating with Quantel's published remote-control protocol. For exchange with CGI systems fast Ethernet TCP/IP interfaces are available directly on Quantel graphics and editing systems.

Clipbox can be configured with from two to eight Dylans, giving up to eight users true random access to a shared store of up to eight hours of full-quality non-compressed video. Furthermore, Dylans store audio. Using Grid compression extends storage time by five-, 10- or 20-fold — to suit application, and increases the maximum number of on-line users (or ports) to 14. For those seeking further expansion, Clipboxes can be networked. In practice, installations range from four ports upwards. ■

Bob Pank is the technical communications manager for Quantel, Newbury, UK.



The Pioneer DiscBrowzer video browse server.

Pioneer DiscBrowzer video server

By Rich Bauarschi

The secret behind a successfully exploited archive is access. Pioneer's new DiscBrowzer video browse server allows facilities to capitalize on their existing libraries by permitting them to efficiently preview archived clips and images on a networked basis.

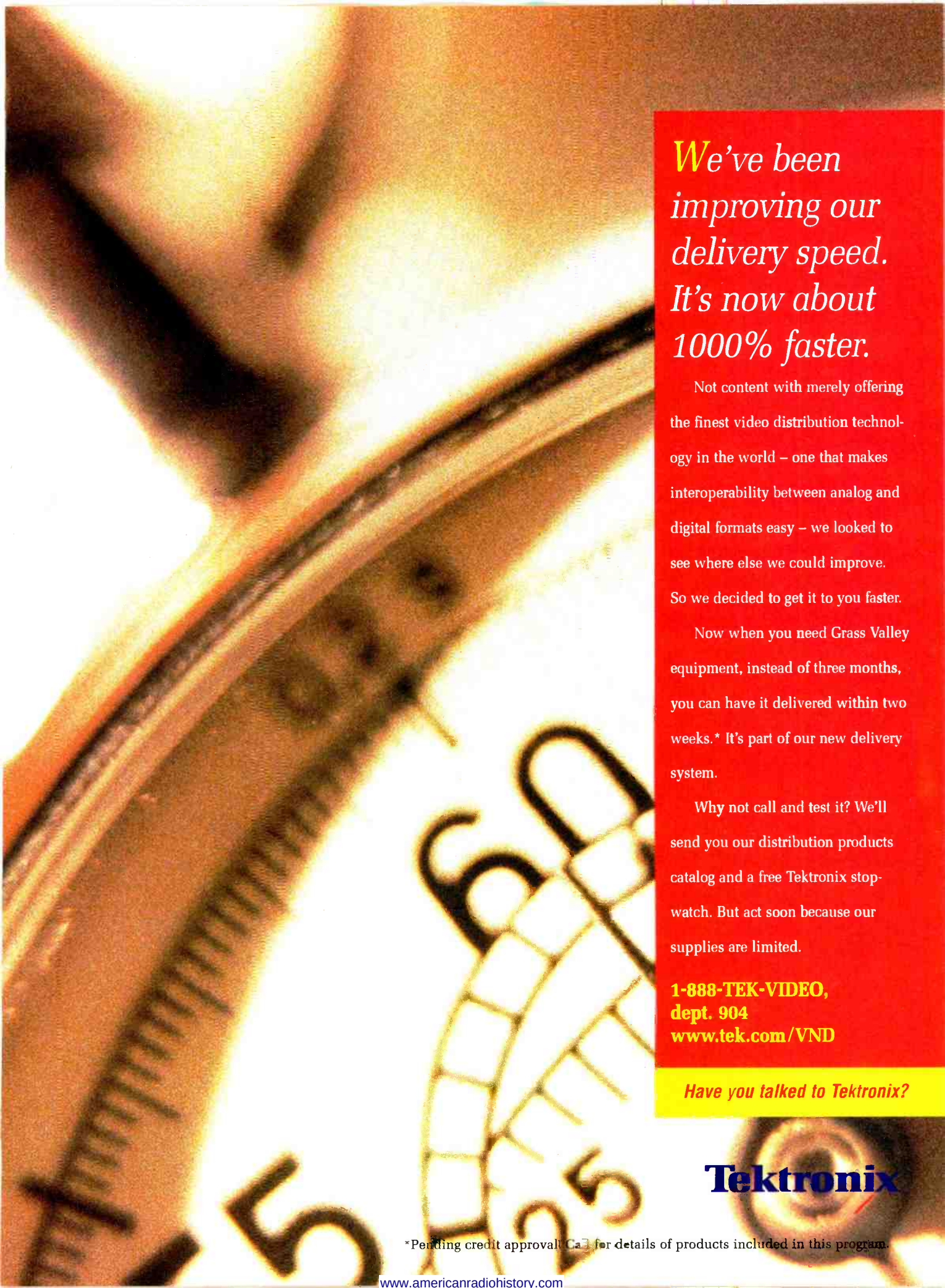
Using Pioneer's leadership in compact disc-recordable (CD-R) technology, the DiscBrowzer video browse server allows users to call up and preview decision-quality copies of archive materials. Next, using network tools, they can create a shopping list for the precise reel or reels they need. Finally, they can generate an edit decision list whereby, in future versions, an editing system can shuttle directly to the reel in question, and pull the desired material without hunting and shuttling, thus preserving time.

System architecture

Material to be archived is encoded to a CD-Recorder (CDR) in a Supervisor Plus Encoding station. The Supervisor station doubles as the encoder and CD-ROM writer. This system, a Pentium computer operated under Windows 95, works by encoding video from real-time sources, such as videotape, and storing the encoded files on a hard drive. When the drive is filled to the capacity of the CD-ROM, or a subset of that capacity used for recording (called a session), a CD-R is written. When the CD-R is full, it's inserted into a robotics disc changer connected to the network server.

The network server consists of a fast Pentium tower, operating under Windows NT, and one or more DRM-5004X CD-ROM autochangers. Each of these towers contains five CD magazines, each holding 100 discs. The tower also contains up to four CD-ROM readers or reader/writers, depending on configuration. The combination of four drives, plus a library of 500 discs with MPEG encoding means the system can store and access randomly more than 500 hours of full-frame-rate video.

Of course, via the network, a large number



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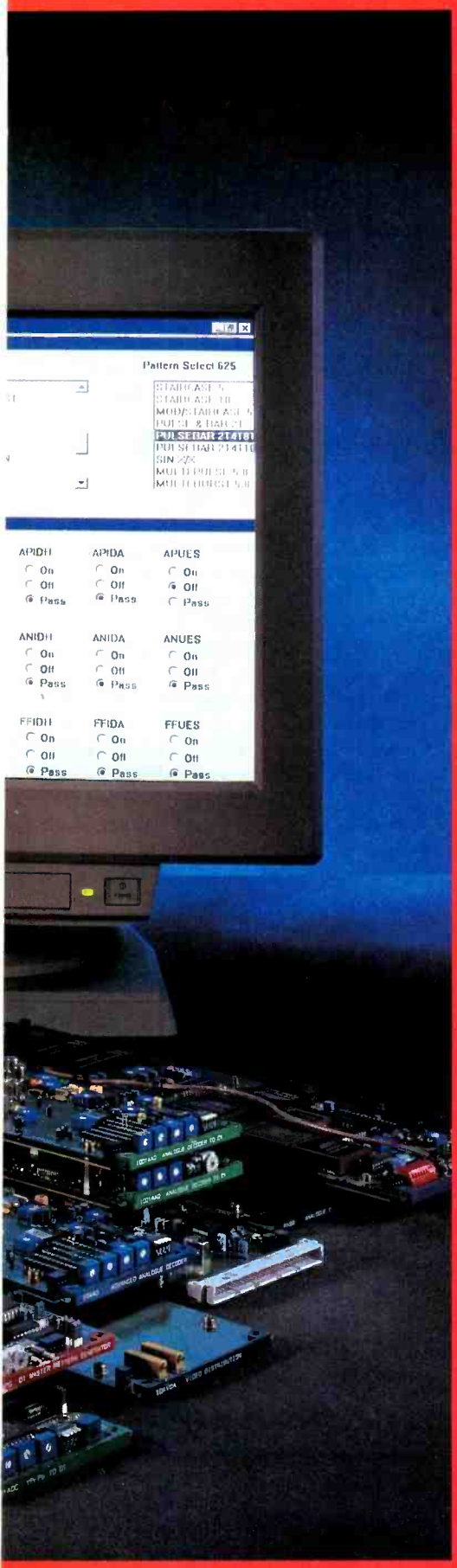

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of users have access to the material in the archive. Although four transports per autochanger will greatly speed access, efficiency is improved further by use of an intelligent caching system. In the DiscBrowzer, MPEG-compressed material is called off of the disc library, which serves as near-term storage and written to a system of hard drives for play on the network. This cache allows users to view a piece in VTR fashion, while leaving the disc transports free for other users. Items expire from the cache according to user-defined rules regarding the frequency and last date of access. This makes the cache self-purging, but in a manner that is user-determinable.

PCs accessing the network are called retrieve terminals. The powerful retrieve terminal software allows users to view archive material using an interface resembling a videotape recorder. Users can mark I/O points based on their needs and paste the reel information to a clip list that is similar to an EDL. Elements on the clip list can be ordered and previewed by a single click of a mouse.

The advantages of CD-R, such as low operating costs and relatively low media costs combined with the nearly indestructible nature of optical as opposed to hard drive or tape media, make adoption of systems such as we've described here inevitable. In the meantime, coupling the advantages of text-based databases with actual video clips forms a search tool that is hard to beat. Also featured is the ability of multiple-user access at the desktop via a network, and the nearly unlimited expansion offered by multiple CD autochanger towers. All of this makes the Pioneer DiscBrowzer video browse server a powerful solution for getting an archive out of the dark ages, and transforming it into an efficient resource for production tasks. ■

Rich Bauarschi is director of marketing for Pioneer New Media Technologies, Long Beach, CA.

The Sun MediaCenter.

Sun MediaCenter

By Jack Androvich

It just got a lot easier to answer the need for rapid access of stored video programs. No longer is it necessary to fidget with a host of architectures and languages to get a media server to talk to a digital network that includes equipment ranging from TV sets to workstations. Finally, a media server is a painless way to provide time-sensitive streams of digitized visual information to clients connected to a local or wide area network.

Sun Microsystems Computer Company has introduced the Sun MediaCenter based on its UltraSPARC platform that uses standardized hardware, a 64-bit file system and software packages to build the media server configuration dictated by almost any application.

Incorporation and integration

The Sun MediaCenter starts as a basic package (either off-the-shelf or customized) with the hardware and software needed for easy incorporation into new or existing digital networks. The architecture of the new system is open for expansion and for access by a variety of equipment. Integration with other equipment on the network is simplified, regardless of manufacturer.

The MediaCenter software provides the drivers and hardware management necessary for the development of advanced applications requiring digital video. The software comes ready for full VOD applications with video playlist editing and control (audio track selection, play, pause, stop with fast forward and rewind optionally supported), as well as providing system resource information.

Compressed digital video programs can be recorded into the MediaCenter at the same time that the server is being used for playback. A "playthrough" feature enables titles to be played approximately five seconds after beginning to be recorded. (The incoming digital video is compressed by an external encoder that is not a part of the server system.)

The storage system starts out with a net capacity in multiples of 42GB, enough to store 21 hours of MPEG-2 programming (at 4Mb/s) or 62 hours of MPEG-1 programming, and can optionally be expanded to 84GB. Applications that require an even larger storage area or expanded data throughput can be addressed by clustering media servers or by using other storage devices available from Sun. (The RAID-4 storage system uses the remainder of the 50.4GB of disk storage in the standard storage system for parity and other overhead.) The MediaCenter software also supports conventional video storage media in addition to hard disks for near video on demand (NVOD) applications that allow slower and less-expensive access to video programs that are not frequently needed.

The Sun MediaCenter simultaneously plays back any combination of MPEG-1 and MPEG-2 compressed video datastreams, up to a 100Mb/s sustained total output rate.

Connectivity

The Sun MediaCenter output interface can be interconnected with ATM (AAL-5), 100BASE-T Fast Ethernet or 10BASE-T Ethernet networks.

Reliability and maintenance issues have been addressed by design, diagnostics and the comprehensive SunSpectrum customer support program. In case of failure, individual disks can be "hot-swapped" without rebooting the system, in most cases without clients ever noticing. Enhanced backup and

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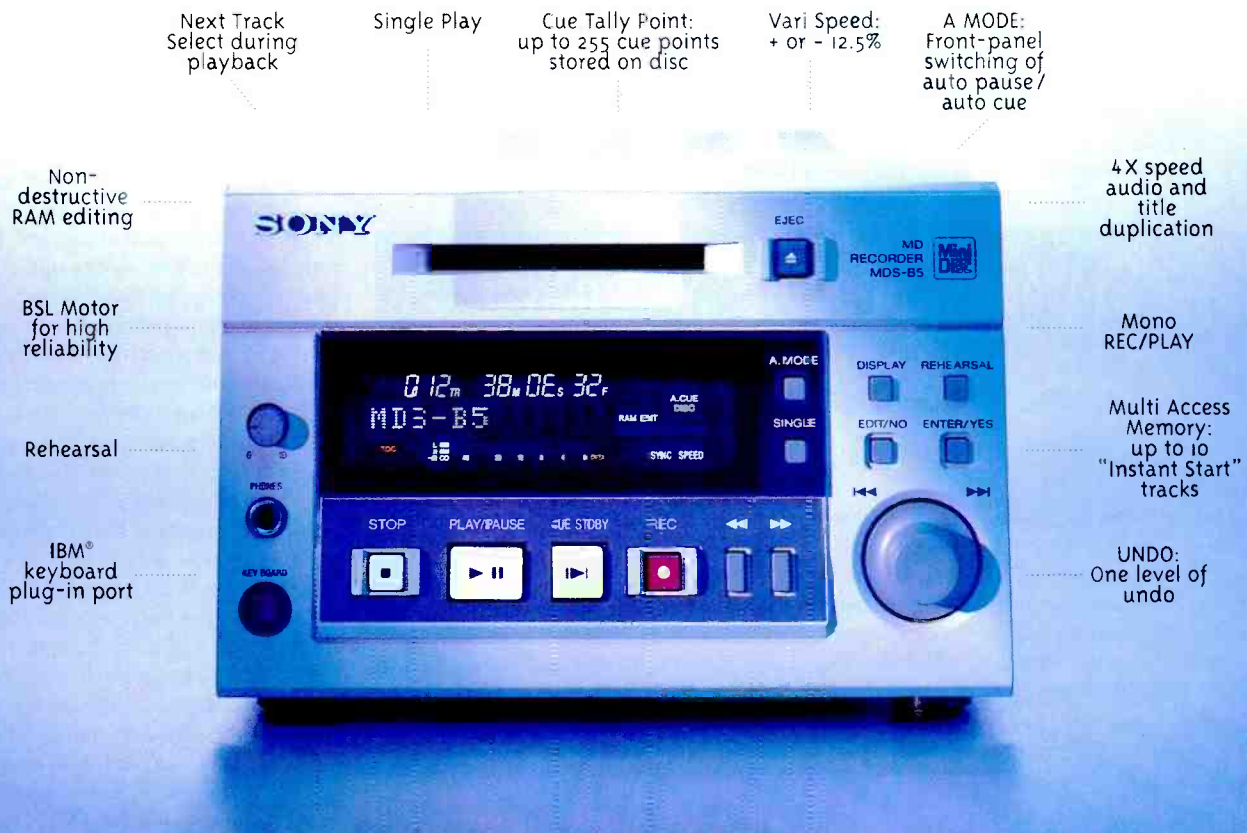

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transfer utilities for video programs are included in the standard package.

The Sun MediaCenter UltraSPARC system offers cutting-edge video storage and retrieval in a package that's easy to install and expand. Effective incorporation of a MediaCenter into a digital network is virtually assured by the open architecture and adherence to worldwide interface standards. With operational reliability and customer support that exceeds the needs of any foreseeable application, the Sun MediaCenter is becoming a cornerstone in supporting visual communications needs. ■

Jack Androvich is product marketing manager, Interactive Services Group, Sun Microsystems, Inc., Mountain View, CA.

Storage Concepts FibreRAID with Silicon Graphics Indigo.

Storage Concepts' VideoStar and FibreRAID

Roger Budris and Martin Bock

Storage Concepts, a leader in high-performance RAID storage since 1984 has unveiled two distinct video server architectures. The VideoStar MPEG-2 video server is aimed at the high-quality VOD and commercial insertion markets, while the FibreRAID disk server array targets mid-to-high-end uncompressed video storage applications for the broadcast and video post communities.

VideoStar system architecture

The VideoStar video server offers broadcast-quality video, accurate timing of program insertion, low overhead cost and high system reliability. The overall system architecture of the VideoStar video server consists of three major system components: video storage, an MPEG-2 decoder unit and a computer that controls system operation.

The three system components are interconnected via a fast-and-wide SCSI bus for data inputting to the video storage device and transfer of video content from the video data storage device to the video decoder unit. The computer is connected to the MPEG-2 decoder unit via an RS-232 link to pass control commands and obtain status information. Each VideoStar decoder unit has eight internal MPEG-2 decoder chips and can run up to eight video steams concurrently.

The VideoStar architecture is flexible in that the computer can be a PC, workstation or even a mid-range computer and video storage can either be disk drives or a RAID system. To support various computers, the VideoStar application software is written in C language and runs under Microsoft NT or Windows 95 and can be ported easily to various versions of UNIX.

System operation is controlled by the VideoStar application software. The application software provides a GUI for manual control by an operator. When integrated into a TV or cable head-end computer system, automated operation is supported through the application software API. With third-party commercial insertion software and multiple decoder units, VideoStar becomes a viable insertion system and will interface to popular traffic and automation systems. In a VOD server application, up to 32 simultaneous video streams and 32 audio stereo pairs can be supported. In a multiple operator environment, such as news, sports and program store-and-forward applications, catalogued program segments and clips can be viewed, EDLs created and stored in list/clip bins.

To guarantee uninterrupted service, the VideoStar servers are available with "fault-tolerant" disk array architectures and channel protection.

FibreRAID video server

In addition to VideoStar, Storage Concepts has developed FibreRAID. It's a fully functional RAID server storage solution designed to provide continuous, sustained data rate storage for high-performance video storage and server applications.

Based on a new real-time controller platform using fourth-generation design topologies, the system features redundant pluggable disk and power supply modules, dual Fibre Channel host connectivity, extensive error logging and RAID functionality control, cableless system chassis design, up to 72GB of storage per chassis and up to six additional satellite chassis for high-capacity storage, equaling more than 500GB per controller. In addition, the system touts a dual-channel design with separate command and internal databuses for efficient high-performance data handling, 4MB of buffering to ensure continuous data transfers, 66 MIPS disc processor for fast command handling and a full 1Gb Fibre Channel interface with a sustained rate in excess of 80MB/s.

