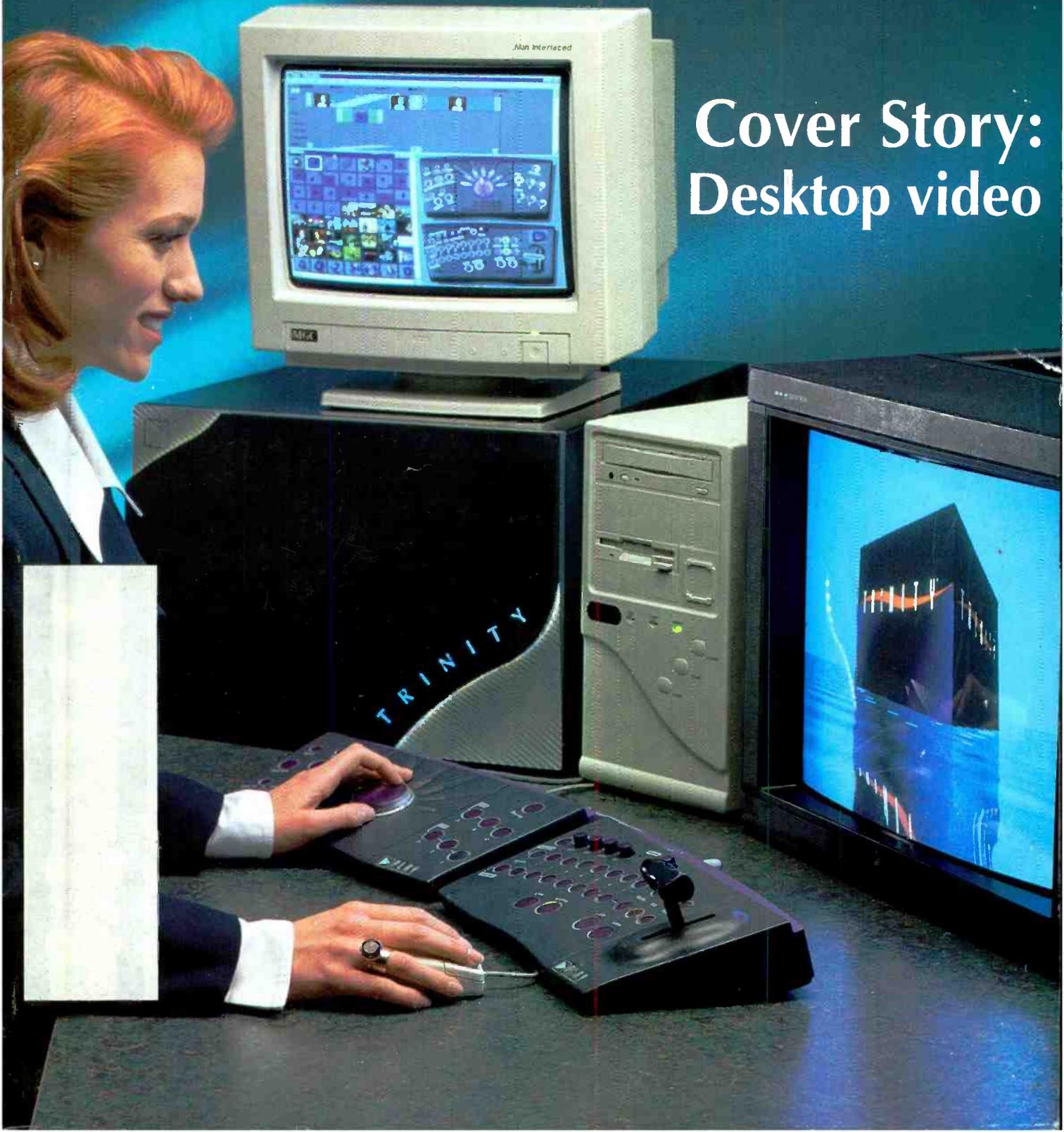


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Cover Story:
Desktop video





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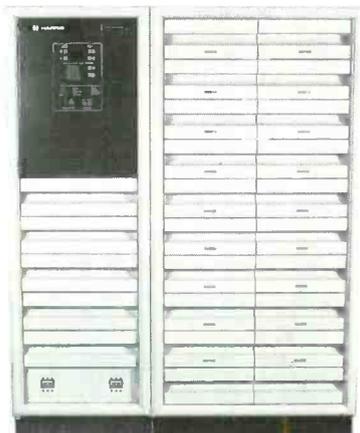
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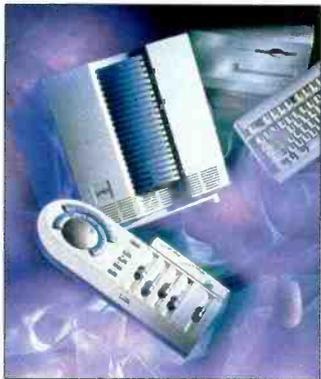
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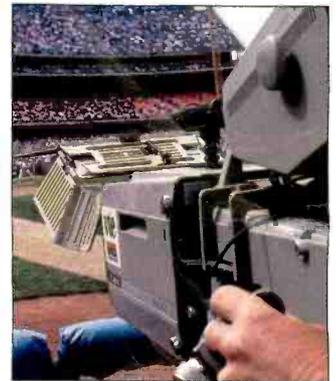
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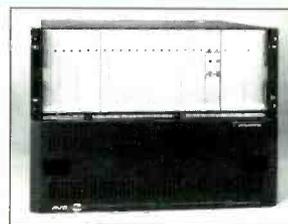
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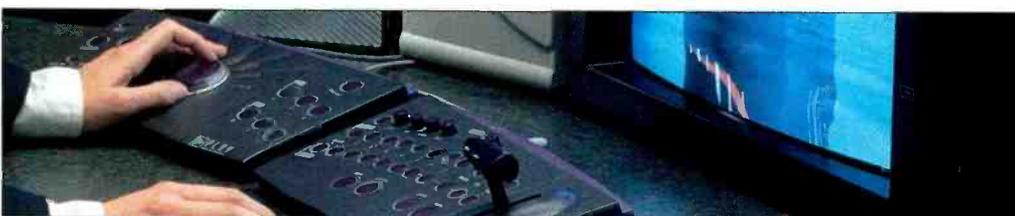
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ON THE COVER: Shown on the cover is the Trinity from Play Inc. Cover design and photography courtesy of Play Inc.

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SYPHA's "Non-Linear Buyers Guide" available

SYPHA has published the first edition of "The Non-Linear Buyers Guide." It gives details on more than 150 non-linear video systems and covers on-line and off-line systems, including turnkey and mixed media (hybrid) systems, cards and software packages, disk recorders, servers and RAM stores.

The buyers guide is designed to be a reference to the numerous random-access systems on the market, allowing potential purchasers and OEMs to zero in on the most suitable products for their applications and budgets. The information includes target markets, hardware and software specifications, operational features, future development plans, configurations/costs and suppliers' details for Europe, the United States and the Far East. The introduction also includes helpful hints on system assessment.

"The Non-Linear Buyers Guide" costs \$30 (plus postage and packing) and is available in the United States by contacting Weynand Training International, 6800 Owensmouth Ave., Suite 345, Canoga Park, CA 91303; telephone (818) 992-4481 or by fax at (818) 992-8641. You can also contact the NAB Services to purchase a copy; phone (800) 368-5644 or (202) 429-5373; fax (202) 775-3515.

FEMA recruiting public affairs officers

The Federal Emergency Management Agency (FEMA) is looking for qualified public affairs professionals to join the cadre of people who provide critical information to disaster victims during times of presidentially-declared disasters.

As part of the FEMA disaster response and recovery team, FEMA public affairs officers serve as key staff members in Joint Information Centers near disaster sites and as emergency support staff at headquarters in Washington, DC. FEMA is looking for professionals with backgrounds in journalism, public affairs, public relations, newspapers, television, radio, corporate public affairs, advertising, marketing, marketing communications, emergency information, crisis communications or the Internet and World Wide Web for emergency information assignments.

The FEMA public affairs officers serve as civilian FEMA reservists who work on an intermittent basis. They must be able to travel to disaster sites, often for extended periods of time.

For more information, call FEMA Recruiting at (800) 879-6076 or fax your résumé to (703) 542-2484. Information also is available on the global Internet at: URL:<http://www.fema.gov/fema/dae.html>. Send electronic mail to eipa@fema.gov.

NAB '96 setting record for sales and size

Just six months out from the NAB '96 International Convention, sales of exhibit space have exceeded the 550,000 square feet of last year's show. NAB '96 will take place in Las Vegas at the Las Vegas Convention Center and, for the first time, at the Sands Expo and Convention Center (SECC). Exhibits are open April 15-18.

The addition of the SECC facilities has allowed the event to expand to meet the growing demands from NAB '96 and Multimedia World exhibitors. The SECC will house more than 300 companies, including all of the NAB Multimedia World Conference and Exhibition, as well as NAB exhibitors. All registration will be located in Hall A of the SECC.

NAB '96 will draw more than 80,000 media managers and industry members, 1,000 exhibitors and feature more than 300 sessions at 12 stand-alone conferences.

For the most up-to-date information about NAB '96, use the fax-on-demand service at (301) 216-1847. Information also is available on the NAB Internet location <http://www.nab.org>.

EAS system passes second round of tests

The Emergency Alert System (EAS), mandated by the FCC to replace the antiquated Emergency Broadcast System (EBS), has successfully completed a second round of tests held in California. The tests prove that EAS works not only with television and radio, but also with cable video systems.

EAS is a digital technology that will alert the public of natural and man-made disasters; the technology allows broadcasters and cablecasters to either issue or pass through alerts, according to the geographic area of the reported disaster. The new technology also reduces the by-now-familiar 24-second EBS test tones heard on television and radio to only eight seconds, virtually eliminating the tendency of audiences to tune out the tests.

The UCCE sponsors continuing education courses

The University Consortium for Continuing Education (UCCE) is sponsoring three short courses. The first course, titled "MPEG-2 & Alternative Video Compression Standards & Techniques," is scheduled for Nov. 6-8, in Palo Alto, CA. The second short course, "Error Correcting Codes for Communications Systems," is scheduled for Dec. 11-14 in Washington, DC. The third short course, "Error Correcting Codes with Applications to Digital Storage Systems," is scheduled for March 25-28, 1996 in Palo

Alto, CA.

For additional information and brochures on these courses contact Joleen Packman by telephone (818) 995-6335; fax (818) 995-2932 or E-mail: ucce@aol.com.

InterBee '95 offers special events

This year is the 70th anniversary of Japanese broadcasting and the centennial of the motion picture. Therefore, InterBee '95 plans to look back at the history of broadcasting through production and technology.

InterBee will be held in Tokyo from Nov. 15-17. On Nov. 15, the symposium, "Changes in Image Expression and Production Techniques from the Standpoint of Camera Operators" will spotlight the work of camera operators and explore how their techniques and know-how have changed.

On Nov. 16, the symposium is titled "Digital Voice Transmission," and on Nov. 17, the symposium "Spotlighting the Importance of Live On-Site Production Sound" is another in the annual series of audio seminars. This symposium will consider the use of on-location mics to enhance reality and the problems and experience users have had with production mixers.

America gets second chance on TV violence

FCC chairman Reed Hundt said that America has a second, and maybe last chance, to promote children's educational television as the industry moves from analog to digital.

The FCC has an opportunity to make broadcasters live up to the public-interest requirement as it reviews the industry's move to new spectrum for digital systems.

Hundt said that unless broadcasters are legally required to do good, the marketplace won't allow it to happen. According to Hundt, as long as the FCC does not ask all broadcasters to deliver concrete, specific, public-interest services, in the heat of competition no single broadcaster can afford to do anything less commercial than the next broadcaster.

The FCC's meeting at the end of August marked the beginning of the end of the analog chapter of TV's history and the beginning of the beginning of the digital chapter. Hundt said the commission will begin rulemaking on possibly granting broadcasters' licenses for digital signals.

According to Hundt, broadcasters have a second chance to use television to inform, educate and entertain. He cited three ways to make it happen: better rules for the Children's TV act; hardware, such as the V-chip or software; and a Contract for Kids and Community between broadcasters and their viewing areas. ■

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Amsterdam: City of 100 canals and (at least) one thief

Traveling is such a pleasure, so relaxing. I was looking forward to going to the IBC Convention. Fall in Amsterdam. Cool weather. Bright sun. Lots of friends and acquaintances meeting at the (most excellent) convention center. Thousands of "browns" and other restaurants with exciting food from around the world. All these awaiting attractions were there for the taking.

Unfortunately, it was the taking that got me.