Also, FibreRAID can be connected to the Silicon Graphics computers. Adapters are available for the GIO interface in the Indigo and Impact lines, an HIO interface for the Onyx and Challenge lines and a PCI adapter for the new PC-based systems. ■

Roger Budris is vice president of marketing of the video interactive division, and Martin Bock is vice president of marketing for the real-time division for FibreRAID at Storage Concepts, Irvine, CA.

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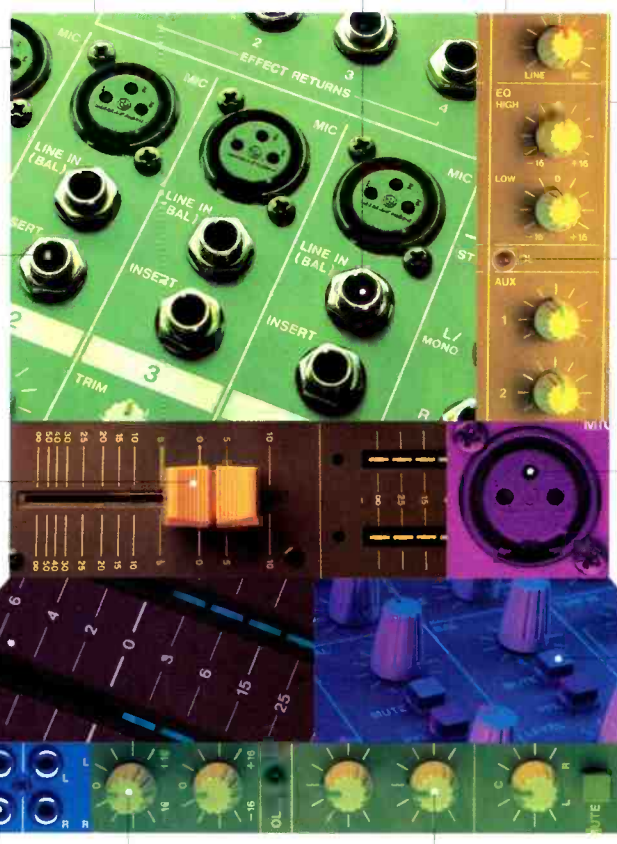

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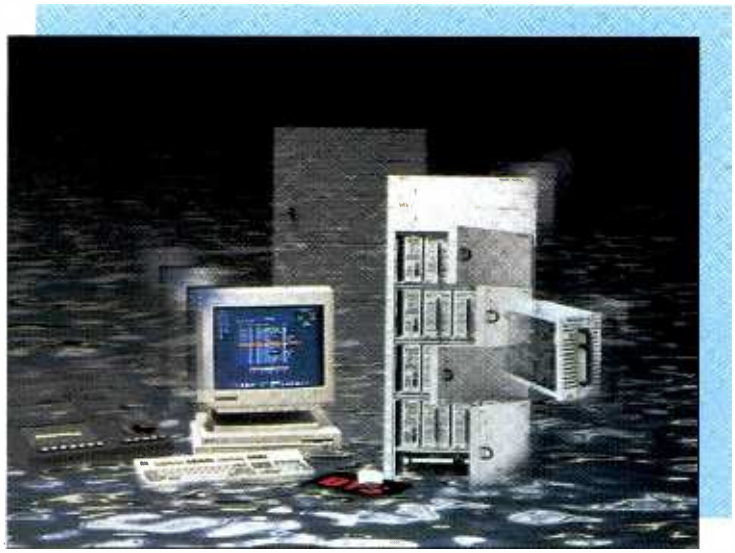


Philips BTS Media Pool.

Philips BTS Media Pool

By Charlie Bernstein

The Philips BTS Media Pool video server combines off-the-shelf components and dedicated hardware that makes it an effective solution for broadcasters. It's a scalable multichannel system that provides the highest-quality video and audio in a facility. Each channel in a Media Pool system is capable of supporting a full-bandwidth CCIR-601 uncompressed video stream, along with up to two AES/EBU 48kHz pairs of audio. In addition, the server can compress the video stream to leverage economies of scale in storage and bandwidth. The Media Pool is a modular system that can be built in various configurations to meet specific broadcasters' needs. The modular architecture offers increased flexibility in video channels, storage capacity, system bandwidth, integrated applications, simultaneous multiuser access and control alternatives.

The server architecture uses multiple arrays of hard-disk technology to provide high bandwidth and high storage capacity. Each array provides up to a full bandwidth stream of video. The system supports from one to eight storage arrays per system. Each array can contain from 10 to 42 drives. This allows for terabytes of on-line data storage that translates into hundreds of hours of compressed video on a single server. A Media Pool system can be configured starting with a single I/O module up to 12 I/Os in a single system. A system purchased with fewer than 12 channels can be upgraded with additional channels in the future. Additional drives and arrays can be added to the system to increase system storage. Additional workstations can be added to run Media Pool's integrated applications in a real multi-user environment.

Scalability

The key to the Media Pool's storage subsystem is its scalability. Multiple drives and multiple arrays allow for storage and bandwidth management. Using compression, storage capacity can be increased and bandwidth shared. Flexible storage capacity and flexible system bandwidth are the result of the scalable architecture of the storage subsystem.

I/O subsystem

The Media Pool video server has dedicated hardware developed for the task of playing and recording video into the server. The server's I/O subsystem provides serial digital component video output on all channels. As all video information is stored digitally in the server, and the industry is migrating to the digital domain, it makes sense to provide a digital signal to a broadcast facility from a server.

Video transfer subsystem

This subsystem is comprised of a gigabit matrix switch called the data transport commutator. Signals between the array subsystem and I/O subsystem are switched rapidly over a matrix fiber channel switch to allow the system to provide up to full-bandwidth digital serial component video for each I/O simultaneously. The timing of the switch is regulated by system software in the I/O subsystem and the control subsystem, allowing for flexible bandwidth allocation and support for multiple data formats.

Control subsystem

The control subsystem in the Media Pool is comprised of one or more workstations. The Media Pool system controller is responsible for initiating system booting, system configurations, compression level setting, system monitoring, media file database administration and running the server's integrated applications.

The system controller contains software applications for system administration, commercial insertion and record/playout. Additional workstations can be added to allow for simultaneous multi-user access.

Media Pool integrated applications

There are currently four integrated applications and three integrated protocols available for the server. The applications provide integrated functionality that take advantage of tightly coupled control and high-end features. The protocols provide the server with an open system approach, so the system can be integrated into the facility with other devices and also to allow for custom application development by broadcasters and other vendors.

The applications are SPLASH, System Administration Application, Stream, VTR Emulation Application, DiskCart Cart Emulation Application and DiskCache Broadcast Facility Application. The protocols supported are BVW-75 serial control protocol, Video Disk Communications Protocol and PoolNet native Media Pool Protocol.

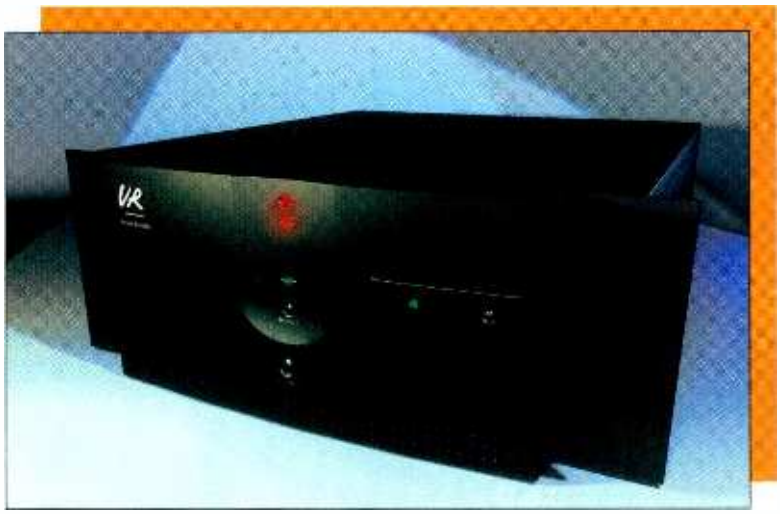
Archiving and compressed file transfer

Any media file stored on the Media Pool can be archived to a robotics datatape library and retrieved. Automatic archiving and retrieval based on playlist requirements is supported. Faster than real-time transfer is possible when compression is used.

Another feature is the ability to transfer compressed files from one server to another. The Media Pool Pool2Pool functionality allows for faster than real-time transfer of compressed files via a compressed serial digital interface (SDI). Files can be transferred using existing digital routers and switchers or via direct connections between two servers.

The Media Pool video server architecture uses independent subsystems, variable compression and integrated applications to provide a flexible solution for storing and serving professional video. The system offers flexible configurations, system scalability and support for multiple full-bandwidth video streams. A Media Pool system configured today can be upgraded in the future with additional storage, bandwidth, channels and users. ■

Charlie Bernstein is senior product manager, storage and retrieval products, Philips Broadcast Television System Company, Salt Lake City.



ASC VR300.

ASC VR300 advanced broadcast video server

By Todd S. Roth

The VR300 advanced broadcast video server is the only disk-based, news and commercial insertion system to unleash the full power of Fibre Channel (FC) technology. By coupling the performance of a PCI/Pentium Pro video server with ASC's FCR300 Fibre Channel RAID video storage, VR systems can provide up to 24 simultaneous channels with up to 96 hours of on-line video storage for a host of real-time broadcast applications, including commercial insertion and network delay.

Building block approach

The VR300 video server is the central building block of a VR disk-based broadcast system. The VR300 is based on a PCI/Pentium Pro configuration running Windows NT. Each VR300 provides two channels of video for either dual simultaneous recording, dual simultaneous playback or simultaneous recording and playback.

The FCR300 is an ultrahigh bandwidth disk-based storage configuration using the latest Fibre Channel storage and networking technologies. FC is a serial interface with a net bandwidth of 1 Gb/s. When combined with RAID technology, FC eliminates the bottlenecks that complicate high-bandwidth broadcasting applications.

Integrated disk-based broadcast system

By using the VR300 video server and FCR300 storage system as building blocks, broadcasters can make the transition to an integrated disk-based environment. They can start with a single VR300 — performing a specific broadcasting application, such as commercial insertion or network delay — and grow to a fully automated, integrated broadcast environment with multiple servers and shared RAID storage for news, spots and programming.

VR system features

The VR system includes one to 24 simultaneous record/playback channels, each with four channels of CD-quality digital audio; maximum on-line Fibre Channel RAID storage of 1.1 terabytes (1,100 GB); ultrahigh bandwidth Fibre Channel storage technology; ASC's Brilliant Image Compression is user-selectable from 1.6:1 (mathematically lossless) to 20:1; ASC's exclusive Virtual Access Architecture for concurrent access to the central media bank; RAID technology for failure-free security; full control by external devices via RS-422, GPI or TCP/IP protocol; fully compatible with Alamar, Louth, NewsMaker, Odetics, Sundance and automation/news systems.

Server and storage implementation

Virtual access architecture is ASC's exclusive storage topology that allows multiple VR300 video servers to share a Fibre Channel RAID array, making all video

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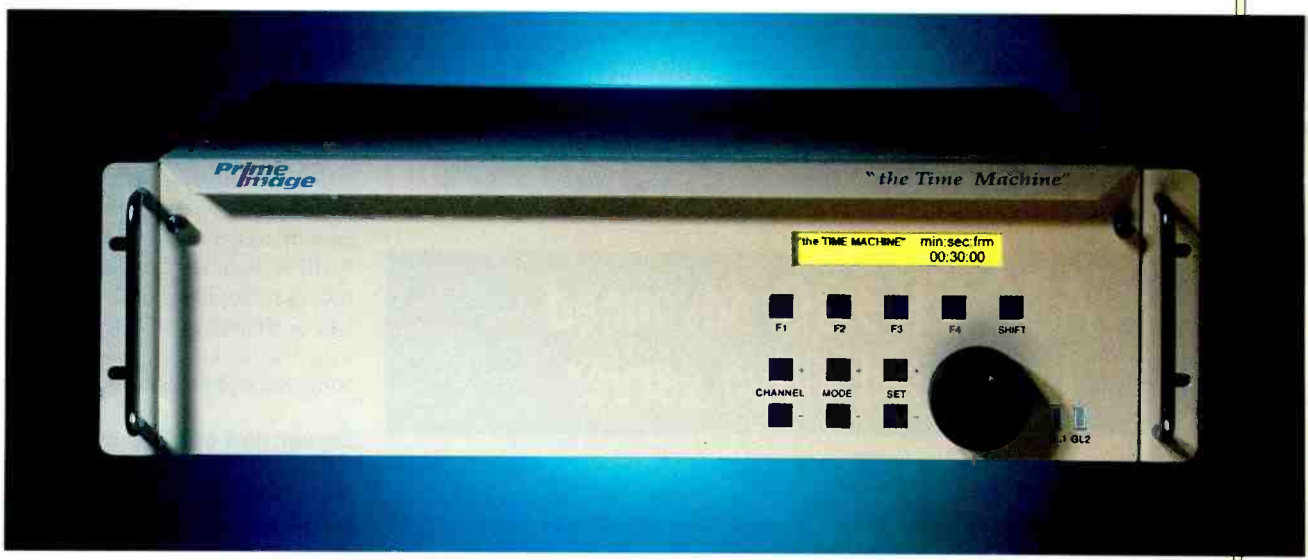

The Time Machine is a new, technological break through product, which reduces program time, to create commercial insertion time. it is a self contained, small 3U rack mountable unit which requires no data compression.

The Time Machine is capable of changing time without changing the pitch (frequency) of the video or audio programming. The Time Machine consists of a main frame which houses the memory and all of the electronics necessary for control of the video and audio-Time Machine storage. A maximum of 30 seconds of video and two channels of time reduction audio is available.

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material instantly and simultaneously accessible to every user in the facility. The technology eliminates the need for local buffers or data transfers from one set of disk drives to another.

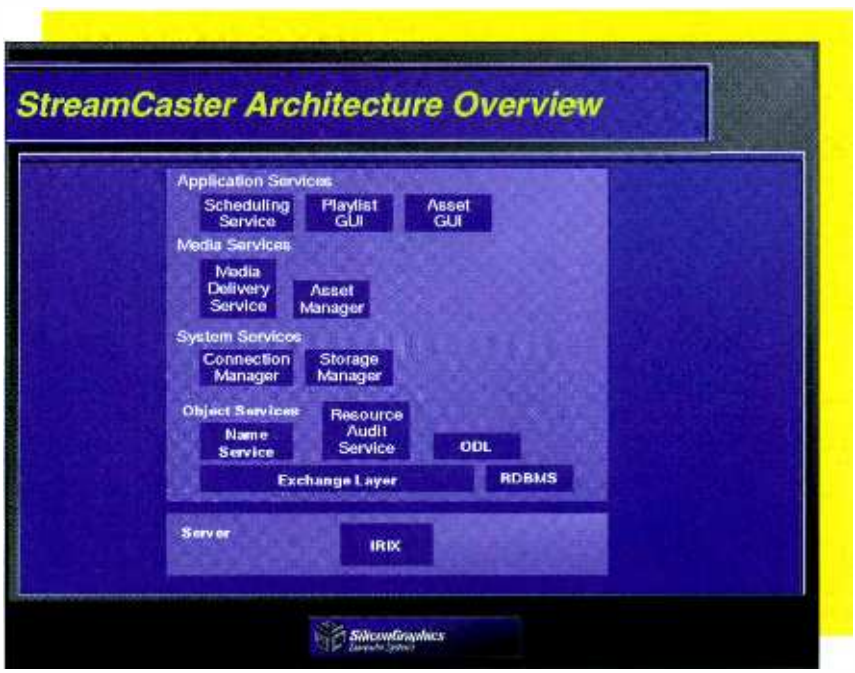
The VR300 features ASC's Brilliant Image Compression, allowing each video segment to be digitized at a compression rate independent of the compression used for other video segments. Compression rates from 1.6:1 (mathematically lossless) all the way to 20:1 are selectable. By taking advantage of FC's high-bandwidth capabilities, the VR300 can support unprecedented channel and on-line storage capacities.

RAIDsoft

RAIDsoft is ASC's patent-pending software that manages the VR300's fault-tolerance mechanism. RAIDsoft eliminates the need for a RAID hardware controller, a single point of failure found in traditional SCSI-based RAID systems. The software can even rebuild individual drive segments, as opposed to entire failed drives, dramatically reducing the time needed to repair a degraded RAID array.

The VR300 video server with all-Fibre Channel technology provides the unparalleled flexibility and reliability broadcasters need to make the transition to an integrated disk-based system. The VR300's innovative technology, advanced architecture and high bandwidth storage capabilities allow broadcasters to design a system that meets their needs — now and in the future. ■

Todd Roth is vice president, research & development for ASC Audio Video, Burbank, CA.

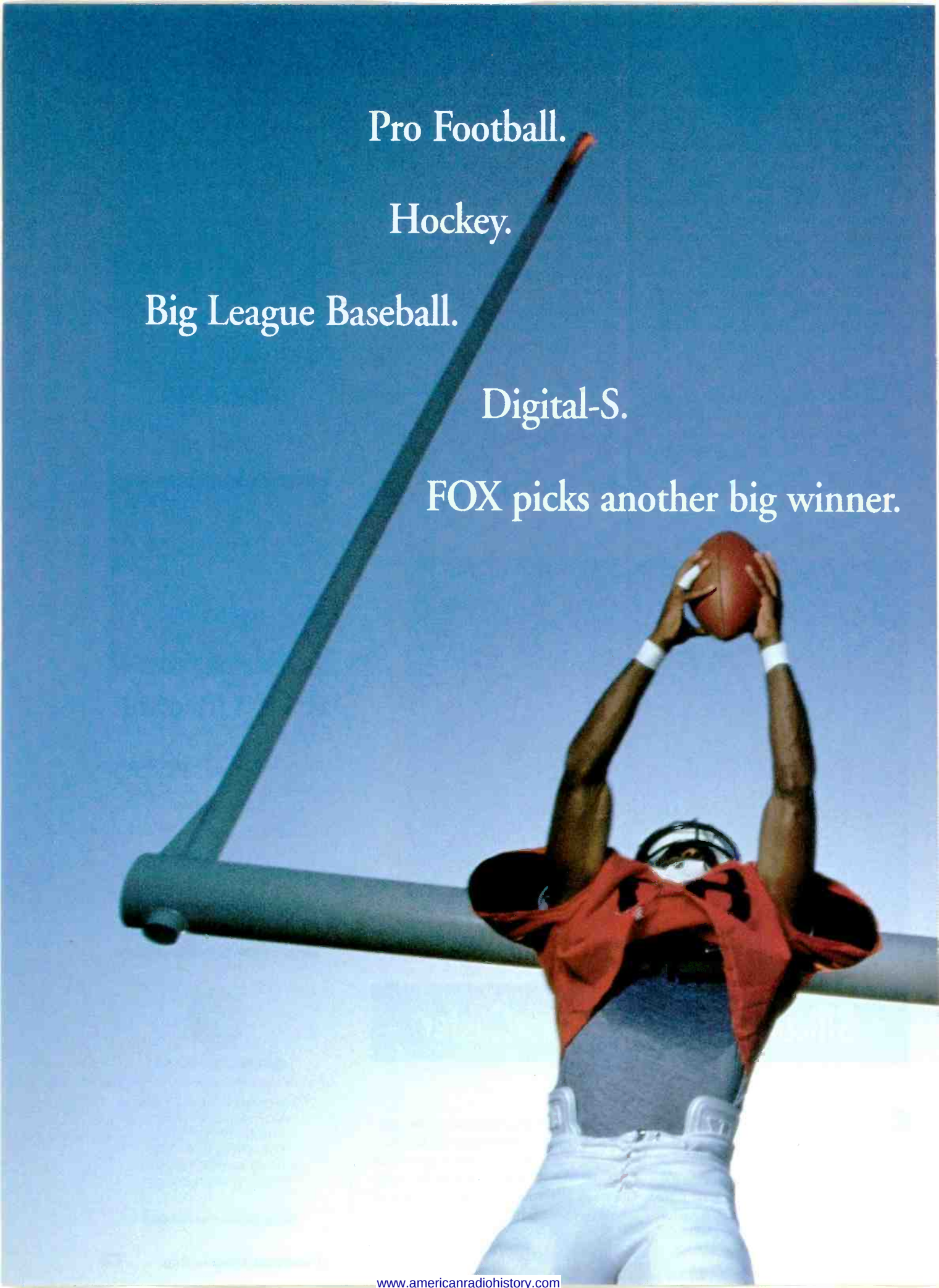


Silicon Graphics StreamCaster.

Silicon Graphics StreamCaster

By Karl May

StreamCaster is one of several Silicon Graphics video server technologies developed for distribution of MPEG-2 video over digital satellite and digital terrestrial transmission systems. StreamCaster is a scaleable, multichannel playback video serving solution that enables the scheduled playout of from 10 to more than 300 MPEG-2 streams. The server can store more than 1,000 hours of compressed media assets and has I/O bandwidth performance of 320Mb/s per controller.



Fox has a history of picking winners. And, when it came to selecting a primary format for their in-house recording and post-production, they knew they had to select another star performer. So, for their new 24-hour cable service, FOX NEWS Channel, they chose JVC's Digital-S. And the reasons are clear.

PICTURE QUALITY. Fox found the picture quality of Digital-S to be superior, even through multi-generation editing. Better than any analog system, better than any 4:1:1 digital system — it even rivals the quality of the most expensive 4:2:2 digital systems.

AFFORDABLE PRICE. Linking up to big time winners like Digital-S usually costs a lot of money. So Fox was pleasantly surprised when they learned how reasonably priced it was. Nowhere else can you find such exceptional picture quality and affordability. And, that's always a winning combination.

AMAZING FLEXIBILITY. Producers everywhere, prefer equipment that enhances their creativity. The same is true at Fox. The 4:2:2 digital signal processing of Digital-S is extremely flexible, and delivers the kinds of layering effects and keying that producers demand.

After considering all of the alternatives, only Digital-S satisfied Fox's most stringent requirements, making it the obvious choice. And, the affordability puts it in a class of its own. To learn why Digital-S should be your editing format of choice, visit our Internet web site at www.jvc.ca or call 1-800-JVC-5825 and mention Product Code 188 0.

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The StreamCaster solution consists of a server platform, disk drives to store digital media content and output interfaces and the StreamCaster application software. Several hardware configurations are possible to support a range of reliability and price/performance goals. The servers are connected to disk drives that are used to store the digital media streams and can be arranged into striped volumes or RAID configurations.

System architecture

The server is built on a layered architecture. On top of the hardware resides the IRIX real-time operating system and IRIS FailSafe high-availability software. The file system technology used is XFS, a 64-bit journaled file system that allows guaranteed specific transfer rates and durations for video files.

IRIS FailSafe connects two servers, designating one as active and the other as "hot" standby. FailSafe allows the two machines to share a common disk system, such as RAID, and will switch over to the standby server in case of the failure of the active server's hardware or operating system.

XFS scales in performance with the server architecture and supports file sizes to nine million terabytes, file systems to 18 million terabytes and parallel dump and restore. XFS supports contiguous data through file system extents, allowing the creation of block sizes from 512B to 1GB.

System components

The StreamCaster application software drives broadcast network applications, such as digital satellite services or terrestrial services, such as multichannel multipoint distribution services (MMDS), fiber to the curb (FTTC) or hybrid-fiber coax (HFC). StreamCaster has four primary components: asset manager, playlist manager, scheduler and operator administration. The friendly, easy-to-use user interface is Java-based, enabling the application to run on an intranet from any workstation or PC.

Asset manager installs MPEG-2 assets into the server, as well as displays, adds, deletes, edits and searches for catalog entries in the database.

Playlist manager creates, edits and deletes the scheduling information for the assets. The playlist may be generated locally on the server through a graphical users interface (GUI) or downloaded to the server from an external system.

Scheduler takes input from the playlist and executes the events, playing MPEG-2 media streams from the storage system to the output system. During playback, the MPEG-2 transport streams are transmitted via an asynchronous transfer mode (ATM) 155Mb/s OC-3c interface.

Operator administration facilitates a range of system administration functions, from monitoring service messages to network bandwidth. The server can be managed via the standard Simple Network Management Protocol (SNMP). Interfaces enable the interoperability with legacy or new external systems. ■

Karl May is group manager for digital video systems, Silicon Graphics Inc., Mountain View, CA.

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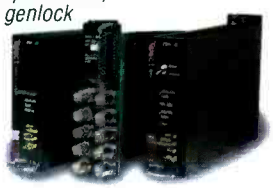

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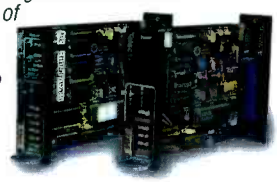

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Video servers crossing the bridge to tomorrow

By Ken Freed

The progress of server development and deployment is like the advance of a humble servant struggling to carry a great burden across a rope bridge in the pale light of dawn. More than a heavy workload vexes the carrier. Too many masters drive him, and their conflicting visions constantly joggle the bridge with new demands. These masters may not be sure where they're going, the server sighs, but they sure are in a big hurry to get there!

Digital server technologies are being developed for every application from television to radio to the Internet. Each usage has different architectural requirements. Channel capacity, bandwidth and scalability may grow with declining costs under Moore's Law, but the standards still vary for video acquisition, production and distribution.

Vendors speak out

The path of server evolution remains undecided, agree those speaking for a dozen server vendors, yet they identify trends and they articulate the issues that may decide which vision of the road ahead will command the video server left standing at the end of the bridge.

"The initial trend," says Jonathan Pannaman, vice president of engineering for Quantel, "was to see broadcast video servers as simple devices, like cache carts, but a number of facilities like CNN have started to break through this philosophical barrier by seeing the revolution that integrated server networks can bring to television."

"As broadcasters start to deploy video servers," says Alanna Dwyer, director of strategic planning for new media solutions at Digital Equipment Corporation, "they're asking for more features and more functionality, more ease-of-use. They're asking for scalability across the board, which means more channels, more output streams, all backed by more storage and faster access to more content."

"A strong trend I'm seeing this year," says Gil Press, manager of network storage marketing for EMC, "is the convergence of media servers and web servers with a graphical interface, like on the web, as the bridge to help with assets management in any facility with a growing digital library."

"The trend everybody is watching pretty carefully is having a more distributed architecture with video servers in high-speed loops," adds Jack Androvich, marketing manager for enterprise servers at Sun Microsystems. He's referring to Fibre Channel, the architecture positioned to compete with the large-server topology favored by IBM and its partners.

"People want a lot more channels than they can get from any single server," says Dan McGee, broadcast products research and development manager for Hewlett-Packard, "and Fibre Channel allows you to have tomorrow's channel capacity with today's technology."

"The real issue is the amount of on-line storage and the amount of near-on-line cache storage," say Don Lefebvre, a broadcast solution executive in the media and entertainment division of IBM. "With the rapid growth from two or four output streams to hundreds of output streams, a gigantic server can offer more storage in less space than a bunch of smaller servers linked together."

The stakes are enormous, says Tim Slate, storage products marketing manager at Tektronix. "Centralized storage may be right for some situations, yet a distributed topology will be easier and less expensive to scale up as time passes on. Even the smallest servers soon will have more channel and bandwidth capacity than today's largest servers as the line between them starts to blur."

"My big concern is server reliability," says Press. "You hear the talk about RAID, for instance, since you need to know what to expect in case of failure, but you also need to know how to match a server's reliability to given applications."

"If you think about the whole video server market in terms of the three main functions of acquisition, production and distribution," says Richard Bauarschi, director of marketing for new media technologies at Pioneer, "the video servers' biggest inroad is in distribution. There are fewer servers available for production, and there's still no standard format for acquiring video and putting it straight into a server where it resides as a file folder that can be transported into an edit suit and worked on immediately."

And once the video is acquired, says Greg Estes, director of marketing for advanced entertainment systems at Silicon Graphics, "What we really need is asset management middleware, so a producer or news director can seamlessly browse assets created by different applications."

The key is to have customized video server solutions, Press says, "but this requires developing a set of common standards that support different types of video formats and compression schemes within the same server."

"Is there one server that can do it all?" asks Jerry Berger, manager of video server technology for the Sony professional products group. "If a total end-to-end solution for acquisition and production and distribution is what you want, MPEG-2 4:2:2 compression can support an integrated, interoperable system, but even here you have to remember that not all MPEG is created alike."

"Eventually," Slate says, "we need a server standard as universal as NTSC for all this technology to be accepted into the mainstream." Says Bauarschi, "I'm convinced market forces will cause all this to sort itself out."

"The question for anybody looking at buying a video server is whether they're looking at an isolated server or a full production system," says Stevan Vigneaux, director of broadcast industry marketing for Avid. "A video server with connections for the workstation may be exciting, but how does it integrate with the entire production system?"

"Customers are looking at consolidating operations to create cost efficiencies and improve effectiveness within their organizations, as always," Berger says. "Yet now they're looking at generating new revenue streams by offering new services. Interactive television in the home is the striving goal of the future, and servers are a key enabling technology for the interactive programming services."

"The expectation today is to deliver interactivity by integrating the Internet into video services as soon as the infrastructure allows," says Dwyer, "yet we still need the digital set-top boxes to deliver true video-on-demand and other ITV services."

The overriding deployment issue, claims Androvich, is the rate of adoption for new server technologies. "We need to work together and be patient. After all, we only just got FCC approval for DTV, which was like waiting for Godot, so we need to accept that it's not going to happen overnight. We also need to know it's going to happen.

"There's still a lot of shaking out required in server technologies and applications," says Pannaman, "and I'm concerned that the wrong choices could leave broadcasters with a bad taste. I'm hearing one of two attitudes toward servers at TV operations. 'I'm doing it this way, and I want to keep doing it this way," or "I've always done it this way, and now I want to do it differently." So, when it comes to servers, a lot depends on how far broadcasters are willing to go and how fast they can let go of the past." ■

Ken Freed is a technical writer specializing in cable and interactive television, and is based in Denver.

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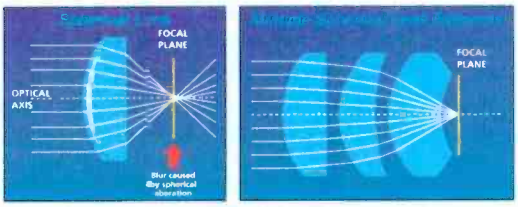

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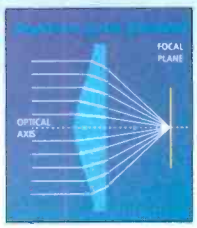

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SDI headroom and THE DIGITAL CLIFF

Digital systems operate in two ways: perfectly or not at all.

BY JIM BOSTON AND JIM KRAENZEL

THE BOTTOM LINE:
Digital systems' consistently high performance under a wide range of operating conditions may seem a panacea, but it can become a troubleshooter's nightmare. Digital paths give no indication of gradual degradation, so complete failure often comes with little warning. Growing experience has recently yielded some new methods of determining how "close to the edge" a digital signal path is running. $

It is well-known today that digital signals are non-linear. To state the obvious, it is the "high" or "low" state of a serial digital signal along with its transition time that determines the state of a data bit cell in a serial digital bitstream. The transition area between the high and low states is undefined when determining the value of an individual bit. To maximize the chances of reliable detection, sufficient signal amplitude is required so noise or receiver inaccuracies don't cause errors, and small amounts of attenuation (e.g., 200 feet of cable loss) do not cause the high and low values to fall into the undefined middle area.

The transitions or "edges" between states are just as important. These transitions enable clock recovery from the bitstream in a self-

Photo: Large digital routing systems such as this one are meticulously designed and, when properly installed, will provide years of trouble-free operation. (Courtesy of Sony and DIRECTV.)

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clocking signal, such as SMPTE 259M. Without a clock at the receiving end, there is no way to know when to check the status of an arriving bit. An algorithm is used to scramble data before it leaves the transmitter to create as many edges as possible. This assists the receiver's PLL circuitry in generating a local clock synchronized to the transmit clock.

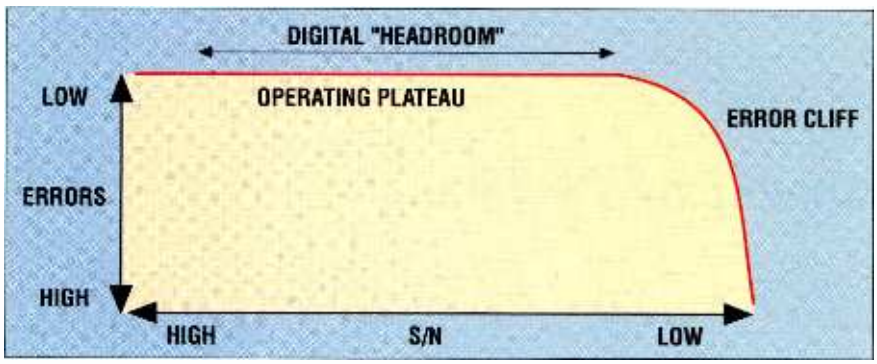

Figure 1. All digital systems experience the "cliff effect," in which performance remains optimal until S/N degrades beyond a certain limit.

Error correction and error masking in modern digital equipment ensures that digital signals don't gradually degrade with increasing attenuation in the signal path as analog signals do. Instead, a digital transmission path continues to work perfectly up to the point where it suddenly doesn't work at all. This is the well-known "cliff effect." (See Figure 1.)

Serial digital interface (SDI) signals that are experiencing few or no errors are somewhere on the operational plateau shown in Figure 1. Operation remains uneventful until you reach the *error cliff*. As the path traverses over the knee of this cliff, errors go rapidly from non-existent to enough to swamp recovery efforts, making the path unusable. As little as three extra feet of coax can be enough to send a signal over the cliff.

Many things determine where you are on that operational plateau. This article describes how to determine where you are on the plateau and how to stay away from the cliff. Although almost all the information presented can be applied to $4f_{SC}$ composite signals (or most other bitstreams), this study centers on 4:2:2 component SMPTE 259M signals.

Bandwidth and signal requirements

Although the SDI signal is used in a "digital" way, many "analog" attributes of the signal can be used to predict how close to the error cliff a particular path is. Figure 2 shows a typical SDI signal. The portion shown here is of three successive "1"s in a SMPTE 259M datastream.

The SMPTE 259M datastream changes state at the start of each bit cell if the bit cell has a data value of "1." This coding scheme is known as *non-return-to-zero inverted* (NRZI), which implies that the receiver needn't worry about the polarity (high or low) of the incoming bitstream. NRZI yields a constant high or low if a string of zeros is encountered, however, so a bit-scrambling algorithm is added.

The peak-to-peak value of SMPTE 259M should be 0.8V, and the *rise time* (or transition time) should be between 0.75ns and 1.5ns. If the signal's transmission path had infinite bandwidth and no group delay, it would appear as a perfect square wave — but no transmission path is ideal.

Moreover, the successive "1"s in that example create a true square wave (50% duty cycle), but the typical SDI signal with a variety of "1"s and "0"s will actually create *rectangular* waves (<50% duty cycles), which require a denser spectrum of harmonics to properly define. This means that a considerable amount of low- and high-frequency harmonics will be present in the SDI signal.

Consider also that many elements in the SDI signal still happen at traditional TV rates. Pairs of *start of active video* (SAV) and *end of active video* (EAV) timing reference signals occur at the horizontal line rate. The patterns encountered during the vertical interval still occur at the field rate. All of this ensures that considerable energy will occur at fairly low frequencies.

Spectral analysis

While a 6MHz bandwidth sufficed for analog video, serial digital video requires more than 50 times that spectrum. In short data paths, SDI harmonic content can approach 1.5GHz. Figure 3A shows the spectrum of a typical SMPTE 259M datastream.

The weak link in most serial digital systems is the path from the transmitter in one device to the receiver in the next device. The physical layer used to transport the data between devices is comprised mostly of coax (although some connectors and perhaps a jackfield might also be included). Coax provides the greatest exposure to problems for a video datastream. It can be thought of as an infinite network of inductive and resistive components in series, with distributed shunt capacitance. This works out to be a low-pass filter whose poles increase in number and move closer to zero with length. Therefore, the longer

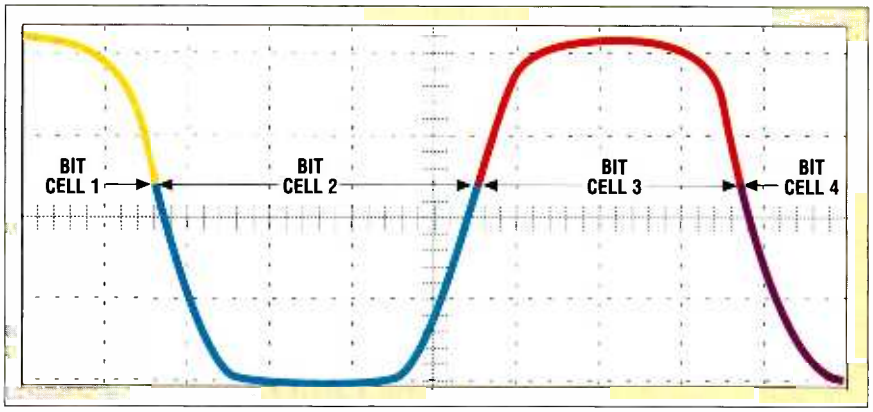

Figure 2. A portion of a SMPTE 259M datastream showing three successive "1"s.