After spending almost seven days talking with a hundred or so exhibitors, friends and business acquaintances, I had built a sizable stack of business cards. Naturally, these cards contained my scribbles about things to do, people to call and items discussed. As you know, exchanging business cards is often the beginning of a friendship, and at least a note or a task to be completed or an opportunity to be taken advantage of. After a show like IBC, these cards represent a database of "to do" things.

During the course of the show, I attended about 12 press conferences and private meetings --- all of which were carefully documented in my notebook. The information was going to be good fodder for future articles and follow-up calls.

On Tuesday morning, after a busy week at the show, I was standing in front of the hotel waiting for a taxi to take me to the airport for my trip back home. I noticed a "student-looking" person walking toward me. About three feet away, he turned and walked (I thought) into the hotel.

Unfortunately, this "student" was really a thief. Instead of going into the hotel, he walked up the short ramp toward the door, back down the steps behind me and swiftly and silently took my briefcase. No more than five seconds passed from the time I first saw him until I turned and noticed my briefcase was gone. Later, I was able to see the entire event on the hotel's security recording system. Five seconds; that's all it took. In that short time, I lost my entire "life."

In addition to the credit cards and cash, I didn't realize how important the other information in my briefcase was. Along with the \$250 and credit cards, the thief got a 9-month collection of

personal and business records, my telephone book, checkbook, driver's license and passport. All my E-mail, airline frequent flyer numbers, savings and checking account numbers, computer passwords, people's birth dates --- everything I always expected to be available was now gone! I didn't even have the phone number to access my voice mail! I dial the number by remembering a text phrase --- not the actual number, and the phones in Amsterdam don't have letters on the keys!

I can't tell you that this story has a happy ending, because it doesn't. I spent the entire day looking in trash cans and alleys for my briefcase, hoping against hope that the thief had taken the credit cards and cash and dumped the rest. Although I did find a briefcase in a trash can, it wasn't mine.

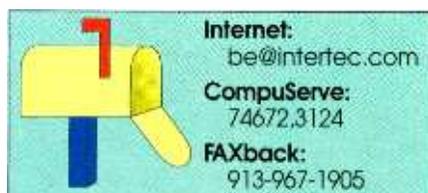
Therefore, to my many friends from the convention who gave me their business cards or if we exchanged promises to do something --- help! Please drop me a line or call and let's discuss whatever it is we were supposed to do. My memory operates on a FIFO (First-In-First-Out) basis, and whatever happened in September is already gone.

In April, if you see some guy walking around the NAB Convention with a briefcase handcuffed to his wrist, it's not one of the president's men with the secret war codes; it's just me making sure that the next guy who tries to steal my briefcase is going to have to work a lot harder.

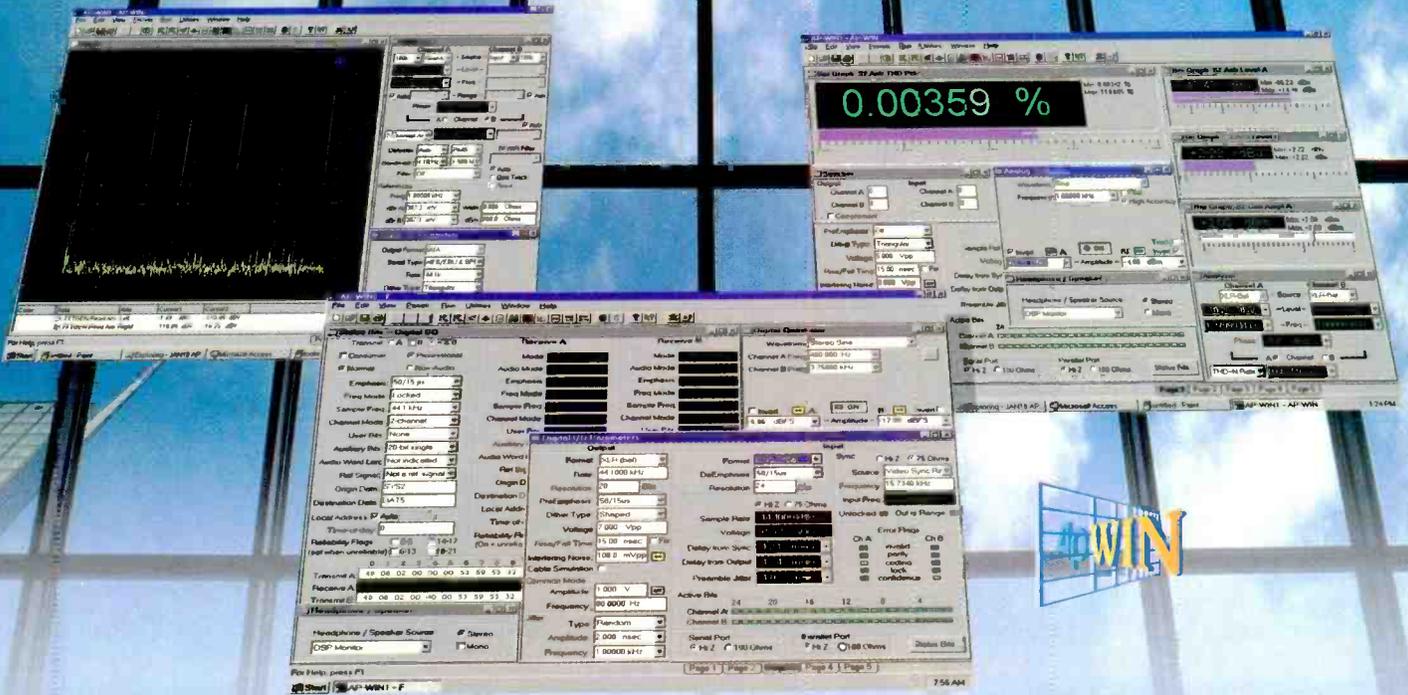


Brad Dick

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Congress wants to sell spectrum

During Congressional deliberations on the Communications Act of 1995, several legislators and public-interest groups urged Congress to rethink its plan to "give-away" a second channel to broadcasters for ATV. Senate Commerce Committee staff members have indicated broadcasters may face either an accelerated transition to digital television or up-front auctions for the second channel they now expect to receive free of charge. One concern underlying the committee's reconsideration of this matter is its need to raise \$14 billion in auction revenue over the next seven years. Even with the additional revenue expected to be derived from upcoming auctions and possibly broadened FCC auction authority, the commission anticipates being \$3.7 billion short of the \$14 billion mark.

Broadcast industry sources believe that beyond the budget pressures faced by Congress, the impetus for up-front auctions stems from pressure from rivals of broadcast television such as the cable, cellular and computer industries. The NAB states that any budget shortfall can be covered by transferring additional government spectrum to the private sector. Public-interest groups argue that the public is not receiving anything for the spectrum "give-away," and there should be at least some broadened public-interest obligations attached to the second channel.

In any event, regardless of whether broadcasters are forced to pay up-front or are given a shorter period in which to make the transition to ATV, it is clear that the cost of moving to digital television will be high for broadcasters. Much of the story will be played out on Capitol Hill.

Hundt announces FCC staff cuts

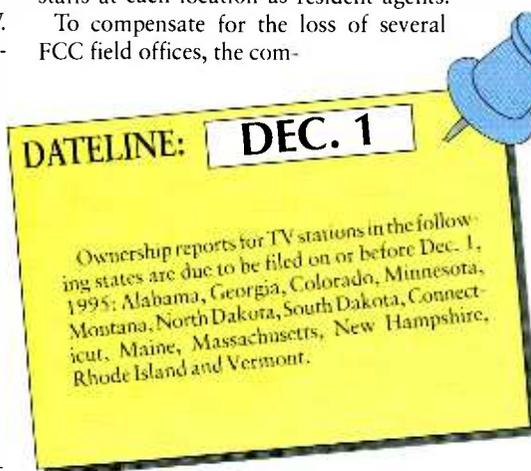
FCC chairman Reed Hundt has announced his intention to reduce the FCC's current level of employees by 10%, from 2,271 to 2,050. According to Hundt, the reductions are the result of the lack of Congressional funding. Hundt anticipates the 1996 fiscal allocation to be \$186 million, \$40 million

less than requested by the commission.

Despite this shortage of funds, Hundt is optimistic the commission can effectively integrate the changes into the future of the FCC.

The FCC plans to accomplish many of these employment reductions by changing its monitoring and enforcement systems. Specifically, Hundt plans to replace all nine of the FCC's frequency monitoring stations with fully automated monitoring networks that are to be installed next summer. The commission also expects to eliminate nine of its 25 field offices, keeping two technical staffs at each location as resident agents.

To compensate for the loss of several FCC field offices, the com-



mission will create a new centralized Call Center. The center's function will be to provide the public with access to information or assistance presently provided by the field offices. Hundt believes this new center can assist the public more efficiently and with more convenience than the existing field offices. Hundt hopes to make all necessary changes without compromising the FCC's important enforcement functions.

Recap of new EBS weekly test scripting

The commission's transition period from the Emergency Broadcast System (EBS) to the new Emergency Alert System (EAS) began July 1. All EBS 2-tone decoders should now be modified to activate after receiving a 2-tone signal of only four to five seconds, and may now transmit a 2-tone signal as short as eight seconds. (In areas with old or unmodified decoders, the longer signal should continue to be used.)

The commission plans to release a new EAS operating handbook within the next few months. In the meantime, it has released a new weekly test script. Effective immedi-

ately, broadcasters should follow this procedure in performing their weekly test:

1. Discontinue normal programming.
2. Broadcast this announcement: "The following is a test of the Emergency Broadcast System."
3. Transmit the attention signal. Broadcast the attention signal for eight seconds as specified in the new EAS rules.
4. Broadcast this announcement: "This station is testing its Emergency Broadcast System equipment. The EBS will soon be replaced with the Emergency Alert System. The EAS will provide timely emergency warnings. This station serves the (insert EBS/EAS local area name) area. This concludes this Emergency Broadcast System test."
5. Resume regular programming.

If a station chooses to perform a longer test, the transmission time of the attention signal may be lengthened, or the script in step 4 may be changed to the following:

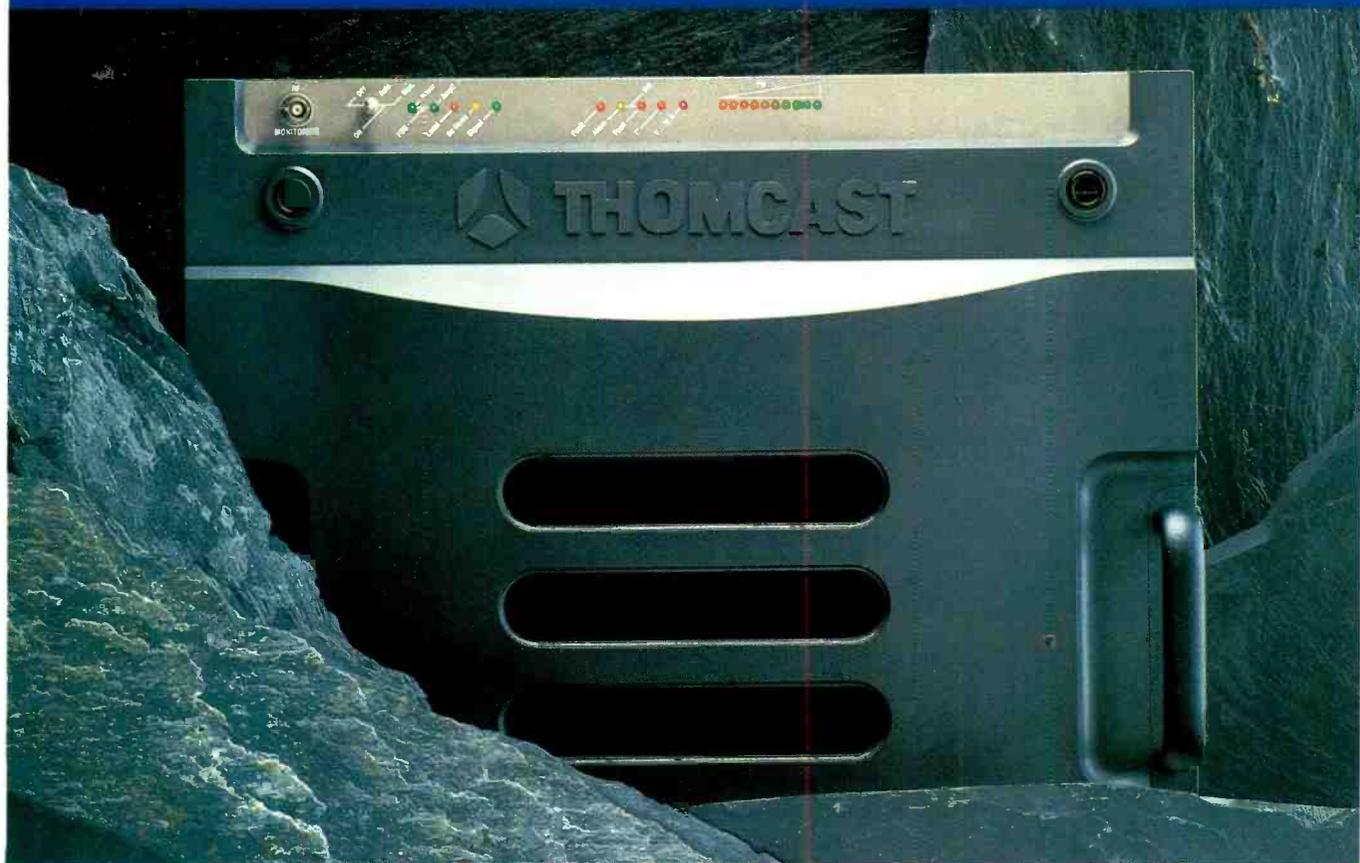
"This station is testing its Emergency Broadcast System equipment. The EBS will soon be replaced with the Emergency Alert System. The EAS will provide timely emergency warnings. If this had been an actual emergency, such as (insert the types of emergencies likely to occur in the station's coverage area), the attention signal you just heard would have been followed by an official warning or alert information. This station serves the (insert EBS/EAS local area name) area. This concludes this Emergency Broadcast System test."