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the cable, the greater the attenuation of all frequencies, with the rolloff increasing as a function of frequency.

Such attenuation with increasing frequency creates losses in the upper harmonics of the SDI signal, while its substantial low-frequency energy remains relatively strong. This causes the signal's square waves to look more like sine waves. Adding 1,000 feet of coax to the SMPTE 259M signal shown in Figure 3(A) makes its spectrum look like Figure 3(B). The signal in the latter graph is just about at the error cliff.

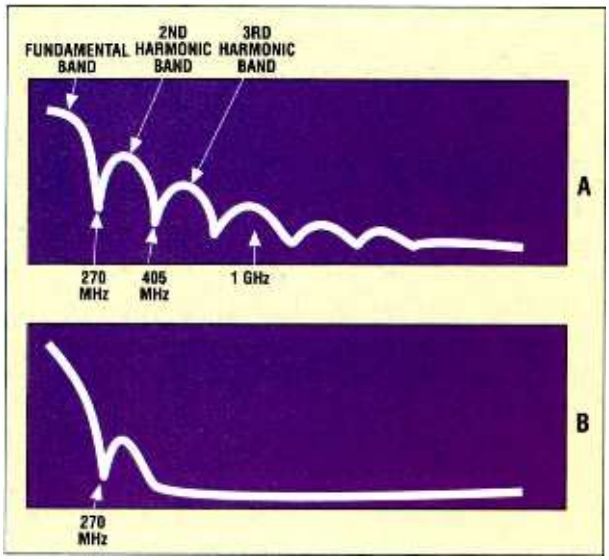

Figure 3. The spectrum shown in (A) represents a healthy SMPTE 259M (component) signal, while (B) shows the same signal after passing through 1,000 feet of coax.

Cable recommendations

To minimize this problem, coax that is robust at high frequencies is required in a digital facility. The center conductor should be solid copper (which offers better skin effect then stranded types), the shield should be braided (with a coverage figure near 100%), and the shield should also include a layer of foil (again for better skin effect at higher frequencies).

The dielectric should produce as low a shunt capacitance value as possible, which will also serve to decrease the high-end rolloff and increase the velocity of propagation. However, note that some dielectrics achieve this by using air pockets to lower the dielectric constant, which can lead to center conductor migration. This, in turn, can cause changes in the impedance along the length of the cable, especially at sharp bends, leading to reflections.

Signal-to-noise measurements

One of the best ways to tell how far away a given path is from the error cliff is to determine the S/N ratio of one of the principle spectral elements in the SDI bitstream. The SMPTE 259M document states in its preamble that the standard applies until the fundamental frequency of the signal (135MHz for 4:2:2 component) has dropped 30dB in value. (Note that 135MHz is the fundamental of the SDI's square wave form, because each half-wavelength carries one bit of the 270Mb/s SDI [component] data rate. Each bit cell in Figure 2 represents one half of that square wave. The fundamental of a 135MHz square wave is a sine wave of the same frequency.)

Experience indicates that there are two spectral components whose S/N values are useful in determining SDI signal health. These are the SDI's fundamental frequency and its third harmonic (405MHz).

Using a spectrum analyzer, the third harmonic band is easy to observe. (See Figure 3[A].) The second harmonic component should not be used to determine an S/N value even though it is easily identifiable, because its initial value can vary from one piece of equipment to the next. Some users focus on the 270MHz second harmonic, and mistakenly believe it's a carrrier. Bit scrambling ensures that SDI pulse trains are rich in odd harmonics, and even harmonics (like 270MHz) are not well-represented.

At the output of most SDI drivers, the third harmonic starts approximately 35dB above the noise floor (vs. 45 to 50dB above noise for the fundamental). After approximately 1,000 feet of high-grade coax, the third harmonic is approximately eight to 10dB above the noise floor. As this signal approaches some 6dB above the noise floor, clock recovery becomes unreliable and errors start occurring.

As this lower limit (the error cliff) is approached, the error rate will rapidly increase from one per day to one per frame over a range of only 3dB. Actual tests have shown the SDI signal going from low error rates to unusable due to a signal level drop of only 2dB. This is equivalent to adding a little less than 80 feet of coax to the path. Therefore, any passive path segment that indicates a third-harmonic S/N value of less than 10dB should be re-engineered.

Remembering that the overall level at low frequencies will not be significantly affected, a time-domain display of the SDI signal will show reduced amplitude on short-duration pulses, but normal levels on longer (i.e., lower-frequency) pulses. (See Figure 4.) Note that the signal also will float away from ground, dependent on pulse duty cycles because of the large low frequency and DC components that aren't rolled off as quickly.

Pathological testing

Another indication that you are near, but not yet at, the error cliff can be obtained through the use of so-called *pathological test signals*. As described earlier, an SDI receiver's circuitry must regenerate the clock signal. To help it do that, most ASICs devoted to receiving SDI signals equalize the incoming signal to boost the high frequencies, allowing easier clock regeneration and data-value determination. Pathological signals produce bitstreams that stress these circuits. Many devices produce these test signals,

> Tests show the SDI signal goes from low error rates to unusable from a signal-level drop of only 2dB.

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including some digital VTRs.

One common pathological signal stresses the clock regeneration and the equalizing circuitry by producing values for C and Y that force SDI bit-scrambling circuits to produce a run of 19 zeros and a single one approximately every frame. With NRZI coding, the single one ensures a polarity reversal for the next run of 19 zeroes. This stresses the equalizer circuitry in the receiver by providing a large DC component "blast" every so often. The fundamental of this signal is at 13.5MHz, which adds to the low-frequency energy component.

Other common types of pathological signals have C and Y values that produce runs of 20 ones, followed by 20 zeroes periodically. This produces edges at only a 13.5MHz rate, which is 1/20 of the optimum zero-crossing rate. This stresses a receiver's clock recovery circuits by making the PLL "coast" for long periods of time. It should be understood that there are literally thousands of possible Y and C combinations that can produce pathological bitstreams.

Experimentally, results show that a path will fail with a pathological signal at received levels 2dB higher than where a non-pathological signal will fail. Therefore, pathological signals can help determine whether an SDI path is near the error cliff.

Jitter

Jitter is the time difference between when the next transition in the datastream *should* occur and when it *actually* occurs. SMPTE RP-184 is the document that covers the suggested method for measuring jitter in a 259M bitstream. The location of appropriate crossover points can either be determined by the previous crossover (PLL internal closed-loop control) or by an external reference signal. Jitter is caused mainly by a transmitter's crosstalk, signal saturation characteristics and its power supply, plus any jitter that was present in the parallel data before it was serialized. (Most digital circuits process digital video as parallel data and only serialize it immediately before transmission.)

> Patchfields and mismatched connections are common causes of serious reflection problems.

The PLL clock circuit in the transmitter should also have a critically damped transient response so that it slews to a corrected frequency quickly without any overshoots (called *overdamping*). Invariably, the PLL will be underdamped at certain frequencies of jitter, and thus, the PLL response will ring at those component frequencies.

If an oscilloscope is used to measure the signal in the time domain by looking at zero crossings, incorrect conclusions will be gathered about the amount of jitter present. The time base (scope sweep rate) will act as a comb filter to cull out certain frequency components of the jitter. This is because various jitter frequency components are only happening at certain rates, and the scope is not looking at all bit cells. If we have a scope triggering on every 10th bit cell, we will not see the 1/10th jitter component at all. Conversely, some jitter components will be seen at double their actual amplitude.

One accurate way of measuring jitter is to extract the clock and phase-demodulate (or discriminate) it. This is the only time that part of the SDI signal should be considered as a carrier. Once the clock — and its jitter — have been regenerated, the clock can be thought of as an FM signal with the jitter information as its payload. The baseband amplitude of this demodulated signal is the relative jitter. Some test equipment claims to take this approach, which allows a bar graph or gas gauge-type display that's easy to read.

Other test equipment uses the approach recommended in RP-184, which extracts a clock that is divided by some amount and used to trigger an "eye pattern" display. The divisor is typically the same value as the word size (usually 10 bits). This method will mask any word-related jitter, which is usually quite small.

The jitter components of frequencies above 10Hz should have less than 0.5ns of time-base jitter. The jitter components with low frequencies (generally called *wander*) could have errors as large as 6ns. Therefore, trying to deduce the jitter while looking at the total aggregate jitter is meaningless.

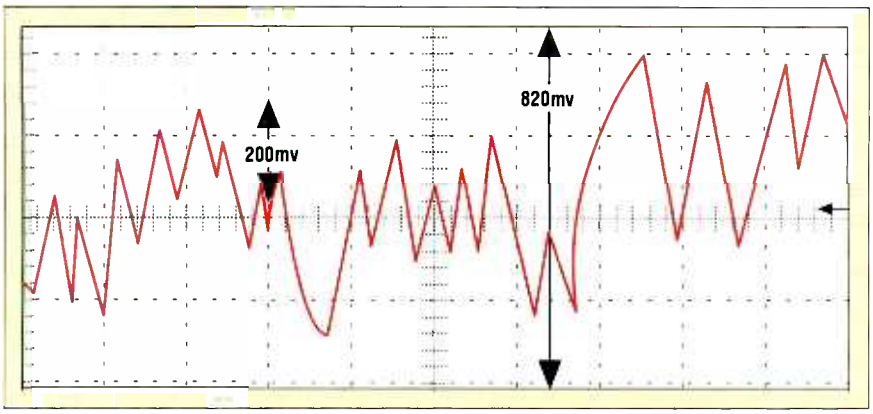

Figure 4. Time-domain display of an SDI signal that has passed through 1,000 feet of coax. Note lower amplitudes on shorter-duration pulses due to high-frequency attenuation by cable.

Reflections

Because it takes 1.24µs for a bit to propagate down 1,000 feet of Belden 1694 coax (velocity of propagation 82%), and a 3.70ns-long bit cell occupies approximately three feet of coax, there are 335 bit cells in 1,000 feet of coax at any given time. The same length of Belden 8281 (velocity of prop-

Continued on page 119

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Moving to software-based open systems

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BY DAVID HOPKINS

For nearly 20 years, the digital video effects seen on television have had a major impact on the video production process. As digital effects technology has grown, so have the appetites of producers to create the latest and greatest digital magic.

Early digital video effect systems (DVEs) required entire racks of equipment and provided simple 2-D re-sizing. During the '80s, the first 3-D DVEs were introduced. Now, they have become fixtures in virtually every edit suite and production room. Many have even found their way into master control. Whether it's a subtle adjustment of color tint or a dynamic quad page peel, digital processing of video data is universally used to correct "mistakes" and add creative impact to video images.

Photo: Four-way real-time page peel with live video on both sides by Pinnacle DVE.

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Digital effects SYSTEMS:

Moving to software-based open systems

The beginning

Digital special effects got started in the late 1970s with the Vital Squeezoom and was followed by NEC's DVE and the Quantel 5000. These were all 2-D boxes able to compress (some could also expand) and position live video. By 1980, special effects were essential to post-production, and the Quantel 5000 was the device of choice.

In the early '80s, 3-D rotation with perspective was introduced by Ampex in the ADO. Soon, the ADO had replaced the Quantel 5000 as the most popular DVE, despite the fact that it cost close to $200,000. By 1986, 3-D manipulation was essential for high-end post-production, while 2-D effects remained popular with the mid-level broadcast, business and industrial markets.

After 3-D manipulation, new innovations became possible: recursive effects, drop shadows, warps and the page turn. By the end of the decade, these capabilities had become de rigueur for high-end post. Mapping a 2-D video signal onto a 3-D object followed soon after. Systems like Sony's System G, Microtime's Impact and Pinnacle's DVEator brought users a new level of creativity by allowing video to be mapped onto 3-D objects in real-time.

Today, the buzz words for broadcast-level DVEs are 10-bit processing and multichannel effects. The number of bits and sampling points define the "approximation" of the video signal in its digital form. An eight-bit video signal resolves the video component to 256 discrete steps, while a system using 10-bits provides 1,024 discrete levels of resolution.

The use of multichannel DVEs is widespread. Most sports and news programs have segments that require two or more channels of digital effects. In post-production work, these can be created in a single-channel system, using multiple passes – something that isn't possible in a live environment.

Until now, it's been expensive to incorporate multiple channels of 10-bit processing capability into a DVE. It's now possible to get a full-blown, broadcast-quality 3-D DVE on a single PCI card at a small fraction of the price of earlier systems. Performance that costs more than $50,000 10 years ago can be had for less than $10,000 today.

In the mid-'80s, the move from task-specific dedicated electronic boxes began. Rather than using specific processors and operating systems, manufacturers turned to standard PC platforms to run dedicated 3-D hardware. The advantages of a common and affordable platform, coupled with standard software development tools, brought enormous cost savings. As an added benefit, the ability to upgrade features and functionality through software-only updates made this approach attractive.

Software effects

While digital effects hardware technology has advanced, so has the use of software-only DVEs. Typically used for still images or rendered effects, the features of software-only systems are impressive.

Using animation software, it's possible to map video onto complex 3-D shapes. The disadvantage is the rendering time. Each frame must be individually rendered and recorded. The results can be stunning, but once recorded, any changes require re-rendering the entire animation. As PCs and Macs became faster, these effects were quicker to create, but could still not be applied to "live" video feeds in real-time.

Discounting the time involved, the software approach is the least-expensive way to manipulate video. Digital video data is read from disk, decompressed and then processed by the unit's CPU. Because programs can be written to manipulate video pixels in infinite ways, there is no limit to the type of effects that can be generated.

The key drawback to software effects is speed. A single frame of video consists of almost 400,000 pixels. With each pixel being two bytes, the processor needs to manipulate almost 1MB of data per frame of video, and the numbers rapidly add up. A single second of video consists of 30 such frames, with the total data rate ranging from 21MB/s for NTSC to 25MB/s for PAL. Because many effects involve two video images requiring the processing of many pixels just to produce one output pixel. Without them, the resulting effect will look blocky and can have aliasing artifacts.

Editor Mike Dennis, seated at one of Realtime Video's post-production suites, considers digital effects equipment required tools when he's responsible for the results.

Generating 3-D shapes from a video signal that is inherently 2-D requires highly sophisticated processing. To make matters worse, real-time requirements mandate unusually powerful processing with extremely high bandwidth. It's not unusual for a 3-D DVE to perform in excess of 20 billion operations per second, while accessing data at rates up to a GB/s.

Although CPUs have made great strides, the limit is bus and system bandwidth. As a result, a page turn effect can be 100 to 200 times slower than real-time. In other words, a one-second transition will take two minutes or more to produce. This rendering time may seem small, but it can add up over the course of an editing session. Moreover, the non-interactive nature of the process can limit creativity.

Because processing doesn't occur in the problem becomes doubly difficult.

Picture quality can also be a problem for software-based effects. Producing top-quality effects requires signal processing techniques, such as subpixel positioning, interpolation and filtering. These are time-consuming algorithms,

Digital effects SYSTEMS:

Moving to software-based open systems

real-time, software effects must be recorded back to disk before they can be played back. This also increases the total processing time, while taking up more disk space.

Non-linear editing systems make use of these software DVEs. However, because most users prefer not to pause during the creative process, many systems offer the option of hardware DVE for real-time effects.

The hardware approach

One solution to the slow processing of software effects is using dedicated hardware. Unlike the CPU, these devices don't need to be general-purpose, and can be made as fast as desired. They can keep up with the input video data and process pixels in real-time allowing direct recording to tape.

The traditional drawback to the hardware solution has been the cost of the additional circuitry needed to process video. However, with the advent of low-cost, high-density custom ICs and ASICs, the premium has come down substantially. Today, clever implementation and large-scale integration has allowed these systems to shrink in size and cost.

The open systems approach

As PC software has evolved, the advantages of an open systems approach also have increased. Standard Windows-style interfaces provide a familiar operating environment. Easy connectivity brings versatility to users, with the ability to copy sequences and graphics from one DVE to another and interface seamlessly between DVEs and still-stores or other graphics devices. Standard networking is useful for integrating different hardware tools. The interconnection of different devices through a standard protocol allows transfer of data digitally.

Although video is still the main source for images, the ability to incorporate material created on a diverse range of systems adds to creative flexibility. BMP, TGA and TIFF file formats, for example, can all be imported into open systems. Even the web can be used as a transmission means for bringing images from around the world into a live broadcast.

Design issues for open systems

When designing an open system, the first step is to choose a software and hardware platform. The PC has become a powerful and cost-effective production platform. In addition, the strength and acceptance of the various Windows operating systems makes them an obvious choice on which to run a DVE control system.

The main issues then revolve around incorporating the necessary hardware into the PC platform. Hardware can be connected externally to the control system, although this can result in the loss of some of the PC's speed benefits. This isn't a problem on the control side, even a slow 386 computer is capable of running a user interface and computing spline points. It is a problem in the transfer of graphic elements within the system. These graphics may be used as part of special wipes or simply recalled as part of an effect.

Pinnacle Genie, a 3-D digital effects system on a single PCI card.

If hardware is incorporated into a PC environment, there are design issues regarding size and power consumption. Also, PC buses aren't inherently fast enough to process video at the resolution and frame rates required for real-time 3-D manipulation of multiple channels of full-bandwidth, uncompressed video.

The adoption of the Movie2Bus (developed by Matrox) provides a standard means to pass video between boards in a PC environment without using the PC bus. The PC bus can then be left to deal with the control issues for which it's ideal. ASICs and large field-programmable gate arrays have helped reduce the size and increase the processing power of hardware systems. This allows the latest generation of DVEs to incorporate multiple channels of video within a single system.

Another element in designing an open systems platform is the customization for the particular requirements of a broadcast DVE. The unit must be able to integrate into existing facilities and it should be rugged in construction to meet the needs of the user. DVEs need to be rack-mountable and resilient to withstand bouncing around in OB vehicles. Standard connectors (BNCs for video, RS-422 for control, GPI connection and peripheral control ports) have to be added to make installation and integration easy.

Once the hardware is designed, the control element requires careful attention. The PC environment relies on its GUI, mouse and keyboard. However, traditional video users still want the availability of a dedicated control panel. Even with the PC, it's possible to bring together the best elements from both approaches. The GUI provides a fast and convenient way of seeing the DVE's status, while a dedicated control panel provides fast access to controls for adjustments. With multichannel DVEs, the amount of information required is substantial. Using small, limited displays can hinder efficient use, but a GUI allows the information to be displayed in a variety of formats.

As DVE systems move from dedicated hardware to a more software-based and open systems approach, the benefits of higher quality, more flexibility and less-expensive DVE technology can be enjoyed by all. ■

David Hopkins is DVE business manager for Pinnacle Systems, Inc., Mountain View, CA.

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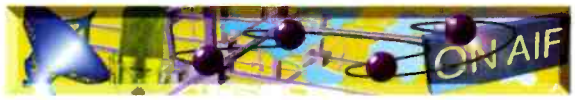

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The new digital CAMERAS

Ready to see the 21st century?

BY KEN FREED

THE BOTTOM LINE:
The future direction and pace of digital camera development will determine the variety and quality of video acquisition. That's logical, yet the process may not be a smooth dolly zoom shot. The digital cameras we'll use in 2001 to broadcast the fireworks on New Year's Eve, will offer performance capabilities rivaling analog video at least, even if not yet capturing the look and feel of motion picture film emulsion. $

The portable cameras available in the next two to four years, according to manufacturers, will be more flexible and reliable. The familiar camcorder may give way to dockable portable and studio cameras. And the digital cameras of tomorrow will be switchable on-the-fly from 4:3 to 16:9. Sound like a tempting way to capture images?

Key technology issues remain unresolved. Tomorrow's portable cameras will be dockable for adapting to competing image recording formats because of the variety of recording formats.

Says Larry Thorpe, vice president of acquisition systems for the Sony Business and Professional Group, "Broadcasters are still looking to make this transition to high-definition digital television. When they decide to acquire DTV cameras, what cameras will they choose? What we're hearing from our customers is that they already get terrific performance from the

Photo: New studio lighting, like this modular lighting system from Videssence, is often a good reason to replace old studio cameras.

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The new digital CAMERAS

existing cameras.

"They're always asking for more and more sophisticated signal processing along with more control over creativity. Users also want support for multicamera operations, with high-speed distributed microcomputer controls, so fewer people can operate more cameras."

"The biggest problem in the conversion to digital TV," contends Bill Sturcke, digital camera product manager for Panasonic Broadcast and Television Systems, "is that the infrastructure has to change so radically broadcasters are not sure how long it will take to get caught up. A new studio camera now sells for up to $100,000. But what will be the final cost of new HDTV cameras? And what will be the total cost of studio implementation to take full advantage of the HDTV cameras? This is a difficult time for broadcasters. If they buy a digital camera today, when will it become obsolete?"

Hitachi PW2000.

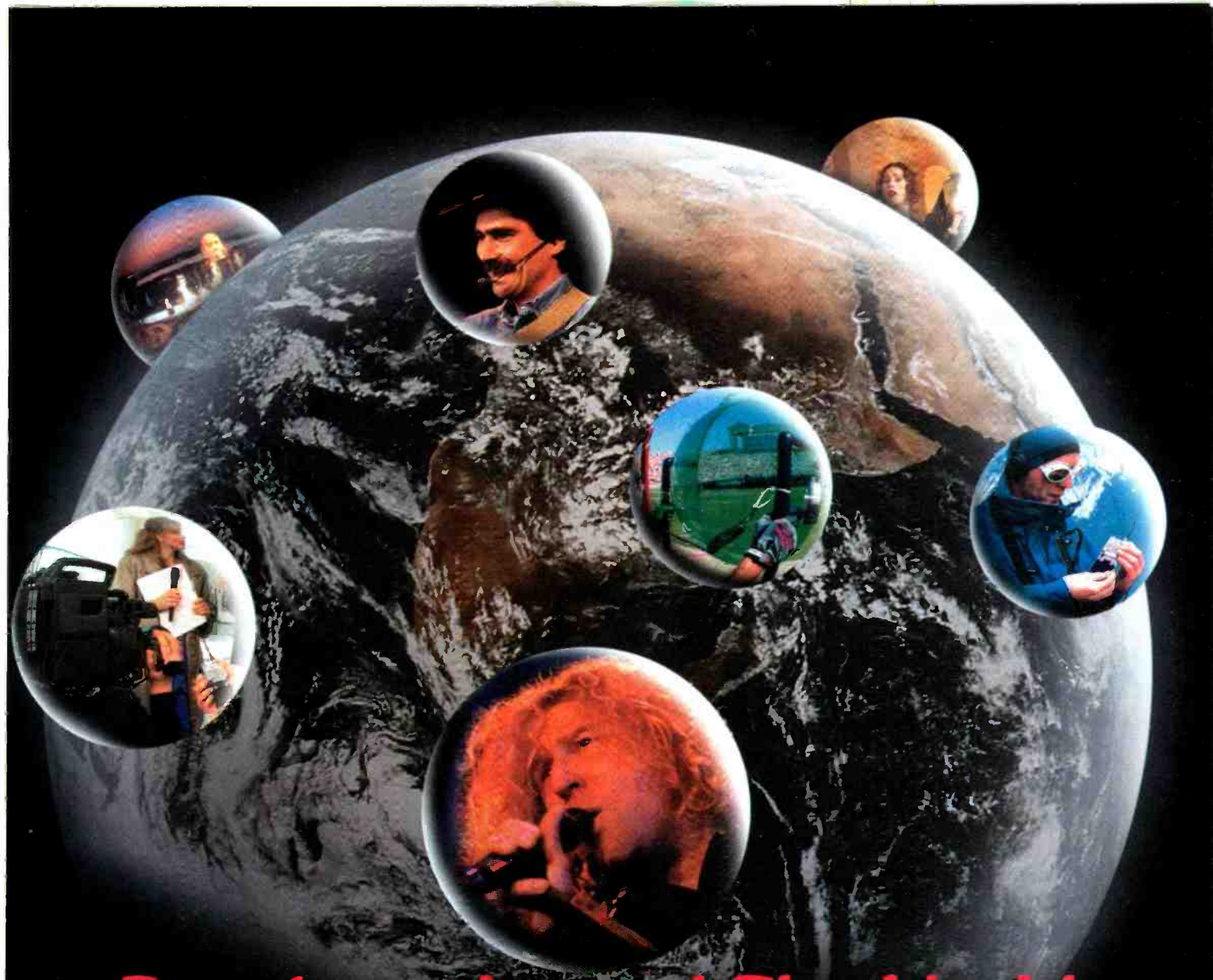
Performance capabilities

"As digital camera technology progresses," says Greg Pine, vice president in charge of cameras for Philips BTS, "many people feel that more is better. The bigger question is how much is enough?" "The market cry has been for digital because of the assumption that digital is better," says Jerry Cohen, camera products marketing manager for JVC Professional Products Company. (JVC cameras with remote-control heads, linked by triax cables, broadcast the Super Bowl.) "But the challenge for digital cameras has been trying to make their raw performance equal to analog or even film. In terms of characteristics, such as artifacts and noise and drift, until recently, the performance of digital cameras has been below that of their analog cousins.

> "But the difficulty with digital cameras has been trying to make their raw performance equal to analog or even film."

"Today, however, it's possible to have digital cameras with the same performance as analog or perhaps slightly better. And we still can't capture the dynamic range of film. Even with these improvements, we need to take giant steps, not the baby steps taken so far."

More details are offered by Alan Keil, vice president of engineering for Ikegami USA. "The wide availability of improved detail enhancement, color matrixing, gamma correction and oth-



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The new digital CAMERAS

er performance features is a result of lower-cost DSP and ASIC devices, and another important element has been development of better CCDs.

"Right now, most cameras are limited to 10-bit signal processing, but we're moving rapidly to 12-bit signal processing. I believe the latest CCD technology puts today's cameras right up there with the capability of the best 35mm film," says Keil.

Sony DNW-90W5.

"A/D conversion soon will move beyond 10 bit and 12 bit to 14 bit," says Michael Rosner, North American camera support engineer for Thomson Broadcast Systems. "Every camera manufacturer wants to have at least 12 bit for broadcast.

"I think we're going to see 14-bit cameras within the next two to four years," he predicts, "but the 14-bit process is not yet implemented because of available technology and product pricing. The 14-bit A/D converters are still too expensive to put into broadcast cameras."

Format flexibility

Pine offers an example of Philips on-the-fly switching between image formats. "At the Italian ski finales in early February, daytime activities are being shot in 16:9 for Italian TV, and at night, after the press-of-a-button, they were shooting 4:3 for live transmission to the U.S. They used aspect ratio converters for playback of the daytime events." According to Rosner, "We expect to see 16:9 cameras move from Europe to the United States by 1998."

"Camera manufacturers are seriously thinking about how to meet the requirements of DTV," says Sturcke. "We're developing cameras that can acquire video at 525-lines interlaced, and we're thinking about more advanced products that can handle 525 progressive, 720 and ultimately, 1,080 lines, interlaced and progressive. Yet, the real issue is the choice between 4:3 and 16:9." "The near-term solution," says Ikegami's Keil, "is for us to manufacture cameras that are switchable between 4:3 and 16:9. We've now reached the place of being able to process digital signals at either image format."

BTS/Philips LDK 10P.

"For a switchable 16:9 camera to do 4:3," says Pine, "you have to turn off the left and right side of the picture for a 25% drop in picture size. Doing this may require an 0.8 diopter or else the camera may have to back away from the subject. In a side-by-side comparison, I think it's a shell game of whether you really do have to switch in a diopter."

"More and more cameras are already starting to include switching capability as an option." Panasonic's Sturcke says, "The ability to switch between 4:3 and 16:9 soon will be a common feature. The problem still will be building the infrastructure. It's expensive to convert to HDTV."

JVC KY D29.

ENG camera flexibility

"When it comes to ENG operations, flexibility is the key," says Pine. "For instance, as the world goes more to digital recording and 601 output, digital news-gathering will evolve so it becomes normal on a fast-breaking story to do a live lead-in and then roll an event from the camera with no time to pre-feed, and then cut back to live again. Cameras must be flexible enough to meet these needs."

Keil says Ikegami customers want flexibility in their digital ENG cameras. Yet, he points out a downside of using that camera in the studio. "You compromise serviceability for portability. The average studio camera doesn't need the flexibility of a field camera, and the benefit of a full-size camera hard-wired into the studio is that it's virtually always easier to service than a portable camera in the field. Plus, the studio camera is more reliable."

Thorpe comments that studio and ENG cameras increasingly are being built into the same basic housing with the same optical lens interface. "This will help ease the transition to HD by reducing the size of the up-front investment required for digital acquisition."

Camcorder or dockability?

We've now considered the camera itself, but that's not the whole story. "When you say camera," says Dave Walton, marketing manager for JVC professional products, "this means only the thing that holds the lens, a prism, a sensor and a processor to create the best possible signal to record. The thing that makes the image is not the recording device."

Blurring the distinction between cam-

Ikegami HL-59.

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The advantages OF TAPE

Videotape has been around for more than 40 years; another 40 is not out of the question.

BY STEVE EPSTEIN, TECHNICAL EDITOR

THE BOTTOM LINE: With all the hoopla surrounding hard drives and video servers, it's easy to believe that tape, if not dead, is dying. Nothing could be further from the truth. Videotape sales are still increasing and for field acquisition, tape is still the best bet. With millions of VCRs in daily use, it will be a long time before videotape joins the LP on museum shelves. $

Magnetic tape, from one-inch to minicassette and DLT, provides the most cost-effective re-recordable storage available. Whether the recorded information is audio or video, analog or digital, the cost in terms of dollars-per-megabyte can be as little as one-tenth the cost of hard-disk storage. At first glance, it's hard to believe that anyone would switch from tape to disk. However, everywhere you turn it seems there is a new video-on-hard-disk application. Is everyone turning to hard drives or is it just smoke and mirrors — like the PR about the web's blazing speed?

For the last few years, we have heard nearly endless arguments promoting the advantages of disk drives and the disadvantages of using tape. Unfortunately, those promoting the advantages of tape have been overwhelmed by the disk proponents. So, what are tape's advantages, and are they relevant in today's business climate?

Dollars and sense

Video applications using hard drives are increasing, but so are tape sales. Getting an accurate picture of the tape markets is not easy with the variety of factors involved. Overall revenues from tape sales can be misleading, because unit prices have dropped

Photo: State-of-the-art slitting equipment is used in the tape manufacturing process at the Fuji facility in Greenwood, SC.

The advantages OF TAPE

over the last few years. Unit sales for older formats also fail to portray a truly accurate picture, as buyers are switching from older formats, such as one-inch and U-matic to newer (mostly) digital component formats. However, despite the switch to newer formats, it's estimated that U-matic sales in 1995 were in the $50 million range, second only to Betacam tape sales.

The most accurate indicator may be tape sales of the newer metal-based formats, which have increased more than 40% over the last two years. Much of the reason for the acceptance of these new formats is due to the higher recording densities offered by improved formulations. These higher densities permit compact, lightweight digital camcorders to be used for field acquisition.

With tape sales for new formats growing rapidly, there is little doubt that recorder sales are significant. For smaller operations without a staff engineer, tape machine maintenance can be a problem, but it's no worse than other types of equipment. For the non-technical, head replacement isn't that different from hard-drive replacement — both are done by someone else.

For those versed in technical matters, either task can be accomplished relatively easily, although the head replacement does require access to test equipment. However, most of the equipment required is standard in any reasonably equipped shop. Only a small percentage of the tools needed are specialized for specific tape machine models. Additionally, newer formats have benefited from years of experience, and manufacturers have gone to great lengths to reduce the cost of replacement parts and the amount of maintenance required.

In terms of sheer numbers and MTBF, tape machines are costlier than hard drives, but when was the last time you lost all of your programming because your tape machines contracted a virus that spread throughout the facility? As independent dedicated devices, VTRs can provide years of service without requiring constant software and hardware upgrades. Rarely do tape machines have to be reset after a "crash" due to software bugs. For the most part, tape equipment is there, day after day, doing what it's expected to do.

A fair amount of maintenance is required, especially cleaning the tape path. However, the more tape machines you have, the easier it is to assign one person the task of maintaining them all. An equal number of computers will also require someone to watch over them. Between installing upgrades, locating lost files and simply dealing with day-to-day incompatibility issues, computer systems require a nearly equivalent amount of maintenance and upkeep. Additionally, in most cases, a top-notch computer maintenance person is likely to cost more than a highly qualified VTR tech — especially if you intend to support multiple platform types or tape formats.

On another front, well-maintained tape equipment has proved to be far more useful at the end of a seven-year depreciation cycle than most computers after only two or three years. The cost of migrating from one system to another must be considered, especially when tape equipment can easily outlast three, maybe even four, computer systems. For field acquisition, tape wins hands down.

Despite the announcement more than a year and a half ago of a disk-based camcorder, the unit remains in beta test with the first shipments scheduled for early this year. Tape-based field equipment is proven technology. It is robust and compact enough to go to the bottom of the Atlantic to record the final resting place of the Titanic, to the top of Mt. Everest, and to make numerous trips into space aboard shuttle missions.

Where tape really shines is in archiving applications. Even the computer folks agree. A 1994 article from *LAN Times* titled "Tape is Here to Stay," states, among other things, that tape backup systems are deeply entrenched in data-protection schemes, and that tape will continue to play an integral role in backup and archiving, especially as part of hierarchical storage schemes. The relative simplicity of tape machines ensures that a 20-year-old tape, if properly recorded, will playback today. Tape is so stable that the hard part is finding a working tape machine of the proper format.

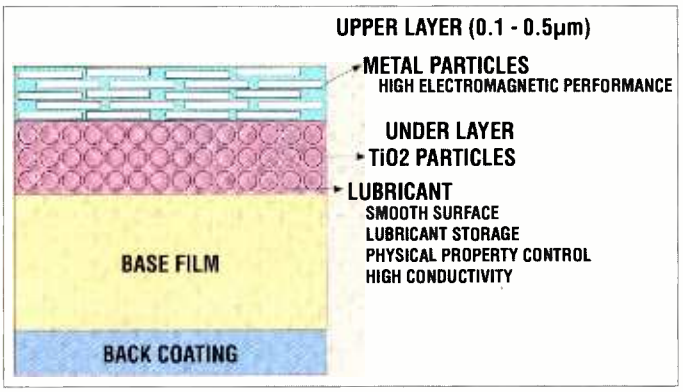

Figure 1. New tape formulations, such as ATOMM from Fujifilm, have made possible new recording formats, such as Iomega's ZIP disk, Panasonic's DVCPRO and JVC's W-VHS.

So what?

Tape provides low-cost, high-volume storage that is stable over the long term if cared for properly. Disk technology provides quick random access. Carefully examining the intended application will reveal which of these technologies is the best fit. Facilities with tape-based equipment will continue to find it useful and are likely to continue to place a heavy emphasis on tape for years to come.

Future upgrades will come in the form of tape and disk equipment. Newer units on the market combine tape and disk systems within the same device giving users even more flexibility.

Tape and disk technology are different, and comparing the two is much like comparing apples and oranges. Having one doesn't necessarily render the other useless. As we move into the 21st century, tape and disk systems are likely to co-exist in a complementary, rather than competitive, relationship. Both are based on the principles of magnetic recording and both will benefit from future advances in magnetic technology. ■

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BRINGING CREATIVE MINDS TOGETHER

By Don Markley

New antenna technology

The problem for transmitting antennas is not really what's available now, but what will be needed in the future. The major changes that have occurred in the past couple of years have been involved with the low-power TV industry. The huge number of stations in that service spurred rapid development of lower-cost antennas to operate at the lower power level. Those antennas have been modified to operate at intermediate power levels and still keep the cost down.

The big manufacturers have been competitive in developing good antennas capable of handling up to 30kW input power, depending upon the manufacturer and the channel. These antennas are available as either non-directional or with a wide range of directional antenna patterns. When equipped with fine matching sections on the input, they can be tuned to provide excellent VSWR across a channel. Readers of this column will remember that a maximum value of 1.05 or less at visual carrier, 1.08 at aural and color frequencies and 1.1 over the entire channel has been highly recommended for NTSC systems. But the new specter of DTV will change those numbers slightly.


Don Markley

As discussed in previous columns, some manufacturers have suggested a maximum return loss of 30dB across the entire 6MHz channel for DTV operation.

> The real problem will be trying to combine the NTSC signal and the DTV signal into a common antenna, especially on adjacent channels.

This corresponds to a maximum VSWR of 1.065 across the channel. This should be attainable with careful construction and field tuning after installation. Remember, this VSWR value is for the entire transmission system including the coaxial cable or waveguide. Higher values of VSWR may result in an increase in the bit error rate, which would contribute to limiting the service area of the station.