Then follow steps 6 and 7 as currently listed in the *EBS Checklist*, page 7. For questions about the EAS, contact the EAS staff at the FCC Compliance and Information Bureau (CIB) at (202)428-1220. ■

Harry C. Martin and Andrew S. Kersting are attorneys with Fletcher, Heald & Hildreth, P.L.C., Rosslyn, VA.

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Circle (11) on Reply Card

EAS update

The EAS coding system

By Paul Montoya

The web architecture of the EAS system and coding of the messages sent through the system are the two elements that make the EAS system powerful. Let's look at the power behind the code.

The most exciting thing about the coding is that messages can be directed to specific areas of the country, state or even county.

The National Weather Service developed much of this code for NOAA Weather Radio. This code was originally called Weather Radio Specific Area Message Encoding (WRSAME) and has been shortened to SAME. Developed in the 1980s, this coding has been in place at many NOAA Weather Radio facilities for years and all facilities are transitioning to this system.

Know the code

The protocol setup consists of a header supplied three times (to ensure decoder latching when scanning multiple inputs), eight seconds of attention code (EBS 2-tone), the voice message or datastream and an end-of-

message (EOM) code.

The header information pinpoints the area that needs to be alerted (as little as one-ninth of a county); lets you know who's originating the alert; sets the type and alert level of the message; tells how long the alert is in effect; and lets you know who is relaying the alert.

The header has eight segments. Each segment is separated by the ASCII character + or -.

The first segment is called the *preamble* or *sync code*. It consists of 16 bytes of AB hexadecimal. This is used to wake up the system, synchronize the asynchronous decoder clocking cycles and set any gain control circuits. This sync code is sent at the beginning of each header and at the beginning of the EOM.

The second segment is an identifier incorporating the ASCII characters ZCZC to show that the ASCII code has started.

The *originator segment* of the header lets all units know who originated the alert. At this time, there are five 3-character codes available for originator use.

The *event code* is a 3-character code stating the emergency and its urgency. Presently, there are 32 alerting codes.

The coding system will allow for precise coding to enable the sender to pinpoint the message to specific areas. This code is set up as six characters. The first character is a digit 0 through 9 subdividing the county it is addressing into nine sectors. The digit 0 will send the message to the entire county. The next five characters tell which county and state to address by using Federal Informa-

tion Processing System (FIPS) codes. The first three characters of this 5-character series identify the county and the last two identify the state. A 000 sent indicates all counties within the state.

The next segment indicates the time period, which is based on 15-minute segments within the first hour, then 30-minute segments.

The next seven characters indicate the day of the year based on the Julian calendar (three characters), the hour of the day based on the 24-hour clock (two characters) and the minutes into the hour (two characters). The time of day will be in Universal Coordinated Time. This time stamp attaches to the original message and remains unchanged.

Unlike the originator ID, the transmitter identification changes as the message is relayed throughout the system. It contains eight characters identifying the transmitting station by FCC call sign.

After the header is repeated three times, a voice message can be delivered or an ASCII datastream can be relayed to computers, printers or CGs. The EOM is then sent, which consists of the preamble code and a series of ASCII character Ns.

Header example:

ZCZC-WXR-FFA-231908+0045-0100852-KOALLLL would indicate that the National Weather Service has issued a flash flood watch for North Central Laramie County in Colorado for the next 45 minutes and was issued on Jan. 10 at 8:52 UTC and was relayed by KOA radio.

Paul Montoya is president of Broadcast Services of Colorado, a contract engineering firm, in Lakewood, CO.



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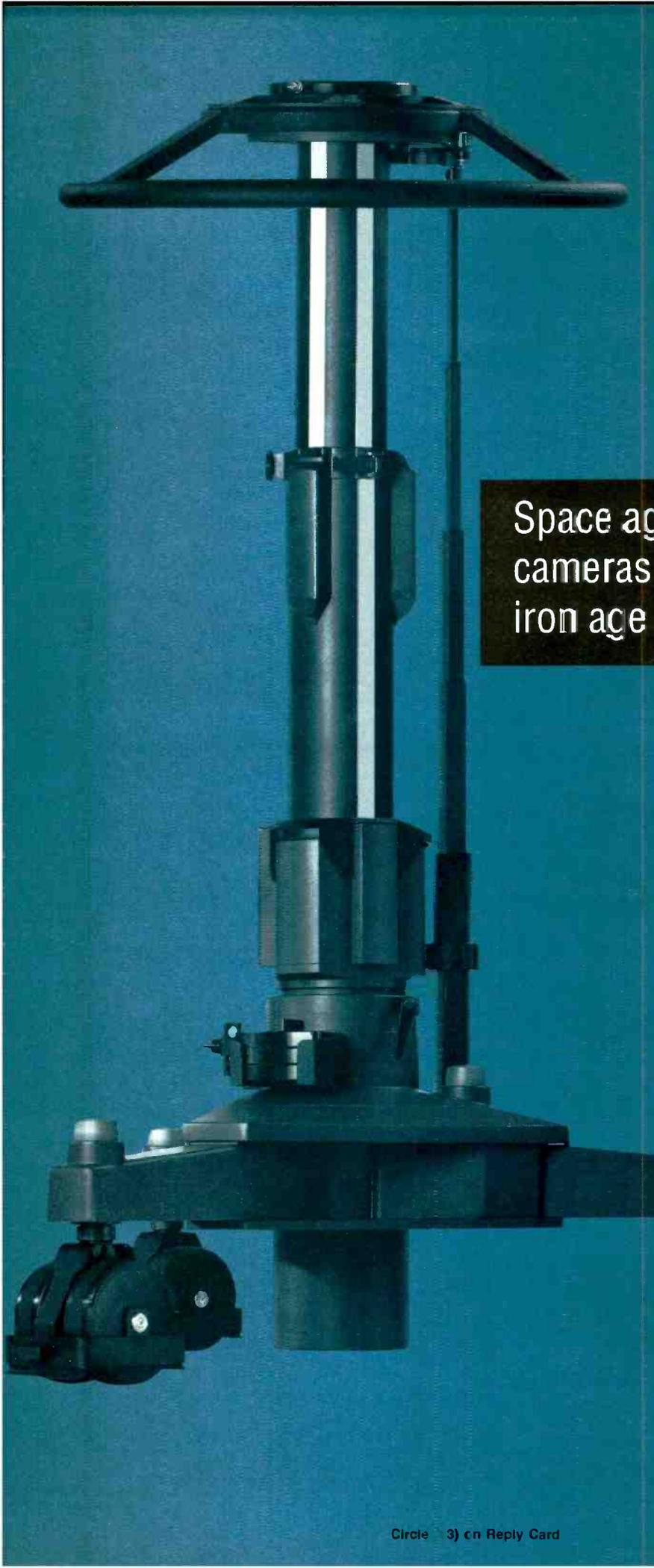
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The role of the broadcast manager (chief engineer) or supervisor has changed dramatically since the early days of television. Like Darwin's theory, evolution is not only inevitable, it's necessary for change. In the case of broadcasting, many of the autocratic, bureaucratic or dictatorial managers have been replaced with college-educated managers that balance team building and management by objectives with short- and long-range goals.

Today's management techniques aren't any better than previous years, they have just adapted to the changing work environment. However, the objective of the manager remains the same: They still want to gain the respect of their subordinates and higher levels of management, while being productive, meeting goals and moving upward. And one of the toughest jobs managers have had to deal with over the years is managing and motivating employees.

Provide an environment of encouragement for creativity.

Following are some areas of concern between managers and employees and how to resolve some of these conflicts so everyone comes out a winner.

Managing difficult employees

One of the most common employee problems is personality conflicts. Although many conflicts are work-related, the most troublesome are those that are based on personality clashes. No matter how clever you are, you're not going to change your employee's personality, so instead, focus on work-related productivity.

If you have an employee that you're in conflict with, try to be an impartial mediator in a private setting at work and begin to work toward a truce. Make sure that your employ-

Winning employees

ee understands that you both are accountable for results. If this attempt fails, the alternatives are to reprimand the employee, send the employee to the personnel department, transfer the employee to another department or terminate the employee.

Cliques are another area of concern. Many times, they have a herd instinct, and they often have a leader. The worst thing that can happen is if the leader has a problem with you...especially if you're his or her boss. Never directly intervene in trying to break up a clique, because the outcome may be a stronger unification of the clique. Instead, try methods like throwing the leader off balance by recognizing the clique's assistance — whether valuable or not — because this will take the edge off any antagonism.

Another method is to create positive dissension for the leader amongst the members or make it difficult for the clique to socialize during working hours. This may go so far as to avoid having clique members work together on projects.

The bottom line is that once a clique is no longer considered hazardous to you or the department, it can be useful. For instance, ideas can be presented to the clique's leader as a sounding board. On joint projects, where teamwork is essential, the clique can be motivated more easily toward a common set of goals.

Proactive behavior

Another interesting area that a manager faces is how to instill beneficial proactive behavior in the employees. Even seemingly dull jobs require employees to use some creative ability or initiative. If you, as a manager, don't show passion, caring, emotion and commitment balanced with a bit of wisdom, intuition, intelligence and patience toward your work, how can you make your staff feel any better about their jobs?

Provide an environment of encouragement for creativity. Always listen to ideas from employees and recognize and reward creative initiative. Develop job descriptions that include creative expectations and remind them of the creative requirements of their jobs. Also take into account the workstyle of your employees. Some will only do what's necessary to get the job done, and others will go beyond the call of duty.

Mixing warriors and foot soldiers

In any company, there's a mix of "warriors" and "foot soldiers." Foot soldiers prefer to work in a linear order by accomplishing one task and then moving on to the next job, and they become the foundation

from which your department is built. In many cases, they have a comfort zone from which it is hard to pry them away. For these individuals, you need to create an environment where they will excel in their assigned tasks and understand that they will look to you for direction and guidance.

Instill in yourself and your staff some of the qualities that make winners.

On the other hand, "warrior" workers are proactive. They seek and use existing resources to create a more productive environment. Left unchecked, warriors can go off into multiple directions with as many probable outcomes. Give them direction, set guidelines and feedback loops and get out of their way and let them do what they do best, which is to be creative.

Creating job growth

To create an environment for job growth within your department or company, make sure that your employees and your superiors understand that you are also looking for growth. This means picking and "mentoring" your successor.

Instead of managing with an iron hand, give your employees some latitude to make changes. Also, think in terms of being more of a leader than a manager of people, and both your subordinates and your superiors will notice the difference. That is, move beyond your process skills to think abstractly and in more global terms and hone your people skills. Find ways to balance your employees' personal goals with your department's predefined corporate goals.

Above all else, instill in yourself and your people some of the qualities that make winners: creativity, initiative, patience, compassion, empathy, perseverance, discipline, a strong sense of focus and commitment. You will all be better for it. ■

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Interfacing cameras to digital systems

As broadcasters continue their conversion to all-digital facilities, many decisions need to be made about converting existing analog devices to digital for these new systems. These decisions are not trivial and will either be dictated by the existing complement of equipment in the studio, or will have to be made before system design can begin. Once made, these decisions will affect the rest of the system for many years to come.