Combined operation

The real problem will be trying to combine the NTSC signal and the DTV signal into a common antenna, especially on adjacent channels. As has been widely publicized, the commission is proposing to allot first-adjacent DTV channels for many existing stations. This applies to high-band VHF channels, as well as UHF. Low-band VHF channels are not proposed for use in the DTV world. The stated reason for this is that they are too noisy. Interesting. The real reason appears to be so the commission can auction off those channels as soon as possible.

The problem is making an antenna flat over 12MHz to accommodate the NTSC and DTV signals. First, the same old numbers are still desirable for the NTSC channel. After all, that's where the station revenues are coming from now and until DTV receiver penetration becomes really significant. So it's necessary to maintain the old 1.05 and less than 1.1 VSWR numbers while


Andrew Corporation's TRASAR broadcast antennas can be engineered to be suitable for NTSC and DTV transmission.

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Circle (57) on Free Info Card

The TUP panel antenna from Dielectric provides UHF operation over any of the assigned UHF channels.

holding the additional 6MHz to 1.065. That should be fun.

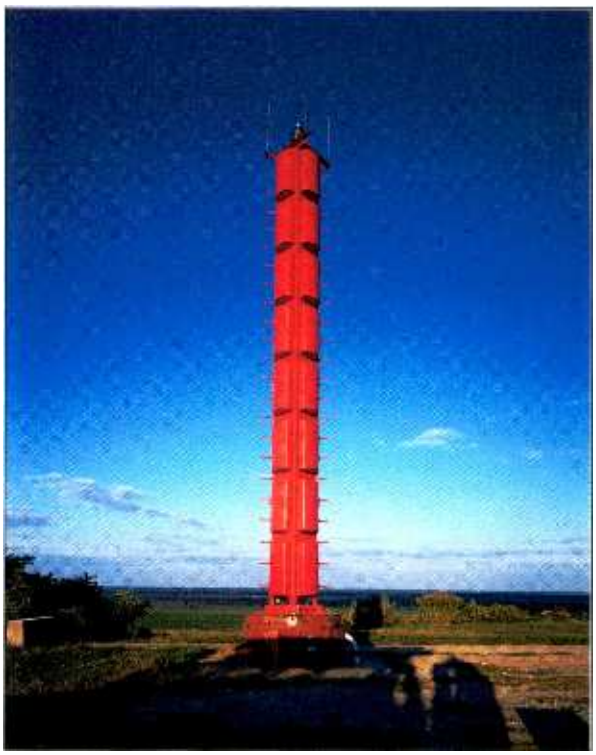
Recent tests performed by Harris Corporation indicate that first-adjacent channel DTV operation may not be quite as simple as hoped. The commission has established a radiation mask for the new DTV service. However, systems that fully comply with that mask may still cause an increase in noise in first-adjacent channel operation. Additional correction or filtering at the transmitter may be necessary to fully eliminate that interference. Extra filtering may also be necessary on the output of the NTSC transmitter to eliminate any lower sideband that may have been reinserted into the output signal by non-linearity in the final amplifier stages.

The primary problem with the new antennas will be the requirement to radiate the two adjacent channels while maintaining the appropriate VSWR. Next, the transmission line system will have to have minimal reflections to avoid all sorts of new problems between the two signals. Finally, the NTSC and DTV radiation patterns need to be similar. Operation in a DTV null area that isn't in an NTSC null opens the door to significant interference even when both transmitters are well-filtered. The same will apply to the opposite condition, which will increase the apparent noise level in the NTSC channel.

The final problems that will be faced are not really known and will not be known until a number of first-adjacent channel systems are constructed.

The old problem of beam steering obviously exists to further increase the antenna designer's headaches. Simply put, the vertical angle to the tip of the main lobe needs to be essentially constant over the entire bandwidth. If a beam tilt of -1° is to be used, that same beam tilt must be maintained over not 6MHz, but 12MHz. Depending on the antenna feed system design, this may be difficult to do, but is essential if pockets of interference between the services are to be avoided.

In review, the final problems that will be faced are not really known and will not be known until a number of first-adjacent channel systems are constructed. Unfortunately, the commission seems to be committed to tearing away as much of the TV spectrum as possible before the industry has a chance to find out how the real world reacts to the new service. There seems to be a frightening tendency to brush concerns to one side with the assurance that it can all be worked out. Maybe it can — we certainly hope so — but it's going to take a lot of work to not only make the new systems work, but to clean up many of the old antenna and transmission line systems so that they can peacefully coexist with DTV.



This Harris TAD-16UDA UHF Deltawing antenna is shown on the company's test range near Palmyra, MO.

This is sort of like figuring out how to obtain 5,000kW ERP DTV operation so that the VHF station moving over to UHF will maintain the same service area. Unfortunately, the commission's computer doesn't understand that such an operation will require a peak transmitter power output of more than 750kW unless highly directional. Maybe that will work out as well. Sure. I think that I just saw some pigs fly by. ■

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

The new digital CAMERAS

Thomson Broadcast Systems1657D.

era and recorder has been done for marketing reasons, confides Cohen. "Some companies in the past may have built a camcorder to force people to buy a camera and recorder at the same time, but now the trend is reverting to dockable cameras and recorders."

"Even if the camera and recorder look like one unit," says Walton, "dockability means the camera head can be physically attached to any recorder you want."

Cohen sees the chief obstacle to widespread adoption of dockable cameras as the failure of the industry to establish some kind of universal docking format. "If cameras could easily dock to various VTRs without the need for an adapter, think what a tremendous benefit that would be to the whole industry. Unfortunately, I do not see that happening yet. Even within some manufacturers' own product lines, VTRs don't always share the same docking format."

Panasonic AQ-23W.

Choosing a camera

"When it comes to buying any new camera," says Cohen, "it all boils down to two simple questions: What does the picture look like, and how much does it cost?

"Broadcasters now have to decide if and when they want to get into advanced digital cameras," says Jack Breitenbucher, vice president of the broadcast and professional division of Hitachi Denshi America. "They need to declare themselves, and not just with HD cameras, but with routing, switching and transmission. A lot of these products aren't even made yet, so there's a big growth curve ahead.

"Assuming it takes off," he says, "this will change the way we look at television and open a whole new doorway for digital products. ■

Ken Freed is a technical writer specializing in cable and interactive television, and is based in Denver.

By Phil Scott

Acrodyne's dual Diacrode transmitter

At CTN we had the opportunity to update our network from low-power transmitters to high-power UHF systems. As part of this rebuild projet, I selected Acrodyne Diacrode transmitters for the Nashville, Tampa Bay and Fort Meyers locations.

In the past, CTN went through a stage of sending our signal by satellite to low-power stations in various locations, but now we've advanced to full-power UHF operations in five major urban areas.

Our flagship station is WCLF-TV, Channel 22, serving Clearwater and Tampa Bay, FL. The other four stations are WHTN, Channel 39, serving Nashville; WHBR, Channel 33, serving Pensacola, FL, and Mobile, AL; WFCG, Channel 61, serving West Palm Beach, FL; and our newest station, WRXY, Channel 49, serving Fort Meyers and Naples, FL.

For the Nashville station, we installed an Acrodyne Au120D dual-tube 60kW Diacrode transmitter with 120kW total output. This dual Diacrode transmitter is one of the first in the country.

At the Fort Meyers station, a single-tube Au60D — its 60kW Diacrode transmitter — is already in place, although we're still completing the electrical hookup. And soon, we expect Acrodyne to ship another single-tube transmitter to the station in Tampa Bay. We'll replace the West Palm Beach transmitter in about a year, but we won't replace the Pensacola transmitter anytime soon because it's less than 10 years old. For the record, the only Acrodyne product we had previously was one exciter in Clearwater.

The dual Diacrode transmitter already in operation is housed at the old transmitter site in the flatlands about 15 miles outside of Nashville. The surrounding terrain has deep valleys and high ridges, but nothing rises more than 100 feet above sea level except for our Dielectric antenna on an 820-foot stick.

In evaluating the decision to go with the Diacrode transmitter, the determining factor was the lower operating cost of the Diacrode tube and the smaller footprint of the transmitter.

Dual system operation

The most unique feature of the dual transmitter is the two 60kW systems running in parallel with an automatic impedance switching device. Each tube produces 60kW in combined mode, aural and visual or 80kW in visual mode alone. And the dual exciter system means each transmitter tube can operate independently. If the Diacrode amplifier system goes down or is taken out of service, the station can stay on the air just by using the driver section of the transmitter for direct-to-air operations at about 15kW output. The driver section is sufficient as a standby backup. For instance, when changing tubes, there's a trickle RF charge that goes to the tube so we can tune the tube off-line and then put it on at full power to complete minor adjustments. I like this kind of user-friendly operation.

The transmitter also has good automatic shutdown

An Acrodyne Au60D single-tube 60kW Diacrode transmitter.

CTN's new Acrodyne transmitter, the Au120D dual-tube 60kW Diacrode transmitter with 120kW output.

features with higher-power turn-off in case of a power surge or a lightning strike. The transmitter turn-off power is 19ns, faster than the rise time of lightning, and it automatically turns the tube off, so it doesn't blow out it in case of a surge.

Something else I like is the lower plate voltage of the Diacrode — about 8,000V as opposed to 32,000V to 34,000V for an IOT or a klystron. I believe that there will be fewer problems with an 8,000V system than a 30,000V system.

This brings up another reason for the dual transmitter. The size of Nashville requires 100kW output, and two 60kW Diacrode tubes together provide 120kW. If we went with an IOT, the capacity of the units available now would have required a three-tube transmitter.

The economics of the Diacrode also mean lower replacement costs. Each Diacrode tube costs about $25,000 with a minimal life expectancy, based on estimates by Thomson Tube Electronics and others, of 20,000 hours, which means about $1.25 per hour for tube replacement.

We had in an initial problem setting the high-voltage trip point without creating a false trip. The transmitter did have a couple click offs while we were getting that adjusted. In this regard and several other instances, Acrodyne has been good with field support by phone or in person. They've flown someone in about three time so far, more at their insistence than ours.

Overall, I can report that the one Diacrode transmitter installed so far is operating well. I'm now looking forward to getting the other two transmitters on-line so that I can sleep better at night. ■

Phil Scott is director of engineering for the Christian Television Network, Clearwater, FL.

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new products

By Deanna Rood

UPL audio analyzer
Tektronix

• UPL audio analyzer: a high-speed, low-distortion, dual-domain audio measurement tool developed by Rohde & Schwarz; the analyzer performs an array of audio measurements at high speeds; features options for flexible digital interface testing, including jitter analysis and generation; the special analog signal pre-processing extends the dynamic range beyond that of the internal 20-bit converter so the UPL can easily verify the performance of tomorrow's 20+bit converter designs.

Tektronix Measurement Business Div., Literature Distribution Center, PO Box 1520, Pittsfield, MA 01202; 800-426-2200 (press 3, code 568); fax 413-448-8033; www.tek.com/Measurement
Circle (250) on Free Info Card

Integrated stills and clips system
Pioneer New Media Technologies

• Digital FastFile: an integrated stills and clips system ideally suited for broadcast applications demanding real-time performance for the retrieval and playback of video segments; using scalable M-JPEG compression and hard-disk technology, users can record up to two hours of material on a standard system (an optional disk storage array can be added to increase recording time).

Pioneer New Media Technologies, 2265 E. 220th St., Long Beach, CA 90810; 310-952-2111; fax 310-952-2990; wwwpioneerusa.com
Circle (267) on Free Info Card

AES/EBU digital interface
Intraplex

• High-fidelity audio modules for AES/EBU digital transport capability: a line of audio modules that can feed AES/EBU digital audio over Intraplex's TDM-160 T1 multiplexer systems and TDM-260 2Mb/s multiplexer systems and stay all digital end to end; the AES/EBU provides transmission of audio sampled at 32, 44.1 or 48kHz, providing interface support to all common digital studio and transmitter equipment.

Intraplex, 3 Lyberty Way, Westford, MA 01886-3636; 508-692-9000; fax 508-692-2200
Circle (268) on Free Info Card

ENG broadcast lens
Fujinon

• A10X4.8EVM/ERD: a wide-angle lens that provides an 85° horizontal range of view; the lens features Fujinon's Aspheric Technology, electron beam coating and a new internal focusing system allowing it to be used in extremely tight settings; in addition, the internal focusing system eliminates pumping effects, providing a constant picture size during focusing.

Fujinon, 10 High Point Dr., Wayne, NJ 07470; 201-633-5600; fax 201-533-5216
Circle (269) on Free Info Card

Logo generator and keyer/inserter
Leitch

• LGI-6801: a serial logo generator and keyer/inserter built as a plug-in module for the 6800 series of frames; it accepts standard computer gif, tif or targa images downloaded through an RS-232 port; logos are stored in uncompressed 4:2:2:4 digital format providing full linear key storage; the LGI generates a logo with linear key and inserts pictures into any area of a serial program video signal; Leitch products that fit in these frames may be used in conjunction with the DigiBus digital conversion system or used as independent products to resolve conversion needs.

Leitch, 920 Corporate Ln., Chesapeake, VA 23320; 800-231-9673; fax 757-548-4088
Circle (266) on Free Info Card

DVCPRO camcorder
Panasonic

• AJ-D200: a digital DVCPRO camcorder that is able to use the large DVCPRO cassette with 123 minutes of recording time; with three 1/3-inch CCDs, it incorporates a new high-density interline transfer CCD giving a resolution of 480,000 pixels, due to double density pixel distribution; the AJ-D200 comes fully equipped including lens, viewfinder and tape and battery.

Panasonic, +44(0)-1344-853870; 100427.1536@compuserve.com
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new products

Adjacent-channel antenna
Dielectric Communications

• DC-10JSC cardioid: an adjacent-channel slot-type antenna that is more than just a two-channel antenna; Dielectric's center feed design and custom illumination provide excellent amplitude and phase response across two channels.

Dielectric, 22 Tower Rd., Raymond, ME 04071; 800-341-9678 or 207-655-4555; fax 207-655-7120; dielectric@main.com; www.dielectric.com
Circle (254) on Free Info Card

Miniature three-CCD camera
JVC

• KY-F32: a highly sensitive 1/2-inch three-CCD color camera featuring high picture quality and wider lens interchangeability; this multipurpose camera weighs 1.9 pounds and has a 1/2-inch standard bayonet lens mount that enhances versatility; in addition, negative video output capability allows the camera to be used for photographic and film applications; the KY-F32 offers 750 lines of horizontal resolution and a high signal-to-noise ratio of 60dB for broadcast picture quality.

JVC, 41 Slater Dr., Elmwood Park, NJ 07407; 201-794-3900; fax 201-523-2077
Circle (253) on Free Info Card

Programmable audio/video controllers
Telect

• Programmable controls for audio/video equipment: programmable button controllers that allow users to remotely program any input, output or level configuration to a single button; with a hand-held keypad programmer, users can quickly set routing controls for eight to 32 different pieces of equipment; the controllers operate up to 600 feet from their routing switchers.

Telect, 2111 N. Molter Rd., Liberty Lake, WA 99019-0665; 800-551-4567 or 509-926-6000; fax 509-926-8915; www.telect.com; getinfo@telect.com
Circle (262) on Free Info Card

Portable time-code DAT recorder
Fostex Corporation of America

• PD-4 (version two): a second-generation portable time-code DAT recorder that incorporates Fostex's unique four-head design in order to provide off-tape confidence monitoring; version two comes with a built-in 3x2 channel mixer with three-position pan functions allowing users to send input from one channel to either or both channels; selectable 48V phantom powering and variable low-cut filters are also available.

Fostex, 15431 Blackburn Ave., Norwalk, CA 90650; phone 310-921-1112; fax 310-802-1964; www.fostex.com; info@fostex.com
Circle (260) on Free Info Card

Spectrum analyzer
RO.VE.R. S.p.A.

• TS1: a compact, robust 1GHz spectrum analyzer that carries out EMC precompliance, scalar network analysis and spectrum analysis; features include coarse and fine tuning, white peak hold to measure modulation depth with high accuracy and universal AM/FM audio demodulator with a built-in loudspeaker.

RO.VE.R. S.p.A., Via Parini 2-4, 25010 Colombare di Sirmione (BS), Italy;+39 30 91981; fax +39 30 9906894
Circle (255) on Free Info Card

Digital intercom
Trilogy Broadcast Ltd.

• Commander 2: the latest version of this digital intercom has been revised with new hardware and new software; the panels have improved ergonomics and some additional facilities including four assignable level controls and local logic functions.

Trilogy Broadcast, 25 Focus 303, Walworth Estate Endover, Hampshire SP10 5NY, United Kingdom; +44 (0)1264 384000; fax +44 (0) 1264 334806;www.pro-bel.com
Circle (263) on Free Info Card

Digital editing system
Pixel Power

• Collage EDit: a non-compressed, non-linear digital editing system that incorporates real-time text and graphics capability; the fully featured Collage ED, including a Mediapack, is capable of storing 36 minutes of non-compressed 4:2:2 video and six mono track hours of 24-bit digital audio.

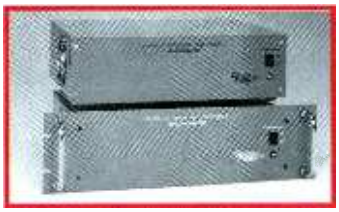
Pixel Power, #1 Trinity Hall/Nuffield Rd., Cambridge CB4 1TG England; +44 (0) 1223-423399; fax +44 (0) 1223-423868; 100424.1514@compuserve.com
Circle (270) on Free Info Card

D1 video transport product
Video Products Group

• VPG8000: a serial digital interface transport system that provides a way to embed digital or analog program audio and machine controls into a SMPTE 259M-compliant or ITU-R 601-compliant 270Mb/s bitstream; the VPG8000 systems can be chained to support metropolitan-area, regional or countrywide 270Mb/s SDI transport network between studios, broadcasters and post-production houses providing pristine, uncompressed, real-time D1 video, audio and data transport.

Video Products Group, 1125-B Business Center Circle, Newbury Park, CA 91320; 805-375-2855; fax 805-375-2851
Circle (264) on Free Info Card

Universal power-line conditioner
Constant Power



• Global power line conditioners series: universal, wide-range input for Constant Powers' 1-3kVa global power line conditioners; the GPLCs provide pure sine wave output which is regulated to ±2%; any user can select their own AC voltage and frequency output because the GPLC series is independent of its wide-range input (80-300Vac/45-75Hz) ensuring adaptability into the multitude of worldwide power voltages and frequencies; the models are available in pedestal and 19-inch rack-mounted configurations.

Constant Power, 14 Commerce Dr., Danbury, CT 06810; 203-748-7001; fax 203-797-9285
Circle (261) on Free Info Card

Educational video series
Sony

• Media Forum: a videotape series that shares more than 40 years experience in simultaneous development of media and hardware; the five-part series covers troubleshooting, tape handling, a step-by-step look at the manufacturing process, the fundamentals of magnetism and a guide to understanding tape specification sheets.