Traditionally, graphics systems tend to be "digital friendly," often providing analog and digital outputs as standard equipment. Digital VTRs, almost by definition, usually provide digital and analog outputs, including digital audio outputs. TV cameras, even the ones with "digital" CCDs as imaging devices, are much more likely to offer only analog outputs. True digital cameras (where the video is kept in the digital domain after it is scanned and sampled) are few and far between. The majority of cameras need to have their analog output signals converted to digital if they are going to be integrated into a digital facility. The method of conversion that you use is determined by the non-trivial core decisions mentioned earlier and described below.

Choosing component or composite

One of the biggest choices to be made is whether to implement a composite digital facility or a component digital facility. A composite digital facility is one where the entire encoded NTSC signal is sampled and

quantized. A component digital facility is one where the color components are individually sampled and quantized.

This choice can be influenced by the type of digital equipment you have in your station. If you have invested in component graphics systems, component digital VTRs (D-1 or D-5) or any of the new compressed component digital VTRs, a complete component digital system might make sense. If you have a large installed base of composite digital VTRs (D-2 or D-3), you may decide to convert all of your analog sources to composite digital and make composite digital your house format. A third, hybrid type of system can also be

The majority of cameras need to have their analog output signals converted to digital if they are going to be integrated into a digital facility.

constructed, where composite and component signals exist in separate "islands." A hybrid system is less desirable because it requires that component signals be encoded to convert them to composite signals. Conversely, composite signals must be decoded into their color components to be processed as component signals. These conversions also require resampling in addition to the encoding or decoding. Even in the "digital age," these conversions are not lossless, and multiple conversions should be avoided whenever possible.

Regardless of the type of system you choose, the coaxial serial transmission interface,

SMPTE 259M, is identical. The only difference is the data rate at which the interface operates. The composite interface operates at 143Mb/s, the component interface operates at 270Mb/s. (For the purpose of this discussion, we will only talk about the coaxial serial transmission format because it is more popular and easier to implement than the parallel format.)

If you choose to build (or already have) a composite digital system, the conversion from analog to digital is relatively straightforward. In this case, an NTSC output of the camera is fed to an analog-to-digital (A-D) converter. This converter could be a rack-mounted external box or it could be an optional board located inside the camera control unit. The entire NTSC waveform, including sync, burst and setup, is sampled at four times the NTSC subcarrier frequency (4fsc) or approximately 14.3MHz. In a facility that already has a large installed base of composite digital equipment (VTRs, video switchers, etc.) or that deals exclusively with NTSC signals requiring little post-production effects (chroma-key or "DVE" effects), this might be the preferred choice. One drawback of such a solution is that the video has already been encoded into the NTSC format, and suffers from the same artifacts as an analog NTSC signal. These artifacts include reduced color bandwidth, chroma-luminance interaction, and the retention of the 4-field color-frame sequence.

If you choose to build a component digital facility, your conversions are more complex to implement, but may provide greater flexibility in the future. In component digital conversion, the individual color components (either the green, blue and red primary color signals or alternately, the Y, B-Y, R-Y color-difference components) are connected individually to the converter, bypassing the encoder. Sync pulses are not digitized, but are included in the datastream as start-of-active video (SAV) and end-of-active video (EAV) signals. A color subcarrier reference is not needed because the signals have never been encoded onto the color subcarrier.

The GBR signals are then "matrixed" (or mixed) to create a luminance signal, Y, and two color-difference signals, Cb and Cr, (which are almost the same as the B-Y and R-Y signals.) The luminance signal is sampled at 13.5MHz while the two color-difference signals are sampled at 6.75MHz (half of the luminance sample rate). The terminology

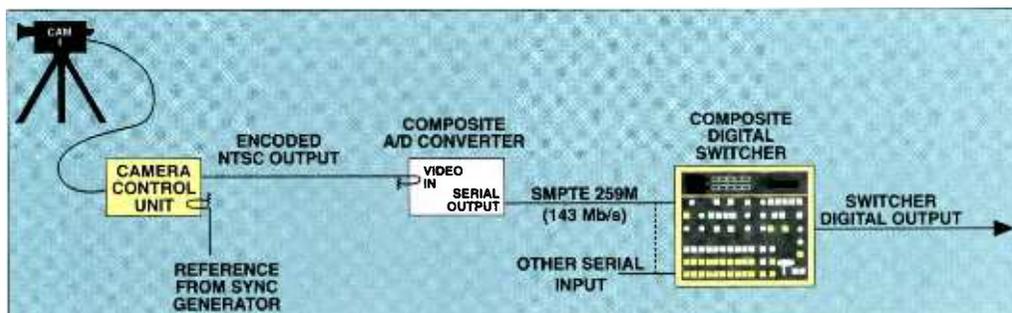


Figure 1. Typical signal flow used when interfacing analog camera outputs into a composite digital facility.

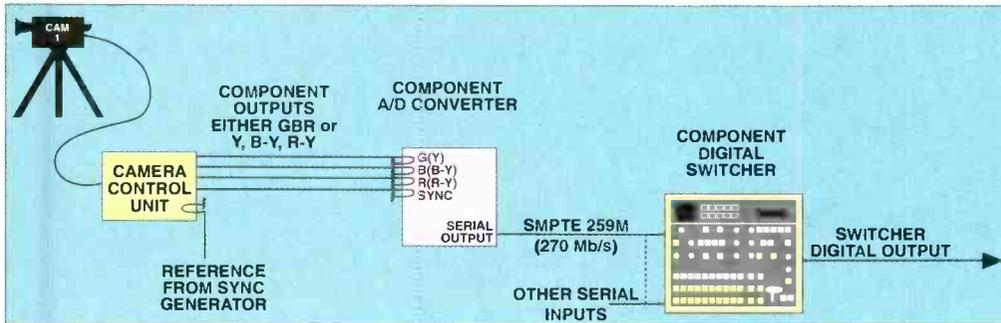


Figure 2. Signal flow used when interfacing analog camera component outputs to a component digital facility. Note: If sync has not been added to the green (or "Y") channel at the CCU, sync must be fed to the converter.

4:2:2 is often used to describe how these components are sampled. This terminology dates from the time when multiples of the color subcarrier signal were being considered for the sampling rates for component digital systems. (During the standard-setting process, it was later decided to use 13.5MHz as the sampling rate because of a common relationship to the 525-line and 625-line TV systems.)

The benefits of component video systems (analog and digital) include wider chroma bandwidth, freedom from cross-color artifacts, and cleaner "DVE" effects. Unfortunately, when you choose the component

digital format, you are forced to become an immediate "expert" in all of the different component standards (SMPTE, Beta, MII, etc.) Typically, GBR signals from cameras do not include setup because it is added in the encoder. On the other hand, the "component" outputs from a camera may have setup on their outputs. Some component standards include setup, others do not. Strictly speaking, ITU-R 601 (formerly CCIR 601) signals do not include setup. Most component systems have different voltages that specify peak white video levels.

There is also the ambiguity of different voltage levels for the color-difference sig-

nals, as well as misunderstandings about 75% color bars, 100% color bars and SMPTE color bars. Proper setting of video levels is crucial at the A-D converter because the video levels cannot be changed with a digital distribution amplifier downstream. (This is actually one of the chief benefits of digital systems.) Video levels are converted to numeric codes and are not changed as they are distributed through the system. Getting the luminance, color difference and blanking levels correct at the converter will go a long way to ensure matched video signals at the output of the digital system. (For more information on component analog video, see the Troubleshooting columns in *BE* November and December, 1994.) A thorough knowledge of component systems will help you integrate the many different analog standards into a consistent digital signal system.

Timing and resolution issues

In the NTSC world, we have become skilled at timing systems to accuracies approaching one nanosecond. This is because in NTSC



"YES! THE WAY AHEAD TO DIGITAL CAN BE PRETTY TRICKY" CAUTIONED SNELL.

any timing error will show up as a phase error, resulting in an objectionable color hue shift in the picture. Because there is no longer a color subcarrier to worry about, horizontal timing requirements can be reduced to what they were in the old black-and-white days. Even "better," most digital switchers have auto-timing circuits that require the signal to be coincident only to within about half a TV line of the reference (30 μ s). This should not be an excuse to get sloppy in the design of digital systems. Timing diagrams should still be created to make sure that the signal is not near the limit of these auto-timing circuits. Also, delay lines approaching several frames in length are easier to implement in the digital domain. This can affect audio-video delay (lip-sync delay) and must be addressed to maintain the proper synchronization.

Another interesting subject to ponder is the limited resolution of the digital system. Even though the NTSC specifications call for a maximum video bandwidth of 4.2MHz, modern cameras have been able to sneak an extra megahertz or two into the signal for improved resolution (even if only for production effects performed before recording or broadcasting). In these days of cameras and monitors capable of resolutions approaching 900 TV lines (TVL), it can be disheartening to discover that these resolutions cannot be main-

tained in the digital domain. Because of the sampling rates chosen for these digital systems, the theoretical maximum resolution of a digital TV system is roughly 540 TVL for component systems, and about 570 TVL for

Proper setting of video levels is crucial at the A-D converter because the video levels cannot be changed using a digital distribution amplifier downstream.

composite systems. Typically, because of sampling theory and the required anti-aliasing filters needed in any real-world sampling system, resolution is further reduced to about 470 TVL. Keep in mind that the resolution of broadcast signals is really only about 330 TVL. This does not mean that high-resolution cameras are not needed in digital TV systems. Higher-resolution cameras are needed to avoid (among other things) effects similar to "jaggies" in graphics systems. It might, however,

mean that superhigh-resolution monitors are not required for the display of digital video images.

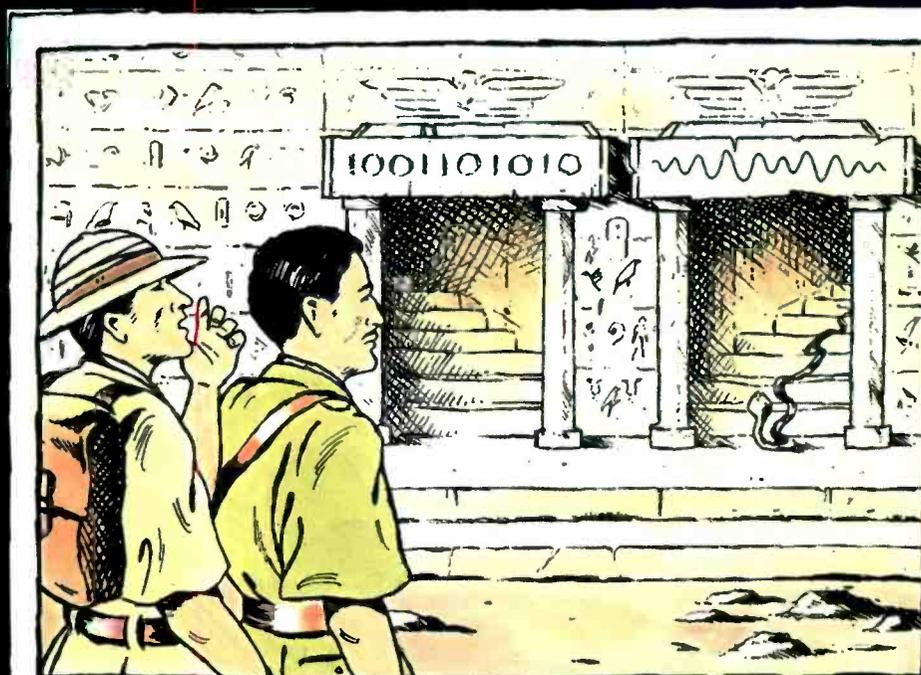
Analog TV cameras are going to be the source for many of the images we pass through our new digital systems for many years to come. As we proceed into the "digital age" of television, we are learning that as we leave behind some of our old analog problems, they are being replaced with different digital problems. Converting analog camera signals to digital will not be particularly difficult as long as the problems, pitfalls and consequences of such conversions are known, understood and avoided. ■

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On Nov. 15-17 in Chicago, *Broadcast Engineering '95: Transition to Digital.* For attendance information, call: FAX ON DEMAND at 1-800-601-3858 or Susan Link at 913-967-1969.



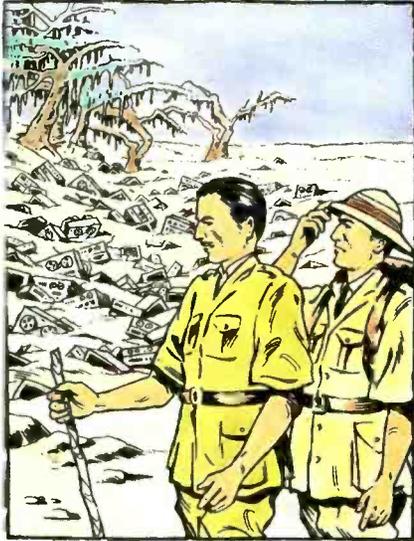
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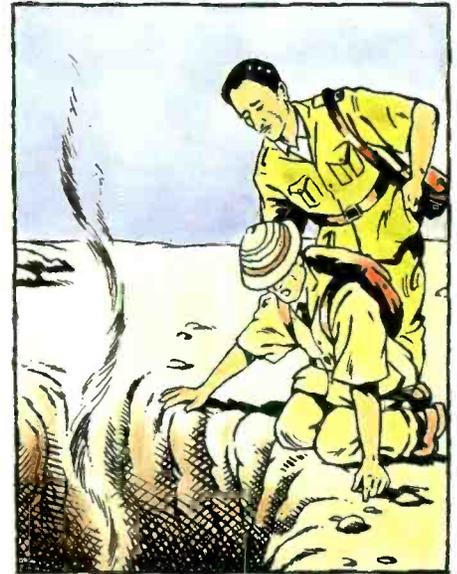
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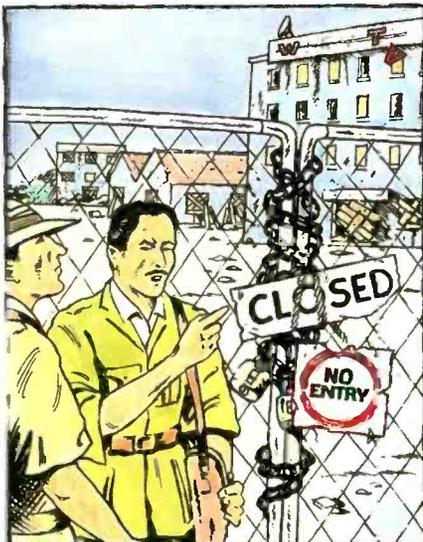
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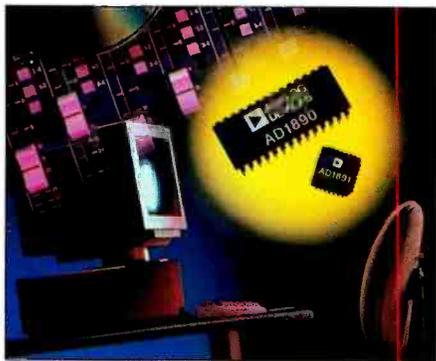
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Sound recording on location poses many challenges. Unlike the studio, there is no acoustic treatment, and there are many sources of unwanted noise. Before you venture out of the studio into the great unknown, ask some questions and make plans.

Many questions need to be answered during the preproduction phase. Visit the location to check the ambient noise level and power availability. Running on battery power can be advantageous, preventing noise from ground loops. If using AC, check for proper wiring, and consider using a line conditioner or surge protector. If recording in an office building or factory, make sure that you have a contact person/employee that can help you with access to areas needed for production. Draw a block diagram of your proposed mix setup. Seeing it on paper will help you avoid forgetting cable, distribution amps or other components. Try to build in some redundancy and extra capacity, in case of equipment failure or changes during production.

Sound treatment

If you want to minimize reflected sound, use sound blankets on the walls and carpeted rubber mats on the floor to minimize foot noise, cut reflected sound and cover tables. Check to see if noise sources, such as heating and air conditioning, refrigerators, and other equipment, can be turned off during production. Sound blankets can be taped to walls or clipped in place, or even attached to hung ceilings. The white side of sound blankets can be used as a soft bounce to help your lighting co-workers. Foot foam, a thin adhesive-backed rubber-like material can solve many sound problems. If your talent is walking on a hard floor, foot foam can be used to soften footsteps, and the floor can still be in the shot. It can also be used on the bottom of a mic deskstand, coffee mugs or other props to eliminate distracting noises. Foot foam is available by the square foot from audio supply houses.

Fluorescent lights can be a sound problem; both the bulbs and the ballast produce noise. They should be turned off when possible. If the fluorescent lights must be left on,

Recording field audio

noise from ballast vibration can be reduced by placing rubber washers over the screws that hold the ballast in place.

Microphones

Select microphones appropriate for the situation. Whether you use lavalieres or desk mics, use the least number necessary to minimize comb filtering. Also, use the same brand and model of mics for consistent sound. Following the 3-to-1 rule for multiple mic placement will also reduce comb filtering: Keep mics at least three times as far away from each other as they are from the sound source.

Placing the microphone too close to the talent can create excessive breath noise. Backplate or true condenser cardioid microphones are preferable to dynamic mics, which tend to have reduced high-frequency response.

Use shock-mounts and windscreens whenever possible. If inexperienced talent will be handling the microphone, avoid using a mic with an on-off switch. Have extra belt clips and tie bar clips to replace the inevitable lost or broken ones. If renting equipment, check all equipment, mics and cables as soon as they arrive.

Considering making custom cables? Quad cable, a special 4-conductor design available from several manufacturers, can greatly reduce hum and noise.

If using wireless mics, check for RF interference at the location. An easy way to do so is with a hand-held scanner set to the wireless mic frequencies. Putting the beltpack on the front of the talent can improve reception. Place the receivers closer to the talent rather than on the sound cart to minimize dropouts and multipath reflections. In wet or snowy conditions, placing the beltpack on the ankle and the receiver antenna on the ground can minimize poor reception due to absorption.

Lithium batteries can provide extended operating time for the wireless equipment. Ace bandages and safety pins can be used to mount the beltpack around the talent's waist.

In the mix

Important features for field production mixers are portability (compact size, battery operation), 14V and 48V phantom power and linking capability. Distribution amps are preferable to splitters when providing multiple feeds. An additional portable mixer could be used to feed the video recorders.

If you have a situation where one voice is dominating another, try using a polarity reverse cable on the dominant voice to partially cancel it.

If your production includes an unscripted discussion with several microphones, you may want to consider using an automatic mixer. For large group discussions, several mixers can be linked to provide 16 or more mic channels, each automatically gated.

Monitoring the situation

If using a boom mic, provide a headphone feed for the boom operator. A headphone feed from the recorder's confidence head, if available, is needed for the recording engineer. Build or buy a headphone source switchbox to make monitoring multiple sources easier. A single-channel mix can be fed to a wireless headphone system for the director, producer and client. These systems, known as Auditory Assistance Systems, are typically used for distributing audio to hearing or visually impaired theater patrons. Enclosed headphones should be used to prevent feedback. Another return can be fed to the crew intercom system.

Use studio-quality headphones for monitoring; consumer models typically have "enhanced bass," distorting the frequency response. A matched pair of self-powered near-field monitors can be used for playback. They should be shielded if they will be placed near video monitors.

Putting it together

One of the most overlooked pieces of equipment is the production sound cart. It not only makes moving your sound gear quick and easy, but it can also keep it organized and accessible reducing setup time as you move from one location to another. It should be large enough to accommodate all of your equipment, yet small enough to maneuver through doorways and fit into tight spaces.

Most of all, listen to your client before and during the production. Ultimately, the client must be satisfied with the product. You may actually find that their needs are less than you anticipated, saving you time, work and money. As you get ready for your next field production, prepare as much as possible, then stand by for changes! ■

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Acknowledgment: Thanks to Sid Williams of Hendersonville, NC, for technical assistance.



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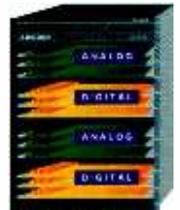
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Audio production for the Net requires that the person doing the production deal with some (until recently) unfamiliar digital audio formats. The Internet has passed around audio files for some time now, and I really don't know when the first audio file was stored and later downloaded from an Internet site.

On-line sound

In the past, the size of audio files has restricted their transmission over the Net to users who had access to the fast Internet connections found at research and educational facilities or to users who could spend a LOT of time transmitting.

Even with the fastest commercially-available modems today, the time required to download a CD-quality audio file is many times the playing time of the audio contained within the file. As a result, shorter pieces of audio or data-compressed file formats have prevailed.

There are Internet sites that store small bits of sound for special-interest groups. For instance, the individuals who want to can have the voice of Captain Kirk greet them in the morning, or groups of musicians who wish to can share sampled audio for use in their MIDI devices. This audio is usually stored in specific formats tailored to fit their end use. A Macintosh user who wanted to add a squishy sound to indicate a mouse click might, for instance, look for an "snd" file (an 8-bit audio file with different sampling rate options, not ".snd" — see Table 1).

Files like this can be found at any number of File Transfer Protocol (FTP) sites around the world. In fact, it does not matter how far you look for these goodies. It takes the same amount of time to transfer (download) them to your computer's hard disk when it is coming from Europe as it does from a site 20 miles away. A short piece of audio in an 8-bit format could use up less than 50kb or 60kb of space

On-line audio formats

and take only a few seconds to download. As the length of the audio in the file increases, the problem of download time quickly becomes an issue, even at 8-bit resolution.

Compatible file formats

Originally, there were different sound file formats for almost every computer platform. Currently, there seem to be several formats emerging that are, if not standard, at least compatible across platforms. The computer hardware does not recognize the different formats; the compatibility comes from the software. The shift away from a dependency on hardware has the advantage of being able to accommodate new formats and compression schemes without the cost of a hardware change; all it requires is rewriting the software.

Since the World Wide Web started developing, a new use of on-line audio has emerged. No longer is audio stored as files on the Net sent to someone's computer and finally used for some creative purpose. With the spread of World Wide Web *home pages*, audio is now associated with another element designed into the Web page. Audio can describe the fine points of a graphic image that is displayed on the page. It can be a welcome message from the President of the United States on the White House home page. It can even be used to provide a sample of the music contained on a CD that is advertised.

The Web has really opened up the uses for audio and made accessing that audio as simple as a mouse click. However, until recently, the mouse click started an automatic process. First the audio file is downloaded, then a *helper* application is launched that

works with the browser software you are using, and finally the sound is played. If you browse the Web, you will run into several small footprint formats such as *.au* with u-law compression or *audio interchange file format with compression* (AIFC) files that are used in this way.

The future holds promise

On April 10 of this year, a new audio format, RealAudio, was announced. The *.ra* files were designed by Progressive Networks in Seattle, WA, to be played in real time over the World Wide Web using a browser application like Netscape or Mosaic and a 14.4kb/s modem. The announcement has been greeted with enthusiasm almost universally by the people who inhabit the Net, not for great audio quality, but because of the promise it holds. The present quality is, in fact, marginal even for some voices, let alone music. It uses proprietary compression on an 8-bit, 8k sample-rate file.

Future developments will undoubtedly improve the audio. The excitement comes from the realization that audio is no longer shackled with a download time. Nor is the end-user's computer required to have enough hard-disk space to hold the sound file. New uses for the audio (new for the Internet, anyway) are being explored every day.

A voice with a guide-type personality can explain complicated issues or concepts verbally on a Web page. Navigational help can be offered to aid a surfer (one who browses the Web) in finding the information he or she needs. Radio shows, like Radio HK in Marina del Rey, CA, are being produced specifically for the Net. ABC network news and National Public Radio (NPR) are already available for playback at the listener's convenience.

Equipment for RealAudio

RealAudio requires three pieces of software: one to encode the file; a second that resides on the computer, which acts as the server for the audio; and finally, a piece of software called a player that is on the end-user's computer. The encoder and player can be downloaded free of charge. The server software is priced according to the number of concurrent users that are expected to be accessing the audio.

Production tools and techniques for the audio formats found on the Net are really closer to multimedia production (where storage

File extension	Platform	Comments
.au or .snd	Next, Sun	Compression available includes "a-law" and "u-law" -- A European telephony standard
snd	Apple	Used mainly for system sounds
.aif (AIFF)	Apple	Audio Interchange File format -- sample rate, # channels, # bits, all variable
.aif (AIFC)	Apple	Same as AIFF with compression
.wav (WAVE)	Microsoft	Features variable sample rate, number of channels and number of bits
RealAudio	Apple, Windows	Compressed 8-bit, 8k sampling

Table 1. Some common on-line formats.

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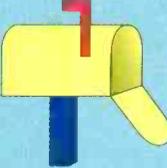
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space is always limited) than traditional audio production for radio and television. Many times the audio is in the digital domain from the moment it is recorded until the audio file is put on the Net.

Although the resulting audio is low-fi, so much of it is being produced for the competitive world of multimedia that special tools have been developed to help it sound as good as it can. Utility software programs have progressed from the limited distribution shareware item with poor user interfaces to polished professional tools to deal with the problem areas of batch processing, sample-rate conversion and bit-depth reduction. SoundHack is one of the best (though slow) shareware conversion programs and products from Waves (Q10, L1, C1, etc.) represent the better commercially distributed production applications. ■

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Simulcast Web site debuts at the Rock and Roll Hall of Fame concert

Post Perfect designed a World Wide Web site for coverage of the concert for the Rock and Roll Hall of Fame that was aired on HBO Sept. 2.