Sony Electronics/Recording Media, 680 Kinderkamack Rd., Oradell, NJ 07645; 201-476-8000; fax 201-476-8072
Circle (257) on Free Info Card

Transmission system
Harmonic Lightwaves

• MAXLink: a 1,550nm transmission system for broadband networks; the system incorporates a unique SBS suppression and performance doubling technology for the highest launch power and performance available at 1,550nm in the cable and TV industries — users can launch 17dBm into a single fiber with no SBS; the MAXLink is ideally suited for long-distance transmission and a variety of evolving applications, such as interconnecting cable system headends and telecommunications sites.

Harmonic Lightwaves, 549 Baltic Way, Sunnyvale, CA 94089; 408-542-2500; fax 408-542-2511
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 Photos from Corel CD

Continued from page 30

of an existing NTSC station. Other channels are eliminated because they would be susceptible to interference from NTSC stations or DTV-to-DTV interference would result if both were used.

In this way, the channel allotted to one city restricts the channels that can be allotted in nearby cities, and this effect spreads like a daisy chain across the United States. When a list of candidates has been prepared for each area, the service areas of the DTV channels are calculated and matched to the existing NTSC service areas. Adjustments are then made to better satisfy certain optimizing criteria and the process is continued until the results appear satisfactory.

The next step: Full-power testing

Full-power testing of experimental DTV stations is the next logical step. In fact, it may take more than one-station-in-a-market to convince all the broadcasters that the allotment/assignment is valid for all stations. Indoor testing needs to be done at different distance radials and varied "effective radiated powers" from the transmitter. Two transmitters in the same market will need to be transmitting at large power differences and measurements must be made accordingly. Data channels of varied widths may be tested to prove viability of data broadcasting in different reception scenarios.

There are already experimental stations broadcasting digital signals. These stations will certainly be involved in this next phase of propagation testing. For example, the model station at WRC, Washington, DC, has already served as a source of encoded digital TV signals to aid equipment manufacturers in the development of new lines of electronic equipment. Auxiliary data transmission, interactive video services and satellite, optical fiber and microwave feeds will be evaluated.

This will be the next phase of testing at the model station. It is a natural progression because the Grand Alliance has loaned two sets of Grand Alliance DTV hardware for use prior to the availability of prototype or commercial equipment. The project involves the collaboration of respective organizations to design, install and operate an experimental high-definition TV terrestrial broadcast station. The main transmitter will be upgraded to a system with much higher power.

The danger and how to avoid it

Generating a good assignment table is a lengthy and complex process, but one that is finally nearing completion. In the draft assignment tables, DTV channels have been assigned so that the DTV service areas closely replicate existing NTSC service areas. Terrain mapping data (Longley-Rice) has been used to predict signal propagation, coverage and interference. The lower power of some of the new UHF stations will save the stations from high power bills. The higher power of some of the new UHF stations will surely provide extra robust signals in urban areas.

We broadcasters have high expectations, as well we should; soon the digital signal will be our primary business! Each channel in every market will have its pros and cons; some may work out better than others. The purpose behind the FCC assigning the second channel is to allow broadcasters to jump-start the DTV market. Should there be too many broadcaster complaints, all broadcasters will lose. There will be no early start, and even worse, the FCC could release the unused spectrum to industries that will not respect or appreciate broadcasters' issues. ■

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

The importance of agreement in the industry

Representatives of the broadcasting, consumer electronics and computer industries reached an agreement on technical standards for advanced television. As with any new technology, the digital TV 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 would not be fully characterized and spectrum would never be fully optimized. If there had been delays in embracing the DTV standard, the marketplace would have been confused, and station implementation would have been at risk. An agreement and consensus on a technical broadcast standard was needed to prevent technical and market chaos. ■

Continued from page 86

SDI headroom and THE DIGITAL CLIFF

agation 66%) has 416 bit cells (2.4 feet long each) within it at any given time. Conversely, a color subcarrier cycle in 8281 is 175 feet long (only 5.70 of those in 1,000 feet of Belden 8281 at any given time).

Any impedance mismatches that occur along the path cause reflections. In the analog video world, only long paths with impedance mismatches had the possibility of causing reflections that were bothersome. Reflections caused by improper impedance matches in cable were hard to discern. They showed up as nearly imperceptible ringing during transitions, providing unintentional enhancement or cancellation (in addition to the obvious incorrect level caused by non-terminated or double-terminated lines).

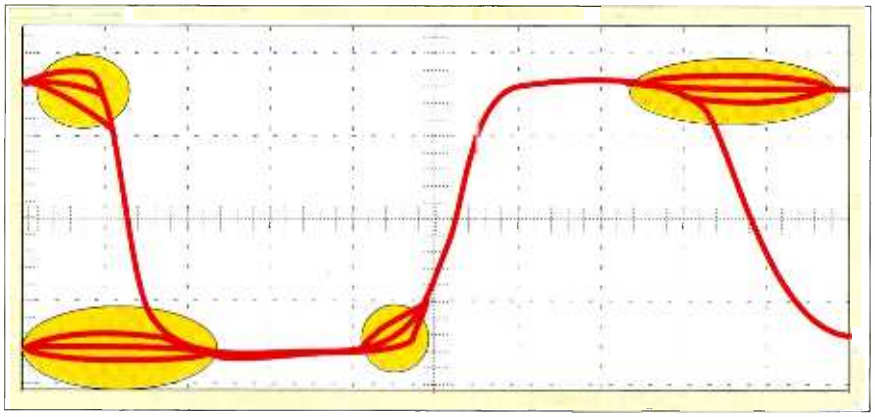

Figure 5. A digital oscilloscope's display of an SDI signal on a double-terminated path. Highlighted areas indicate ringing at transitions caused by reflected signals.

In the digital domain, however, a path that's only a few feet long with reflections could prove disastrous. In this case, it's not the incorrect level that usually draws attention when incorrect terminations are applied to a path. Rather, it's the *total loss* of recovered video because reflections have made recovery of the embedded clock impossible. Impedance mismatches as small as 20% can cause errors. Even tees with short lengths of unterminated cable can cause complete loss of signal. Patches, connectors or barrels can increase errors or cause signal loss, as well.

Problems can develop particularly in older installations, because until a few years ago, most BNC connectors had a characteristic impedance of only 50Ω. Subsequently, the amount of polyethylene or Teflon dielectric was reduced to increase the characteristic impedance to 75Ω. Early 75Ω connectors were manufactured by reducing the diameter of the center conductor pin, making them unable to mate properly with 50Ω connectors. But newer 75Ω connectors ("reduced dielectric") will mate reliably with the 50Ω connector, allowing them to keep turning up at older facilities.

Although a time-domain reflectometer (TDR) is the best tool for finding impedance mismatches along a path, a digital oscilloscope set to a long persistence will give hints that reflections are occurring. Figure 5 shows a path that is double terminated. The receiver looking at this datastream will probably report many errors, if it is able to recover data at all. Reflected energy, not only out of phase, but possibly many bit cells behind the current data, is creating a ringing effect at transitions.

> Reflections can totally shut down a digital path, even when all its other attributes are normal.

Also consider that impedance is not constant with frequency. The value of an impedance is represented by a complex number, which has not only magnitude, but also direction (or phase). It is the ratio of resistance and inductive plus capacitive reactance that determine the magnitude and direction (or phase angle) of the resulting impedance. When impedance in one segment of a digital path is not equal to impedance of the next segment of that path, reflections result. Reflections cause power to be reflected back to the source, lowering the transmitted power and causing transmission loss.

Patchfields and mismatched connections are common causes of serious reflection problems. These can greatly reduce the distance a digital signal can travel without errors. Note that reflections can totally shut down a digital path, even when all the other attributes of the path are normal and healthy. Casual observation of the eye pattern generated by the data passing through a mismatched path might not indicate any serious problems. This is where network analyzers or TDRs are more helpful, but lacking these, you should remain critical of the analog attributes of the eye pattern. Just because a system is now "digital" doesn't mean that its group delay, ringing and pre/post overshoots are no longer important and need not be monitored.

Good engineering during the design and implementation portions of a digital video project should ensure that your data paths are some distance from the error cliff. In addition, determining the signal's amplitude above the noise floor (especially at higher frequencies), ensuring that jitter is as low as possible and that there are no reflections along your paths should provide proof that you have a well-engineered and trouble-free digital system. ■

Jim Boston is senior product support engineer at Sony Automation and Transmission Systems Engineering, San Jose, CA. Jim Kraenzel is senior systems engineer for Sony Systems Integration Center, San Jose, CA.

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QUICK DIAL 72

nova SYSTEMS, INC.

StudioFrame Modular Video Processing System

The Nova StudioFrame Series is a modular, flexible, digital/analog signal processing system. It is designed to efficiently and effectively combine a wide variety of individual function (or processor) boards such as A-D and D-A converters, video signal encoders and decoders, audio and video distribution amplifiers and frame synchronizers into more complex function groups, all in one equipment mainframe. The scalable nature of the StudioFrame design allows it to be easily reconfigured and/or upgraded as today's video standards and requirements continue to evolve. The system is based on two rackmount frame models (the SF-3 and SF-1) allowing up to thirteen front loading processor boards and thirteen rear mounted passive interface cards to be accommodated in a single chassis. Both the StudioFrame SF-1 and SF-3 chassis are designed to meet the most stringent broadcast requirements. The SF-3 is a thirteen slot, 3RU chassis while the SF-1 is a 4 slot, 1RU chassis. All studio cards as well as the two chassis' are backed by a two year warranty on parts and labor with guaranteed 24-hour turnaround service. The units are ruggedly constructed to endure studio rackmount, production van and DB (Outside Broadcast) mobile applications. A universal power supply operates at either 110 or 240 VAC, 50/60 cycle. DC operation is optionally available as is a redundant supply with automatic switchover. Dual exhaust fans maintain proper airflow and cooling. "Hot swappable" front card loading allows power-on removal/insertion of individual processing modules without disturbing others in the system. All cabling can remain in place while you service any module. An intelligent "centerplane" provides power, sync, timing and data distribution, facilitating expansion to more complex, more cost-effective signal processing functions.

NovaASD/NovaSDA
Analog to Serial Digital & Serial Digital to Analog Converters

Components of the Nova StudioFrame series, the NovaASD and the NovaSDA incorporate the latest digital video processing techniques for high speed A-D and D-A signal conversion. They are designed to meet the most stringent broadcast requirements and their "hot swappable" front card loading facilitates servicing without disturbing other cards in the system. The NovaASD is ideal for for interfacing analog signals with digital video formats and the NovaSDA for interfacing serial digital signals with existing analog video systems as well as for signal monitoring applications.

SDA-1 Serial Digital Component to Analog Component Converter
- SMPTE 259M 4:2:2: Serial Digital Component (D1) input.
- Equalized and reclocked serial digital component output
- Analog component video (Y, R-Y, B-Y/YUV), RGB or RGB/S outputs
- 10-bit D/A converters
- Output level control
- NTSC and PAL compatible

SDA-2 Serial Digital Component to Composite and S-Video Converter
- SMPTE 259M 4:2:2: Serial Digital Component (D1) input,
- Equalized and reclocked serial digital component output
- Dual composite & dual S-Video outputs
- Color bar output selectable
- 10-bit D/A converters
- Output level control
- NTSC and PAL compatible

SDA-3 Serial Digital Composite to Analog Video Converter
- SMPTE 259M Serial Digital Composite (D2,D3) input,
- Equalized and reclocked serial digital composite output
- Four analog composite video outputs
- Color bar output selectable • 10-bit D/A converters

ASD-1 Analog Component to Serial Digital Component Converter
- Analog component video (Y, R-Y, B-Y/YUV), RGB or RGB/S input
- Dual SMPTE 259M 4:2:2 Serial Digital Component (D1) outputs
- 10-bit D/A converters
- Picture positioning control
- NTSC and PAL compatible

ASD-2 Analog Composite and S-Video to Serial Digital Component Converter
- Analog composite and S-Video input
- Dual SMPTE 259M 4:2:2 Serial Digital Component (D1) outputs
- 10-bit D/A converters
- NTSC and PAL compatible

ASD-3 Analog Composite to Serial Digital Composite Converter
- Analog composite video input
- Dual SMPTE 259M 4:2:2 Serial Digital Composite (D2/D3) outputs
- 10-bit D/A converters
- Input gain adjustment

NovaMNR Median Noise Reducer

The NovaMNR is a StudioFrame card that eliminates impulse and transmission noise, cleans up satellite, microwave and fiber feeds and fills in CODEC and time-based corrected videotape drop-outs. It features full bandwidth, uncompressed 10-bit digital processing for ultimate video transparency as well as analog composite inputs and outputs.

- Eliminates "sparkles", those black and white dots that sometimes appear on remote video feeds. The NovaMNR incorporates a proprietary adaptive three-dimensional median filter that analyzes pixels from several fields of video and replaces the impulse noise with uncontaminated, clean video.
- Universal drop-out compensation replaces missing video information, whether it is from a time-base-corrected VCR source or the decoded output of a CODEC feed. The NovaMNR effectively fills in drop-outs with replacement video from the surrounding pixels and previous video field.
- Control's are accessible locally or remotely. A three position threshold switch (off/low/high) adjusts system noise sensitivity while a bypass/operate switch is also included. Both switches are remoteable via RJ-11 jack.
- Also available in PAL and PAL-M versions.

NC-8 RGB/Component to Composite/S-Video Encoder

The NC-8 processor module is a 10-bit digital encoder that converts analog RGB or component video input sources into Y/C and composite video. Designed to facilitate multi-format interface requirements, the module incorporates the latest digital video processing techniques along with luminance and chrominance pre-comb filtering to assure the highest quality encoding. A frame of memory is utilized to provide an effective zero insertion delay.

- 10-bit processing, 8-bit D/A conversion
- Zero insertion delay, frame of memory
- Two composite and one S-video output.
- Analog RGB (Sync on Green or all three), RGB/Sync and YUV (Betacam) inputs. Also available with looping inputs.
- Variable luminance notch filter
- Y and C pre-comb filtering for maximum encoding performance
- Remote serial control
- Output level control
- Color bar output selectable
- Designed to meet the most stringent broadcast requirements.
- "Hot swappable" front card loading facilitates servicing without disturbing other cards
- Available in PAL and PAL-M versions

NovaRouter Intelligent Matrix Routers

NovaRouter is a series of serially controlled audio and video matrix routing switchers. These intelligent routers are available in 8x8, 16x16 and 32x32 matrices. They are capable of up to five switching levels to support unlimited combinations of Stereo Audio, Composite Video, Y/C Video, Component Video (Beta or MII), RGB/S and VGA Graphics. Audio follow video or breakaway routing is controlled by very intuitive computer software or optional XY control panels.

The computer software and VGA display provides quick visualization of all crosspoints and facilitates routing operations. An unlimited number of switching configurations may be stored and recalled at the click of a mouse. User defined labels for all sources and destinations provide positive identification of the matrix status. One computer can control several NovaRouter Systems for multiple studio or large presentation system applications.

The optional, easy to use, XY control panels provide routing functions for basic systems without the use of a computer interface. All video, audio and audio follow video switching functions are controlled by source select and destination select switches. Changing and verifying the matrix configuration is simple and clear. The XY controls may be front panel mounted or are available as a remote control unit.

Broadcast quality audio and video processing and microprocessor control ensure superior quality and performance. Yet, the simplicity and modular configurations of NovaRouters™ make them economical for broadcast, production, cable TV, graphics, presentation, teleconference and educational applications.

- 8x8, 16x16 and 32x32 switching matrices
- Stereo audio, composite video, Y/C, component video, RGB/S and VGA
- Up to five (5) levels of switching
- Audio follow video and audio break-away
- Serial control via intuitive computer software or optional XY control units
- Computer VGA monitor display provides quick visualization of all crosspoints
- Easy single "click" mouse switching control
- User labeling of sources and destinations
- Store system configurations in memories
- Multiple locations can be controlled from one computer
- Push-button XY control options, front panel mount or remote control units
- Audio and video modules provide easy system upgrade

VIDEONICS POWER Script™
Animated Postscript Character and Graphics Generator

QUICK DIAL 74

The most advanced character generator ever designed for video production, multimedia and industrial applications, PowerScript delivers the huge range of titles and graphics supported by PostScript display technology, plus animation, effects, transparency and color keying. It features two GPI inputs, anti-aliased, 17.5 ns (nanosecond) pixel resolution and 4:2:2 broadcast-quality video. It also offers high-speed RISC processing to provide real-time Level 2 PostScript imaging and fast rendering—even with the most complex images. The PowerScript works stand-alone or with a computer, has a built-in TBC, offers a powerful and intuitive interface, and is suitable for the desktop or can be rackmounted.

Powerful Character Generator
- Choose from 35 built-in fonts or download PostScript fonts from your PC. PowerScript's high-speed RISC processor provides real-time PostScript imaging.
- Characters can be rotated at any angle, scaled to any size, stretched horizontally or vertically.
- Styles include variable bold and italic, underline and shadow (drop shadow, variable displacement and opacity). Each character can be adjusted separately.
- Text can be positioned anywhere on the screen or automatically centered, vertically or horizontally. Left, right, top, bottom and center justification is also provided.
- Characters are automatically kerned, using the font's standard kerning information. Spacing is highly flexible with variable word and letter spacing and line spacing (leading).

Intuitive User Interface
- Built-in real-time object-based drawing tool and text editor—no computer or software required. Design can be done ahead of time and displayed later, or can be done on the fly.
- Supplied keyboard and mouse are used with easy on-screen menus to place and modify graphics and text.
- Change fonts, colors, and other characters instantly.

Transparency and Colors
- Characters can be made transparent (0-100%) over video, other characters and graphics with 64 levels of transparency.
- Opaque characters can use over 4,000,000 colors, transparent characters can use over 8,000.
- Different colors can be used for fill and outline (variable width) as well as each letter and each graphic.

Roll, Scrawl, Animation, Effects
- Variable speed roll, crawl and push (slide) in all directions.
- Every text object, graphic and logo can be animated. Complex animations include having elements follow paths, bounce, etc.
- Elements can change outline and/or fill color, transparency, position as they move and results are displayed in real time.
- Move individual characters in different directions; make colors change; flash words; make letters and words bounce; spin a letter across the screen. Use fades and wipes to transition between titles and video or between two pages of titles.

Backgrounds and Graphics
- Titles can be placed on solid color, patterned or graduated backgrounds, or they can be genlocked to incoming video.
- Lines, squares, rectangles, ovals and circles can be created and placed anywhere on the screen. Each graphic object can use a different color, transparency, rotation, size, fill and outline.