The HBO Internet site offered the entertainment company's on-line audience a variety of information on the performers, including text, photos, and audio and video clips. During the concert, the Web site carried portions of the HBO audio feed and provided still frames from the video portion every 15 seconds. Two teams of reporters conducted exclusive interviews for the Web site, which also featured bulletins from reporters attending rehearsals, as well as digital photographic images of major events prior to the concert.

The multimedia project was produced by Interactive 8 and Joseph Prieboy, director of new media at Post Perfect. ■

World Wide Web sites for additional information:

Audio formats information can be found at:

<http://www.cis.ohio-state.edu/hypertext/faq/usenet/audio-fmts/top.html>

Progressive Networks information is located at:

<http://www.realaudio.com/>

Production tools for Macintosh can be found on the DAW-Mac home page at:

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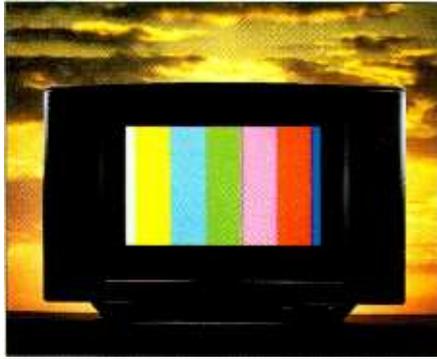
In addition to its optical advantages, with IFplus, the heaviest group of elements remains stationary in the focusing section of the lens, so that the camera's center of gravity never changes.

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In addition to its new digital electronics, other enhancements to the Digi-Super 70 include: a new servo system with a wider range of focusing speeds; 10-bit iris technology for a precise level of repeatability; LED tally lamps; and a sleek, new, ergonomic design that features improved RF noise shielding and easier access to the lens' electronics.

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The U.S. ATV transmission standard: Out of touch with the world?

To review, COFDM is a transmission system that spreads information over multiple carriers. The two primary advantages to broadcasters using COFDM systems relate to two developments in transmission: the use of spread-spectrum techniques and the use of a guard interval. When these two features are used together, coverage is improved. COFDM technology could allow receivers to perform in the presence of 0dB ghosts or echoes when the signals are delayed by less than the guard interval duration. This is a significant advantage to broadcasters who often transmit in strong echo environments.

Spread spectrum

The COFDM multicarrier system spreads digitally encoded data over a large number of unrelated carriers, each modulated at a low bit rate and a low symbol rate. COFDM technology uses a form of multicarrier modulation where the carrier spacing is selected so that each subcarrier is orthogonal to the other subcarriers — a relationship that mathematically ensures that during the sampling time for one carrier, all other carriers are at a zero point.

The carrier spacing in frequency is the inverse of the symbol rate of each carrier. This is the theoretical minimum spacing for zero intercarrier interference according to the Nyquist criterion. Impulse noise is spread out over many carriers and is, thus, reduced. The fact that the symbol time, compared to a single-carrier system, is multiplied by the number of carriers, provides a great advantage over single-carrier systems. The effect of intersymbol interference will become less severe because a smaller part of the symbol is affected.

One way to make these effects even smaller is to extend the symbol length beyond what is dictated by the Nyquist criterion by adding a cyclic extension to each symbol. This extension slightly degrades the spectrum usage efficiency, but provides the possibility for a receiver to completely remove intersymbol interference caused by echoes that are shorter than the guard interval.

The guard interval

A guard interval is added before the beginning of each symbol to avoid intersymbol interference in the presence of echoes. The proximity of this guard interval, located at the beginning of each symbol time, protects against multipath distortion where the multipath delay is less than the guard interval. Echoes received within the guard interval do not cause intersymbol interference because the receiver ignores the first part of each symbol because that part might be affected by previous symbol echoes. Multipath reception can cause attenuation of some carriers; therefore, error protection with soft decision decoding is a vital part of the system. A COFDM system of good design can handle strong echoes concurrently with the direct signal. For reference purposes, the COFDM system could potentially use 64µs as a protection window, compared with approximately 25µs for the 8-VSB system.

The Certification Experts Group's report: What really happened

The prototype 6MHz COFDM transmission subsystem developed for the COFDM project was evaluated by a "certification" team of the FCC Advisory Committee on Advanced Television Service (ACATS) on July 20. The goal was to determine if the COFDM prototype showed "demonstrable superiority" when compared to the Grand Alliance's (GA) 8-VSB transmission subsystem; and, if so, to recommend that the prototype be tested at the Advanced Television Test Center (ATTC). Testing of the complete GA system at the ATTC was also completed the week of July 20, and the results of the 8-VSB tests were presented for reference at the certification meeting. The COFDM system had been undergoing preliminary testing at the Communications Research Center (CRC) in Ottawa, Canada.

Performance characteristics	COFDM	8-VSB
Carrier-to-noise threshold (C/N)	15.7dB	15.2dB
Co-channel D/U ratio (NTSC into ATV)	-2.7dB	1.8dB
Lower adjacent channel (NTSC into ATV)	-55.2dB	-44.5dB
Upper adjacent channel (NTSC into ATV)	-51.0dB	-44.4dB
Peak-to-average ratio (not exceeded 99.9% of the time)	8.2dB	5.9dB
Peak-to-average ratio (not exceeded 99.99% of the time)	9.5dB	6.8dB
One static ghost 15µs	0dB	4.4dB

Performance measurements made at the ATTC and the CRC.

The results show that the COFDM has a slightly worse C/N threshold but a better co-channel and adjacent-channel immunity and a somewhat higher peak-to-average ratio than 8-VSB. The COFDM prototype did not handle delayed signals whose amplitude or phase varied as a function of time effectively. This should not be construed as a shortcoming of COFDM technology. The prototype hardware was not designed to perform channel characterizations at an iteration coefficient to operate in situations with time-varying channel conditions. Implementation limitations of the prototype software also resulted in a relatively long acquisition time (from about three to more than eight seconds depending on the specific test circumstances) to lock onto the incoming signal. This also was an implementation shortcoming. Based on these deficiencies, the Certification Experts Group (CEG) decided not to recommend that testing of the COFDM system be carried out at ATTC.

An analysis of the CEG's recommendation

CEG issued a report stating that the system proposed for test had problems in five areas:

1. **Receiver phase noise sensitivity** — The receiver phase noise sensitivity is an important consideration for consumer-grade equipment. CEG took issue with the use of an HP frequency synthesizer for some tests, although the original 8-VSB system was configured with similar equipment. It was noted that an internal oscillator failure was the reason it was used, and it had since been repaired. Most important, tested data submitted to the group reported no significant cost penalty for the COFDM-6MHz tuner over the 8-VSB.

2. **Peak-to-average power ratio** — Laboratory tests and studies have shown that the peak-to-average ratio of a COFDM signal is between two and three decibels higher than that of the 8-VSB signal. This would have no impact on coverage. The prototype COFDM modem C/N result was 15.7dB, which is 0.5dB higher than that of the 8-VSB result. This was the first-generation prototype, with room for improvement of about one decibel in modem and tuner performance.

3. **Linearity and dynamic range** — In the COFDM modem, 12-bit A/D converters were used, but only 11 bits were implemented. Tests have shown that the number of bits used in the A/D

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converter can be reduced to eight bits with limited impact on receiver and system performance. The use of an 8-bit A/D would result in a low-cost COFDM receiver.

4. *Dynamic signals or moving ghosts* — The COFDM modem performance for moving ghosts cannot be interpreted as the system's limitation. Theoretical analyses and demonstrations in DAB and OFDM technology have proven that COFDM can withstand moving ghosts. Dynamic ghost handling is one of the advantages of COFDM technology. The CEG's call for two orders of magnitude of improvement, from 0.05Hz to 5Hz, is achieved within the COFDM system performance expectation.

5. *ATV-to-NTSC on-channel repeater interference* — A COFDM system can work as well as the 8-VSB system when a single transmitter is used. However, COFDM provides flexibility for multiple on-channel transmitter operation, allowing for significant improvements in coverage. The use of multiple transmitters also allows for the possibility of a power reduction of the main transmitter.

The CEG requested additional data on certain coverage aspects of COFDM in a number of markets. In view of the available response time — the COFDM group was given only three working days to answer the questions — data presented was limited to the Los Angeles market, where studies were already in progress. These in-depth studies included all NTSC and ATV interference data for the 8-VSB and the COFDM transmission subsystems. The results demonstrated significant advantages in the COFDM approach for the case of a synchronous on-channel coverage extender.

According to the report, "The members of the CEG had expected that after a year of investigation, the COFDM-LLC would provide much more depth of explanation as to the details of *deployment* of COFDM and SFNs, since most of the potential difficulties had been identified in the technical subgroup by early 1994." Broadcasters, as well as the Grand Alliance, have yet to make the determination as to the details of *deployment* of the 8-VSB system. The main objective of the COFDM project was to put another "tool" in the "tool box" of those who will implement and build the new stations.

The CEG noted concerns about many peripheral issues, none of which were applicable to the choice of ATV transmission subsystems. For example:

1. *Lack of microwave spectrum to feed remote transmitters.* There are many potential solutions for this problem, with microwave or fiber only two of the many choices.
2. *Lack of tower space for the remote transmitters.* Some of these remote transmitters may be extremely small, not cell sites springing up in many new locations.
3. *Allocation impact in already short-spaced area.* Each market requires its own study and solution.

Continued on page 109

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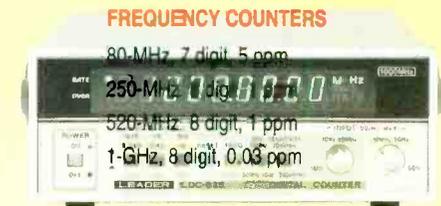
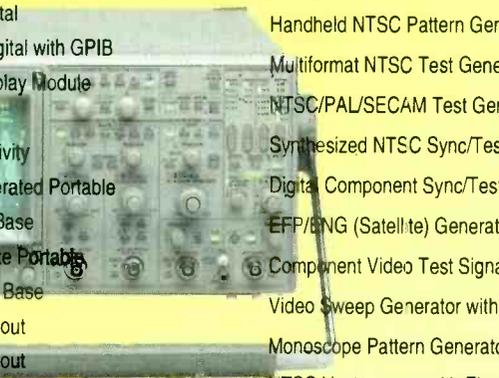
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Desktop video

Locating the potholes under all that snow isn't always easy.



The Bottom Line:

Desktop video systems have made tremendous advances over the past few years. Despite the potential cost savings, is desktop video ready for the rigors of broadcast use? There are numerous examples of consumer equipment good enough for professional use. However, signal quality is only one issue, others include customer support, serviceability and reliability in extreme conditions. There is little doubt that some desktop products are ready for broadcast, but picking them must be done carefully. — \$

About the time the leaves finish falling and the nights get long, the sky grays and the wind turns brisk, it won't be long before we are surrounded by one of nature's winter miracles — potholes.

Potholes are as much a part of winter as drifting snow and frosted windowpanes. The pothole experience is rather a personal one. Some experience their potholes daintily, tiptoeing in and out, gently spilling coffee to the lurch and sway of their vehicles. Others take them with full gusto — few things compare with the thrill of a pothole taken suddenly, at say 50 miles per hour. Hit correctly, a pothole can change the steering characteristics of a new car forever. And there is nothing like some potholes to take the willfulness out of a high-spirited set of tires. A really good pothole can burst a tire outright. Even a modest pothole will come back to you in the spring, when your tires sprout goose eggs to remind you of the times you and some pothole crossed paths.

Why the interest in potholes? It is a metaphor. Because even the best roads are likely to have potholes hidden beneath the snow and slush, it behooves drivers to go slower. To proceed with caution is nearly always wise. The path to desktop video is an important road, one we are all likely to travel. Unfortunately, some vendors have done their best to cover it with snow.

There are times and places for desktop video, just as there are times and places for nearly any new technology. But to expect desktop video to be all things to all people is absurd. It falls to the engineers to keep the wits about those around you and to be aware of the capabilities and the pitfalls of desktop video.

Before trusting any technology so far as to cast it in concrete (sometimes literally, in the case of a new facility), there are a few questions that should be asked:

- What guarantees it will work in your facility?
- Is it as reliable as the equipment it will replace?
- Who will install and service it?
- What extras are needed to ensure required performance levels?
- What is the true cost (long and short term), including the extras?

This article will help you with some of the answers, but mostly, it is a warning to shop carefully. The road to desktop video may be perilous if you aren't prepared.

Defining terms

You may know precisely what "desktop video" is, and probably others in your facility know, too. Just for fun, ask a few to define it. Compare their definition to yours. If you complete this exercise, you will realize the term desktop video is widely used, but poorly defined. You are likely to hear a lot of sweeping generalizations ("desktop video is like that AVID box they use over at channel x") and marketing hype ("videotape is obsolete") mixed in with some sound doctrine.