Imported Logos and Graphics
- Accepts most PostScript or PCX format graphics without modification. Imported images can be any size and can be scaled, skewed, and rotated when placed on screen. Transparency and anti-aliasing can be defined when graphic is generated.

Expansion Capabilities

Although PowerScript operates on its own, you can still add peripherals and connect to a computer or network. Two PC-card slots allow the addition of non-volatile flash-RAM and Ethernet cards. RS-232 port allows connection to desktop computers for added storage and downloading of fonts or graphics from a PC.

QUICK DIAL 72

LEADER

Manufacturing test and measurement equipment for over 40 years, Leader Instruments is the standard which others are measured against for reliability, performance, and most important—cost effectiveness. Before a product is brought to market, an exceptional degree of energy and effort go into its design. Prototypes are built and tested to withstand environmental and other factors far exceeding actual operating conditions. These include high humidity, extremes of heat, cold, shock and vibration. Manufacturing quality is built in every step of the way and only the finest parts are used. At each production run, subassemblies are separately tested before they are integrated into the finished product, then each product is tested again. This is why less than half of 1% of all Leader products are ever returned for warranty repair or adjustment.

5860C WAVEFORM MONITOR

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

5850C VECTORSCOPE

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

5100 4-Channel Component / Composite WAVEFORM

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

5870 Waveform/Vectorscope w/SCH and Line Select

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

5872A Combination Waveform/Vectorscope

Models 5872A offers all the operating advantages of the 5870, except for the following: SCH is deleted from the 5872A (line select retained), making it ideal for satellite work.

5864A Waveform Monitor

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

5854 Vectorscope

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

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

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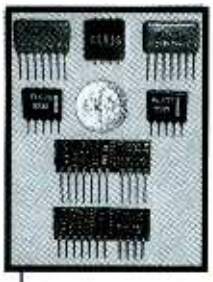

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WYZZ-TV, A SINCLAIR COMMUNICATIONS INC. station, is seeking an Assistant Chief Engineer. Television studio maintenance or electronics troubleshooting background is required. Prior television experience and UHF Transmitter knowledge is a plus. Top notch maintenance engineer with an ambition to grow are encouraged to apply. Great benefit package. Pre-employment drug screening required. EOE, Women and minorities are encouraged to apply. Fax resume to 309-663-4374. WYZZ-TV, 2714 East Lincoln, Bloomington, IL 61704.

UHF BROADCAST ENGINEER for Tribune owned ABC affiliate - experienced in installation, maintenance and repair of UHF TV transmitters, microwave links, satellite systems, ENG/SNG trucks, master control, production studio and news equipment. Must be self-starter who can work successfully with minimal supervision, meeting deadlines with high quality results. FCC General Class or SBE TV Certification and 5 years experience preferred. Good interpersonal skills are essential. EOE. Cover letter, resume and salary requirements to Keith Cibulski, WGNO, 2 Canal St. - Ste. 2800, New Orleans, LA 70130; FAX (504)581-2182; e-mail: KCibulski@tribune.com

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WYZZ-TV, A SINCLAIR COMMUNICATIONS INC. station, is seeking a Chief Engineer. Applicants should possess UHF Transmitter knowledge as well as a studio maintenance background. Organizational and people skills are a must. A minimum of five years television experience is preferred. Top notch maintenance engineers with computer knowledge and management abilities will be considered. Great benefit package. Pre-employment drug screening required. EOE, Women and minorities are encouraged to apply. Fax resume to 309-663-4374. WYZZ-TV, 2714 East Lincoln, Bloomington, IL 61704.

TV CHIEF ENGINEER KETA-TV, Oklahoma City, is seeking a hands on leader with strong broadcast maintenance background. Supervisory and organizational skills will be essential in guiding our technical team in planning and implementing projects. 5 years broadcast experience required. Salary range $40,000-$45,000. Send resume to Personnel, Oklahoma Educational Television Authority, P.O. Box 14190, Oklahoma City, OK 73113. AA/EEO

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We are looking for seasoned engineers to design large-scale digital audio/video facilities, including floor plans, equipment rack layouts and detailed signal flow diagrams. Candidates must have 5+ years' experience with state-of-the-art analog and digital A/V, production and broadcast facilities and be especially strong in system level engineering design and technical problem-solving. Fluency in MS Excel for Windows is required; AutoCAD, Word and Access knowledge is a plus. Team building, communication skills and the ability to work with minimal supervision are also key. We have both regular and contract positions available, but all require full-time presence at our San Jose facility. Some travel during installation/testing will be required. (Job # CY-BE1)

Software Project Support Engineer

Work closely with software designers and interface with domestic and international support groups to provide guidance in their support plan development. Your focus will be providing technical and management support for new software products from design through deployment. Position requires a BS or equivalent with 6+ years of industry experience. Must have strong troubleshooting capabilities relating to software-based systems. Programming experience in C/C++ and knowledge of Windows/NT are highly desirable. (Job # LG-BE1)

Software Systems Engineers

Perform system engineering design for complex video system control software product. You will work with a software development team to implement the next generation of Sony professional broadcast systems consisting of both hardware and software components. Position requires 5+ years of systems engineering, with experience in design and development of complex hardware and software systems. Solid disciplined systems design and architecture background required. A background in video hardware is preferred, as is an understanding of object-oriented programming. (Job # LG-BE2)

Software Product Support Engineer

Manage all technical support for products such as Sony's Integrated Duplication Operation, Video Store and Edit Station. You will review all technical documentation, actively problem-solve and act as a liaison between factory design and support, and marketing, field service and product sales. Position requires a BS in EE or CS with 7+ years of experience developing and supporting software-based products and 2+ years with servicing or designing Sony products. (Job # CY-BE2)

Project Managers

Responsible for the management of resources to execute fully-integrated broadcast systems. Must be able to complete projects on time and within budget. The ideal candidate will bring 5+ years of project management in broadcast or production systems. (Job # CY-BE3)

Senior Instructor

Present training courses focusing on the television industry's standard production techniques and technologies. This involves developing and implementing courses associated with the introduction of new technologies, products and services intended for the video industry. Position requires a BA/BS or MFA in TV production, broadcast journalism or communications with 5+ years' experience in broadcast or industrial production. (Job # CY-BE4)

Senior Marketing Manager

Develop and direct marketing strategy for the broadcast industry. This includes video file server-based automation systems, master control routing switches and related products. Position requires 10+ years of extensive marketing experience in broadcast or other closely related industry. (Job # CY-BE5)

Please send your resume, INDICATING CODE OF INTEREST, to: Sony Electronics Inc., Attn: Professional Staffing, MS SJ-2C2, 3300 Zanker Road, San Jose, CA 95134-1901. FAX: (408) 955-5166. E-mail (in ASCII text): sj_jobs@mail.sel.sony.com. For more information, visit our Web site at: http://www.sel.sony.com/HR/ EOE.

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MAINTENANCE ENGINEER WBFF-TV is expanding its engineering department and is seeking an additional broadcast maintenance engineer. Experience maintaining MII a must, as well as knowledge of studio, production and master control equipment. Two years broadcast experience is required. Send resume to: WBFF-TV, Engineering Manager, P.O. Box 4800, Baltimore, MD 21211. Equal Opportunity Employer.

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MAINTENANCE TECHNICIAN Skilled technician position available requiring an in-depth knowledge of RF systems and TV transmitters along with ENG equipment, maintenance and operations experience plus TV production experience. General Radiotelephone license and ENG equipment maintenance experience preferred. Please send resumes to KCNC-Human Resources, 1044 Lincoln St., Denver, CO 80203. EOE/MF.

TECHNICIAN ENGINEER Two years experience as broadcast TV bench technician. Must be familiar with 1/2 inch broadcast video tape machines and small cameras (CCD and tube types). Some knowledge of microwave and satellite operation. Should possess or qualify for a state driver's license in order to operate company vehicles. (Some auto mechanics ability preferred, but not mandatory). Apply at KOB-TV, c/o Sam Tikkanen, KOB-TV, 4 Broadcast Plaza, SW, Albuquerque, NM 87104 EOE/M-F.

HANDS-ON EXPERIENCED TELEVISION studio engineer. Repair of video tape & studio equipment to component level. Resume to Jerrell Kautz, WCBI-TV, Box 271, Columbus, MS 39701, FAX: 601-329-1004, Email: jkautz@wcbi.com.

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BROADCAST ENGINEERING is edited for corporate management, engineers/technicians and other management personnel at commercial and public TV stations, post-production and recording studios, broadcast networks, cable, telephone and satellite production centers and networks. Qualified persons include consulting engineers and dealer/distributors of broadcast equipment.

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By Paul McGoldrick

NAB '97 is on the horizon

NAB is about a week earlier this year. Not a big deal, but for engineering groups in the broadcast equipment companies, that week could make or break many planned demos. It's the little things that can botch projects. We all know to "measure twice, cut once," but what about projects that can't be completed?

It happened to me in a country in the Middle East. One site that was supposed to receive my TLC in the installation of three medium-wave transmitters (three frequencies, two towers) was built upside down by the local contractors. After trying every possible combination with models, we had to give up, the equipment wouldn't fit. That build-it-again disaster was compounded by an opinion from a soils engineer that the antenna field was actually a 100-year flood plain.


Paul McGoldrick

Things panned out better when building a high-power TV transmitter on a beach in the same country. We were using ducting to get what amounted to a religious propaganda signal across 50 miles of water — nasty ERPs at a low antenna height, not something for suburbia. Our problem was that we didn't know which country we were in and selected a likely part of beach at around the right coordinates. We weren't the only ones who didn't know who owned the beach. After being visited by patrol boats from three nations it became obvious they didn't care either, as long as the hospitality tea kept coming. With the desalinization plant being the first thing we had to build, we were also the only source of drinking water for quite a distance.


The DS1000 series of TV demodulators assesses the quality of analog TV modulated RF transmission systems.

Gaming or fun?

Gambling in that sort of way could have been expensive. There are other gambles that bear watching. The first is something to be observed and, maybe, precautions taken for our line of work. We are entering the next peak of solar-flare activity, which should be highest in mid-1998. During the last cycle, all sorts of amusing things happened to communications across the frequency bands. Dependence on RF communications, both direct and point-to-point for common carriers, has increased so dramatically that last time's amusements might have some terrible consequences.

The second gamble is directly relevant to *Broadcast Engineering*. In the NAB 1996 "Pick Hits," editor Brad Dick included the QuVis data recorder. To qualify, the product had to ship during 1996. It did, in December. (Good call, Brad!) The principals of QuVis are rather gutsy to challenge the compression monopolies of the broadcast industry. Its wavelet-like compression system works on the assumption that at higher image resolutions it's more advantageous to store image information rather than samples.

The QuBit can store up to 80 times higher pixel rates than composite video systems. The flexibility of the structure allows the format to be composite, component or serial, all at up to 12-bits per component resolution and with up to four channels. It should be capable of handling high-definition video and high-definition film recording. QuVis could stay out of the video market and be successful in other industries without undergoing the scourges of corporate interest in MPEG-2.

Waiting for decades

There hasn't been a significant high-performance TV demodulator introduced for some years. Tektronix launched the DS1000 series at The Western Cable Show in December. The units are intended for the cable market where the quality is high enough for operational demodulation for processing and re-modulation. It's also a high enough quality for off-air measurements for cable. But that's selling it short. The specs show the unit is suitable for rebroadcast reception uses and is also so close to broadcast measurement quality as to make it a probably-should-be used product. The DS1000 is the NTSC unit for $3,900 and features 47.25 to 860.25MHz tuning, BTSC stereo, separate intercarrier output, depth of modulation zero-carrier pulse and ICPM quadrature output. ■

Paul McGoldrick is a free-lance writer and consultant based on the West Coast.

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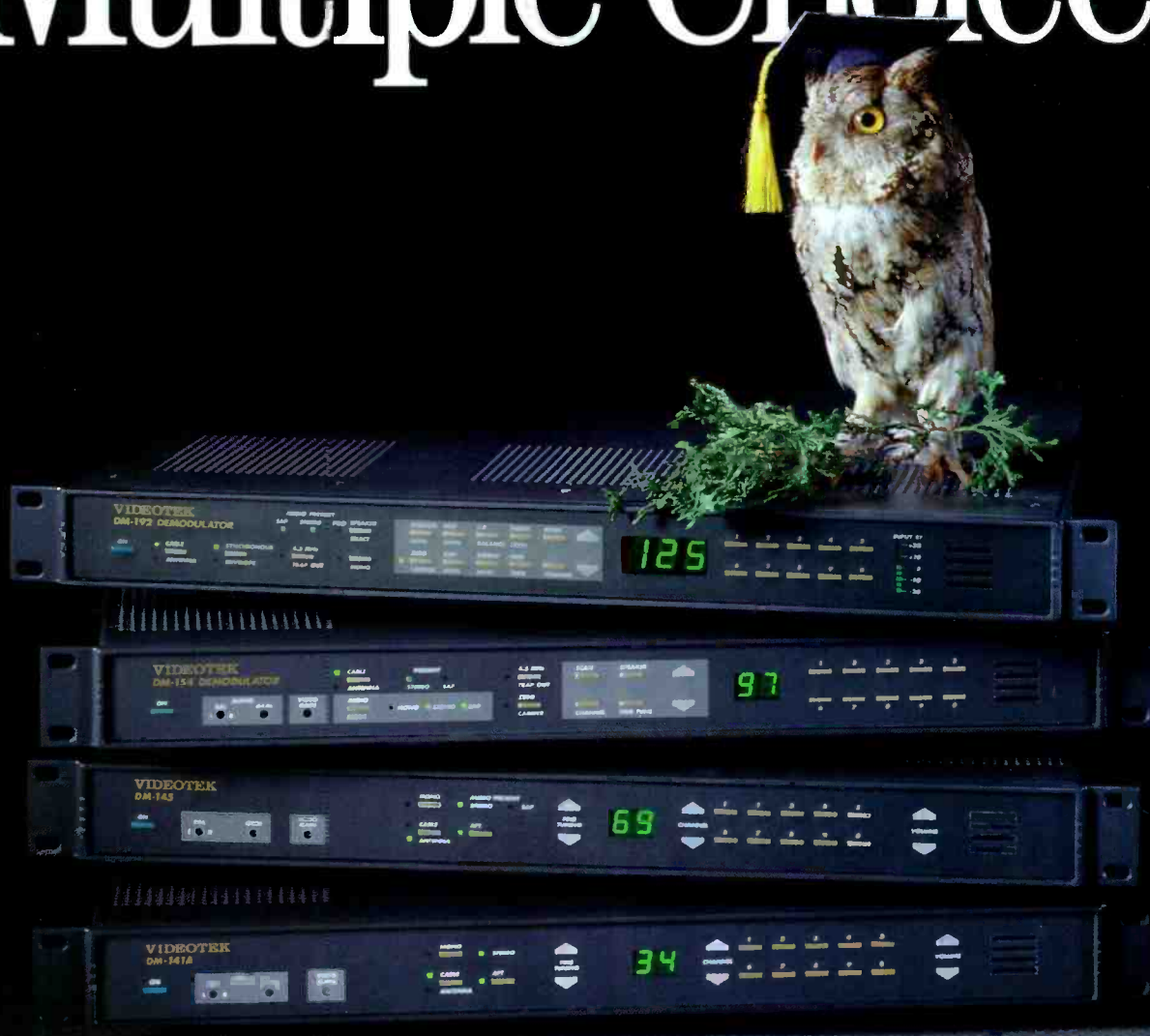

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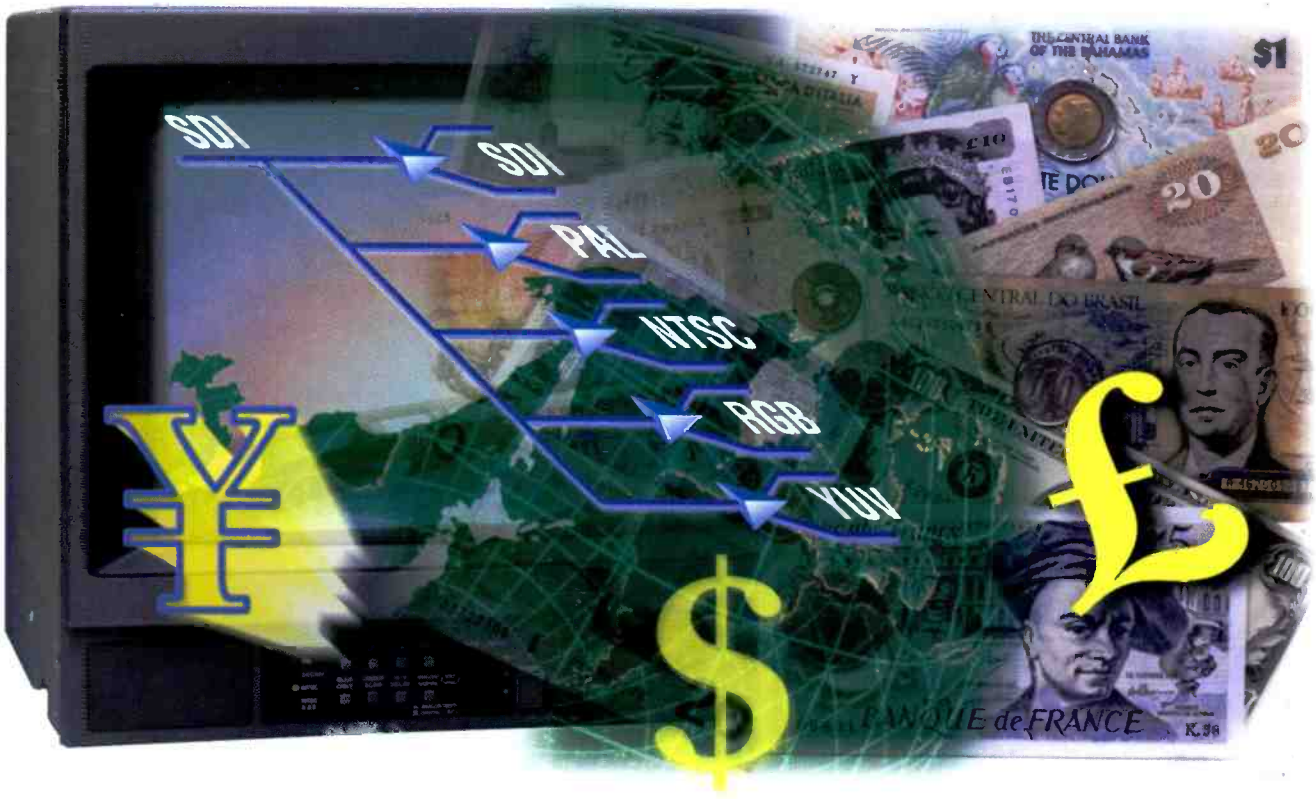

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