The term desktop video is widely used, but poorly defined.

We are all shaped by the information streams that feed us. Most likely, station management has different streams than station engineers. If management's streams say "multimedia computers and the Internet will provide stunning live color video to the whole world within five years," this will color their view of upcoming purchases of non-desktop video equipment, such as switchers and VTRs. It's easy to see that a \$2,000 PC from the local appliance superstore can deliver fantastic graphics and sound, and consumer camcorders deliver wonderful-looking pictures at reasonable cost. Many may deduce that the entire video production process is going to be simplified shortly, and that the personal computer is likely to be at the center of it.

The station engineer's job, on the other hand, centers on the creation and delivery of real-time video signals to user terminals called TV sets and user time-shift systems called VCRs. Quality of the signal is important, because users will constantly compare your pictures to your competitors', but controlling cost is critical, too. This is complicated

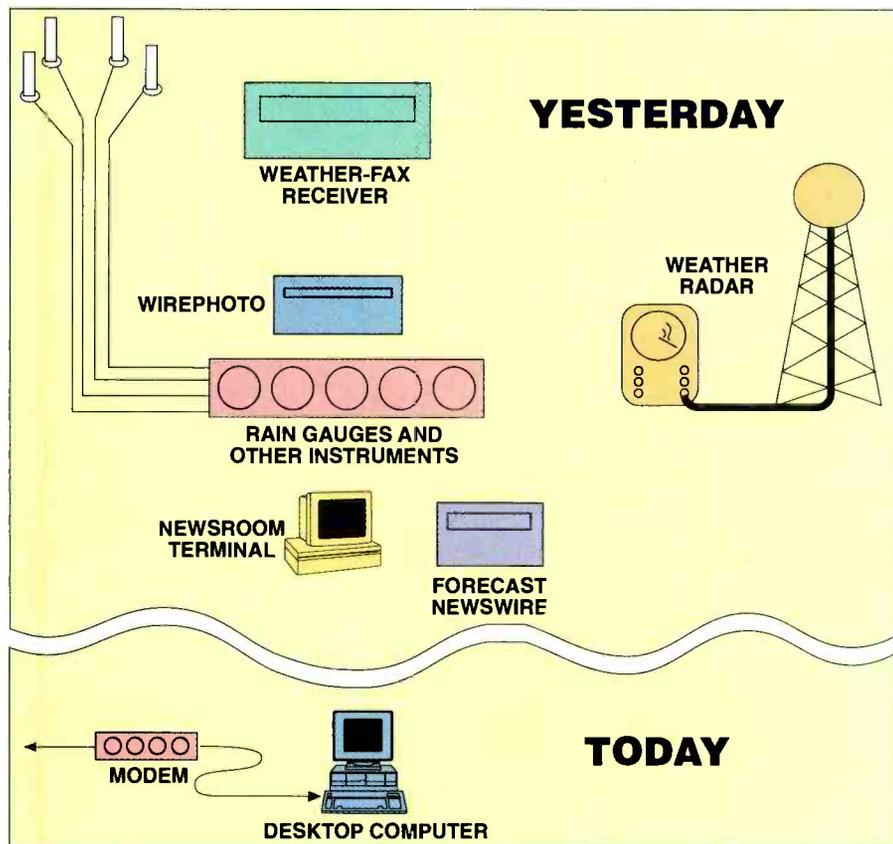


Figure 1. Meteorological equipment has changed significantly in the past 10 years, moving from bulky dedicated equipment to desktop computers.

by the fact that engineers must often second-guess the decisions management makes in response to competitive pressures and profit-taking by owners. Facilities need to be designed to be cost-effective now, but easily reconfigured as priorities change. Given the various perspectives, it is likely that facility engineers and managers will have different outlooks on the subject of desktop video.

Redefining terms

Many functions are moving toward the desktop. This is because people sit at desktops. It is also because the most powerful microprocessors today are designed to operate in the desktop environment. In other words, some of the thrust for desktop video exists because it is increasingly easy to find a powerful computational engine there, not because the desktop is a preferred location for performing the work. In fact, given the noise that accompanies cuing segments, shuttling tapes, changing transports and kibitzing between editors and others, "desktop editing" becomes a figure of speech. What we really mean is an ordinary room (as opposed to a sound-isolated, climate-controlled room) for editing.

If we expand our view to include other TV production functions, the move toward ordinary room operations has been around for some time. Meteorology, for instance,

has undergone a dramatic transformation. (See Figure 1.) Less than a decade ago, a fully equipped weather center required a large thermo-fax receiver/plotter for weather maps, a small news wire printer for receiving bulletins and forecasts, and a standard newsroom computer terminal for interface with the rest of the station. There were also assorted rain gauges, barometers, wind gauges and anemometers, as well as recording thermometers, each with a control point and possibly an on-air display. Finally, in some stations there was the weather radar, a fire-breathing apparatus that was extremely cumbersome. The equipment was power hungry, and the specialized CRT display made the operator's terminal large and antiquated looking.

The computer and modem quickly revolutionized broadcast weather. The fax machines and news wire printers were replaced by map services that delivered pre-drawn weather images. As military digital electronics filtered into commercial radars, the sweeping CRT display was replaced by a computer terminal with an SVGA display. Even the on-air presentation systems have been simplified. Times and temperatures are displayed by either the weather computer or the station character generator. Weather maps are now presented by blue screen.

Station art departments' systems underwent a similar transformation. Once, a draft-

ing table and file folders full of paste-up art were used to create camera cards. This was followed by large on-air computer graphics systems. These systems may now be giving way to fairly generic PCs with specialized graphic output cards and paint software. (See Figure 2.)

Switching and signal compositing have also moved into the PC environment. For years, one major manufacturer of conventional video switching systems has had a parallel development track in the PC world. However, the manufacturer has never aggressively marketed these products. To port all of their technology to computers presents a marketing problem to established companies. They can't be in a rush to chop off sales of their existing product lines, yet they are under competitive pressure to establish turf in the emerging market. Watching the push-and-pull of these companies' internal politics, has been, to say the least, interesting.

In all of these cases, hardware costs have plummeted through the use of PC technology. Manufacturers no longer have to bend sheet metal and paint chassis. Software costs have in some cases remained high, but the specter of off-the-shelf solutions being adapted to the broadcast situation has kept a competitive pressure to bear.

Recognizing the PC's role in technological evolution

Even though there is a current emphasis on desktop video using PCs, there is no reason to assume that this is the ultimate, or even the most desirable, implementation of video production technology. The personal computer today is much like the internal combustion engine was in the late 1920s. It is showing up everywhere. In the quest to find a stable power source for manufacturing and mining, the steam engine, followed by the internal combustion engine, quickly found wide application in everything from submarines to flying machines. Eventually, however, specialization emerged. The diesel, the rotary engines (first piston, then turbine) and various electrically powered motors soon emerged to fill roles for which they were best suited. This specialization is still settling out today; there are diesel and gas automobiles, and gas and electric lawnmowers and hedge trimmers.

Computers are subject to this same evolutionary force. The x86 (386, 486, Pentium) family of processors and its competitors, the 64K (640x0) followed by PowerPC, represent a silicon codification of the Von Neuman architecture that has been with us for many years. Bubbling quietly in the background for some time now have been families of embedded microcontrollers. These are computers designed to oper-

ate appliances and control machinery. Today's new cars have nearly two dozen computers of various sorts inside them. The low-power demands of portable computing and emerging wireless computing and communicating applications are also forcing spin-offs of the original families. The powers of digital signal processors (DSPs) have increased to the point that they cannot only perform signal processing with lightning speed, but can emulate other microprocessors. Parallel processing, fuzzy logic and neural network technologies also promise to fill specialized applications better than the mainstream microprocessors.

Video equipment manufacturers, and those who want to be such, are flocking to \$2,000 desktops because they are available (as were gas engines in the 1920s). But PCs may not end up being the optimum engine for video production. A leap away from proven tools to PC technologies may or may not be warranted, and a leap away from PCs to some future architecture should be anticipated.

All of this follows a trend in the semiconductor industry known as Makimoto's Wave. It describes the periodic swing of state-of-the-art in integrated circuits as they move from general-purpose, integrated circuits that can be programmed to do anything (such as programmable devices and DSPs) to special-purpose ICs (such as TV ghost cancellers or line doublers) and back.

One size doesn't have to fit all

A can opener need not be an effective letter opener. A certain amount of specialization is okay, especially when productivity must be high. Escaping the notion that a desktop video system has to be all things to all people is one of the most important parts of effectively using this technology.

One of the most cost-effective uses of the Video Toaster is found at NASA headquarters in Washington, DC. A large cart machine plays back a repeating series of programs for the NASA Select Network any time there are no missions flying (in which case, control transfers to Huntsville, AL). In the event that the cart machine fails, a backup source must identify the network's signal. A still-store would be perfect for this application, as would a slide chain, but cost and maintenance are prohibitive. Instead, a Video Toaster fills the role. Day after day it sits, ready to go to air.

This PC-based substitute for a still-store or slide projector has the advantages of being low cost, of not drifting out of color balance and of never needing to have its light bulb changed. Furthermore, it includes its own built-in paint system. For the price, there probably are few better appliances to fill this application. Yet, the Toaster was marketed

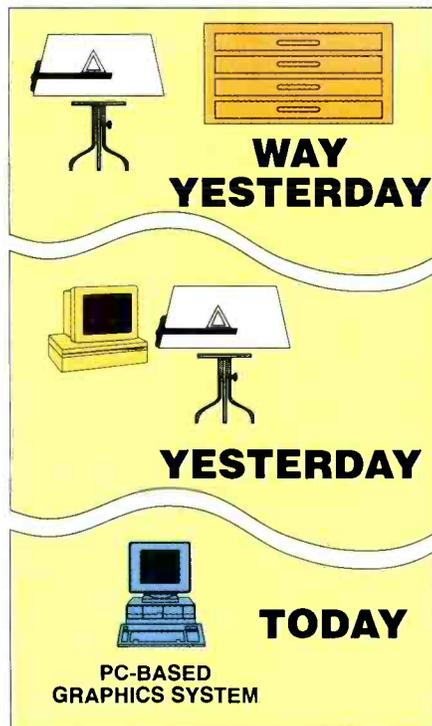


Figure 2. Many station art departments have updated their cutting and pasting tools from razor blades and glue to modern computer systems using sophisticated software.

as a can-do-everything box, obscuring its application in niche roles.

Planning for changes

Desktop video rarely saves work, it merely shifts it around. An example is the use of desktop video equipment in news. Once, the shooter shot, the editors edited and the reporters wrote the scripts. The integration of the pieces, including graphics and supers, was handled in the control room at airtime. With desktop editing, the assembly of cuts into complete packages is easier. Supers, charts, effects and music can all be combined in the edit bay. All the news control room has to do is play back the tape.

But the work has not decreased. It has merely shifted from the control room to the editor. From an artistic-quality point of view, this is great. The reporter and the photographer presumably are better able to collaborate with the editor, keeping the piece more in line with their intentions. However, the power of the producer and director are reduced. Production occurs in a room away from their field of view. Changes cannot be incorporated on the fly. Quality or editorial control may be compromised.

Moving bottlenecks

Desktop video also breaks some bottlenecks, but creates others. In the "shooter's shoot, editor's cut" paradigm, the bottleneck is likely to be the edit bay. It takes a finite amount of time to shuttle tape, change

reels, set levels and edit. This time is essentially wasted, meaning that a larger number of bays and editors are required to process all the work in time.

In a non-linear editing system, tape shuttling is eliminated or greatly reduced. Editors select segments from a bin with a mouse, arrange and rearrange them until the order is right, and then print the finished product to tape. Because there are no reels to shuttle, this is faster than linear editing. But a new factor has entered the equation. It is necessary to get the video from the shooter's tape into the non-linear editing system. This process, called video capture, is time consuming. Whether it is cheaper to increase the number of digitization facilities or to just use the resources for conventional editing is an important concern. Even more important, however, is the time spent digitizing. It can exceed the amount spent shuttling and changing reels.

A new generation of video cameras has been unveiled to overcome this problem. Instead of tape, these systems use removable hard-disk cartridges to record the video. In one prototype, shown at last year's NAB, the disk packs record 20 minutes of video. The photographer can mark which scenes are keepers and which should be discarded. The system automatically re-records over discarded material. As a result, each disk will contain a high proportion of usable material (as opposed to videotape, which is typically shot at a 1:3 usability ratio). The big plus, however, is that the disk packs are instantly ingestible by the editing system. No digitization is required; they plug right in.

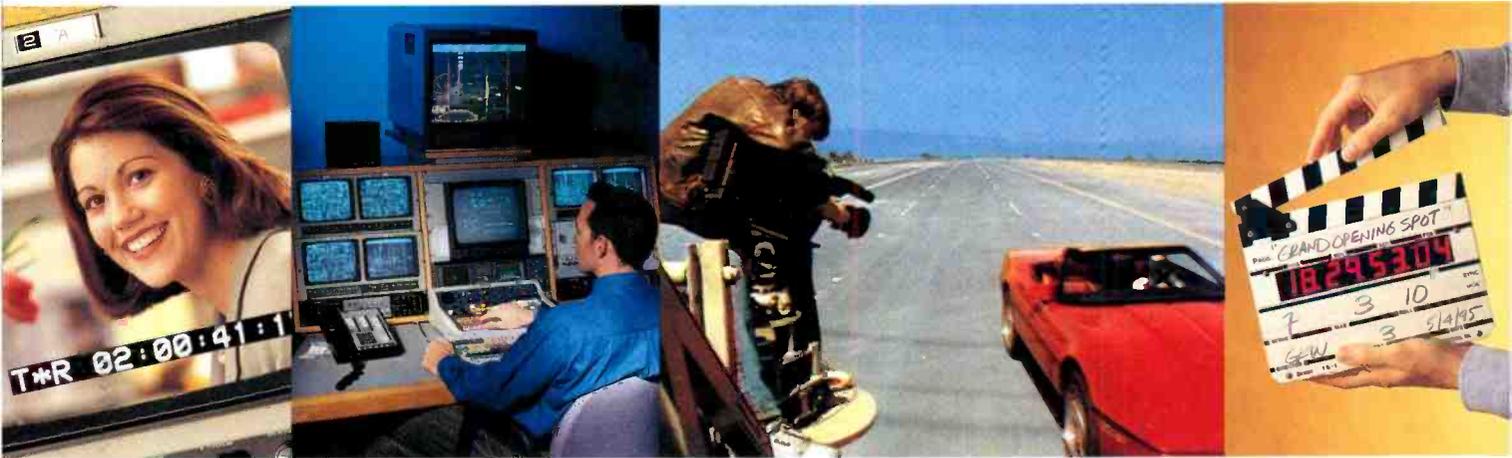
It is curious to note, however, that such a system returns us to the issue of quality control. Suddenly, it is the photographer, not the editor, deciding which scenes to keep and which to discard.

Concerning compression

Another issue regarding desktop video must be considered. It is the artifacts caused by video compression. It is somehow not socially acceptable to discuss compression artifacts, somewhat like commenting on a big nose or other distinctive feature. This is a ludicrous and dangerous tradition, and perpetrators should be shot.

The block diagram in Figure 3 (page 34) shows a generic non-linear editing system. Included are a couple of modules not commonly discussed. Video enters the system and is flash digitized in an analog-to-digital converter. In lower-quality systems, the signal is then beat to pieces in scurrilous circuitry, which may delete alternate fields, modify the sampling ratios and pre-scale the video into a small pixel array. Surviving video data is next subjected to a compression algorithm to further reduce the bandwidth. The resultant stream is sent to the hard disk

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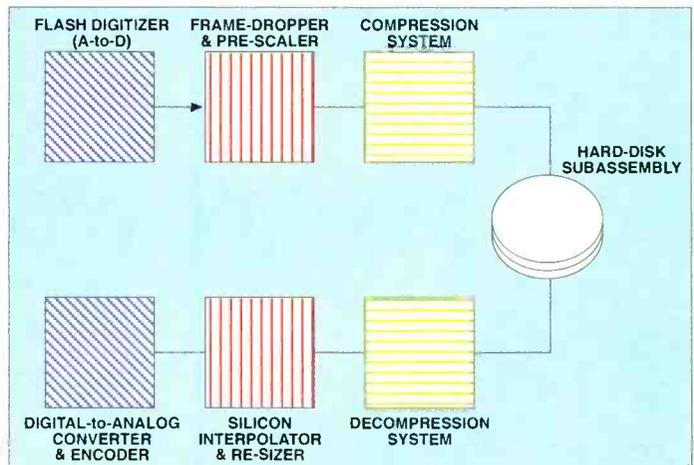


Figure 3. In a typical desktop video system, the analog input must be digitized and compressed before being stored. Many times this requires that frames or pixels be dropped or rescaled. For playback, the digital signals are decompressed, interpolated and resized before conversion back to analog.

for storage. Editing is accomplished by varying the order in which stored video is read out of the hard-disk subassembly. At playback time, compressed video data is called off the disk and reconstituted.

Using present technology, it is nearly unavoidable to get video on and off of most hard disks without using compression. The sad truth is that most compression systems leave telltale footprints, or artifacts, in the signals they process. This is not to say transparent, disk-based digital video recording systems don't exist. Of course they do, but they are expensive.

The primary advantage of digital video signal systems is that once the video is quantized, its values remain the same thereafter. Error-correction systems ensure it, and error-concealment schemes pick up where the correctors fall short. Analog video is by definition more accurate than digital (because there are no quantization errors), but the analog signal degrades continuously from the second it is created. A digital signal is so much more robust that any quantization errors are easily ignored when compared with the effects of noise.

The primary advantage of digital video signal systems is that once the video is quantized, its values remain the same thereafter.

The composite digital system is a direct digitization of an NTSC or PAL video signal. The incoming video is sampled at four times the subcarrier frequency (4Fsc). Each sample is 10-bit resolution (eight bits primary, with two lower-order bits to protect the signal against rounding errors). The component digital system samples the luminance channel (Y) and each of the color-difference channels (R-Y, B-Y) with the same resolution. Because color information is not as critical as detail information, however, the samples are interleaved in the pattern (Y), (R-Y), (Y), (B-Y), (Y), (R-Y), (Y), (B-Y) and so on. By inspection, it is easy to see that for every four (Y) samples, there are two (R-Y) and two (B-Y) samples, making component digital a 4:2:2 system.

Anything other than these sampling rates and orders is not approved standardized digital video. And yet, the purveyors of non-linear editing schemes will try to foist off any number of strange schemes. Some use a 4:1:1 color system. Some discard every other field. Some sample at full rates and patterns, but do so over a tiny field of pixels, relying on silicon interpolators to pump the signal back to



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viewable size. All of this would be tolerable if these purveyors were honest about it. Instead, many do not hesitate to call their wares "broadcast quality" or claim that their compression is "transparent" or "lossless." In this world, there are lies and damn lies. Some manufacturers simply skip straight to statistics.

In most Discreet Cosine Transform algorithms (JPEG and MPEG), artifacts are easy to spot. In images rich in detail, certain parts of the picture seem to be overlaid by tiny glass tiles. These are the 8x8 pixel blocks on which the algorithm is based. When the compressor has to work extra hard, detail must be sacrificed to allow the frame to be regenerated in 1/30th second.

A killer of DCT systems is wood grain. The tiny grain patterns are detected by the compressor as detail, and the image develops tiling. Background color gradations near the top and bottom of some studio sets will sometimes create tiling. Non-DCT systems are available, but these also have artifacts. One emerging compression system reduces detail globally throughout the image, rolling off a least-significant bit in each digital word, and implanting random noise in its stead. This system is tile-proof, but it has the alarming characteristic of deleting detail information when the compressor is working the

hardest. Thus, a necktie may suddenly change from polka-dots to solid, depending on the amount of clutter in the background.

Someday, compression systems will be transparent and powerful. At that point, discussion about compression will fade. For now, however, its impact on picture quality is so strong that anybody who ignores it, or glosses over it, is not exercising due diligence.

When is it good enough?

Is video from an inexpensive desktop system good enough for air? Certainly. For instance, there are occasions where it is appropriate to air "news-hound footage" from amateur videographers shot on VHS. The visual quality can go down when the importance of the contents goes up. In fact, some stations have discovered that non-linear editing systems make great tools for promotion spots that change daily. The advantage of being able to produce the promotion without having to tie up the main switcher outweighs the quality hit on something that will only be aired a dozen times.

It is critical that stations realize the pitfalls of such an approach. If they enter into the project with eyes wide open, however, they will likely reap big financial rewards. Even

though we've stressed the danger of artifacts, they can, in fact, be tolerated in certain applications. The key is to determine the system's true capabilities, independent of manufacturer hype. And don't let them tell you that there are no problems. There will be, but you might be able to live with them comfortably in certain applications. Understanding where the problems are will allow you to make an informed decision.

Caveat emptor

It would be foolish to denounce desktop video out of hand. The technology has revolutionized many aspects of production where visual quality is not a competitive concern. However, carefully investigate the signal quality of any proposed desktop system to verify that it meets the needs of your facility. The important thing is to be prepared. Demand to see the output of any system under consideration using test equipment you trust. The road to desktop video will be peppered with potholes, but it may be a road worth traveling. The choice is yours. ■



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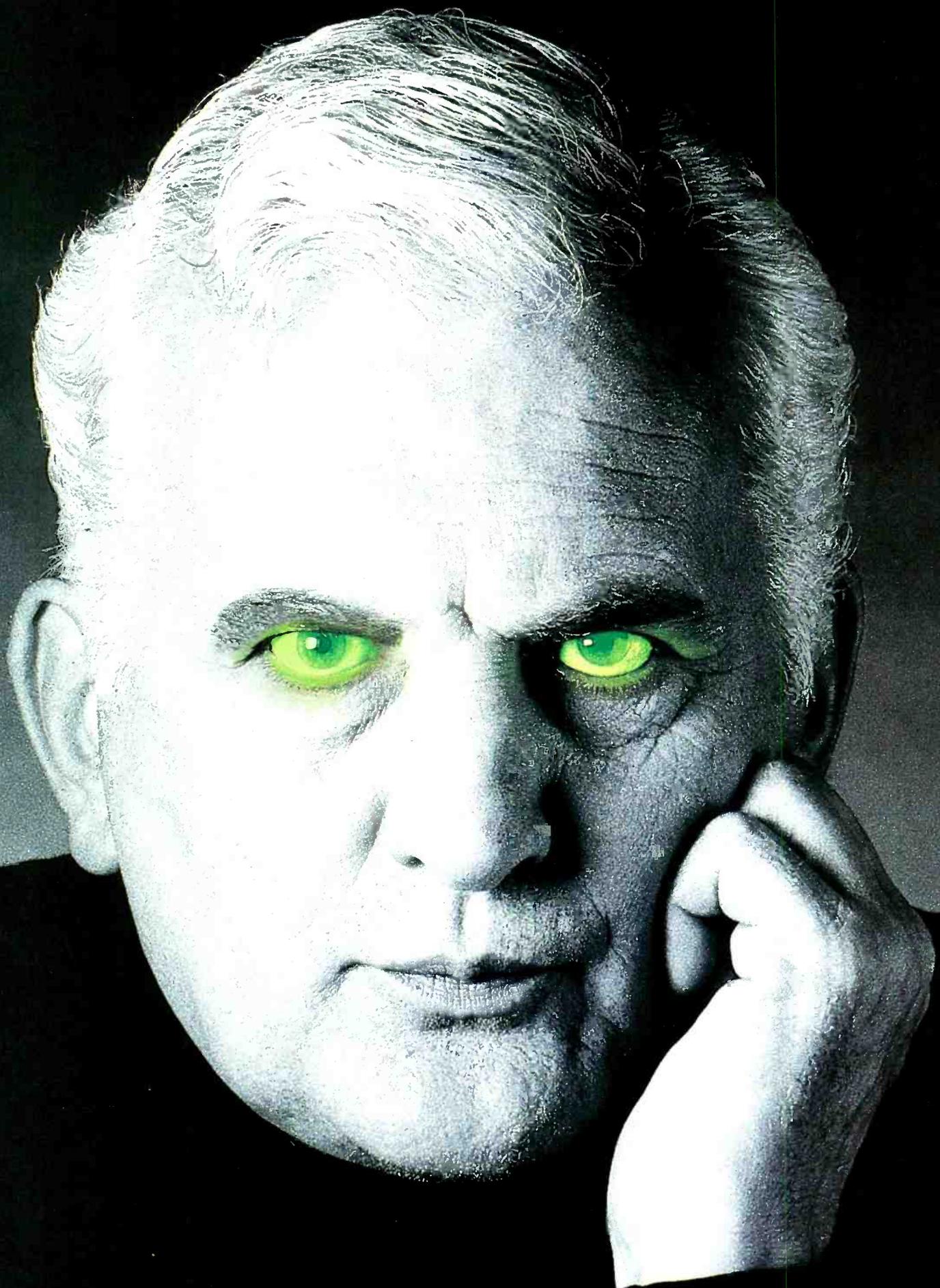
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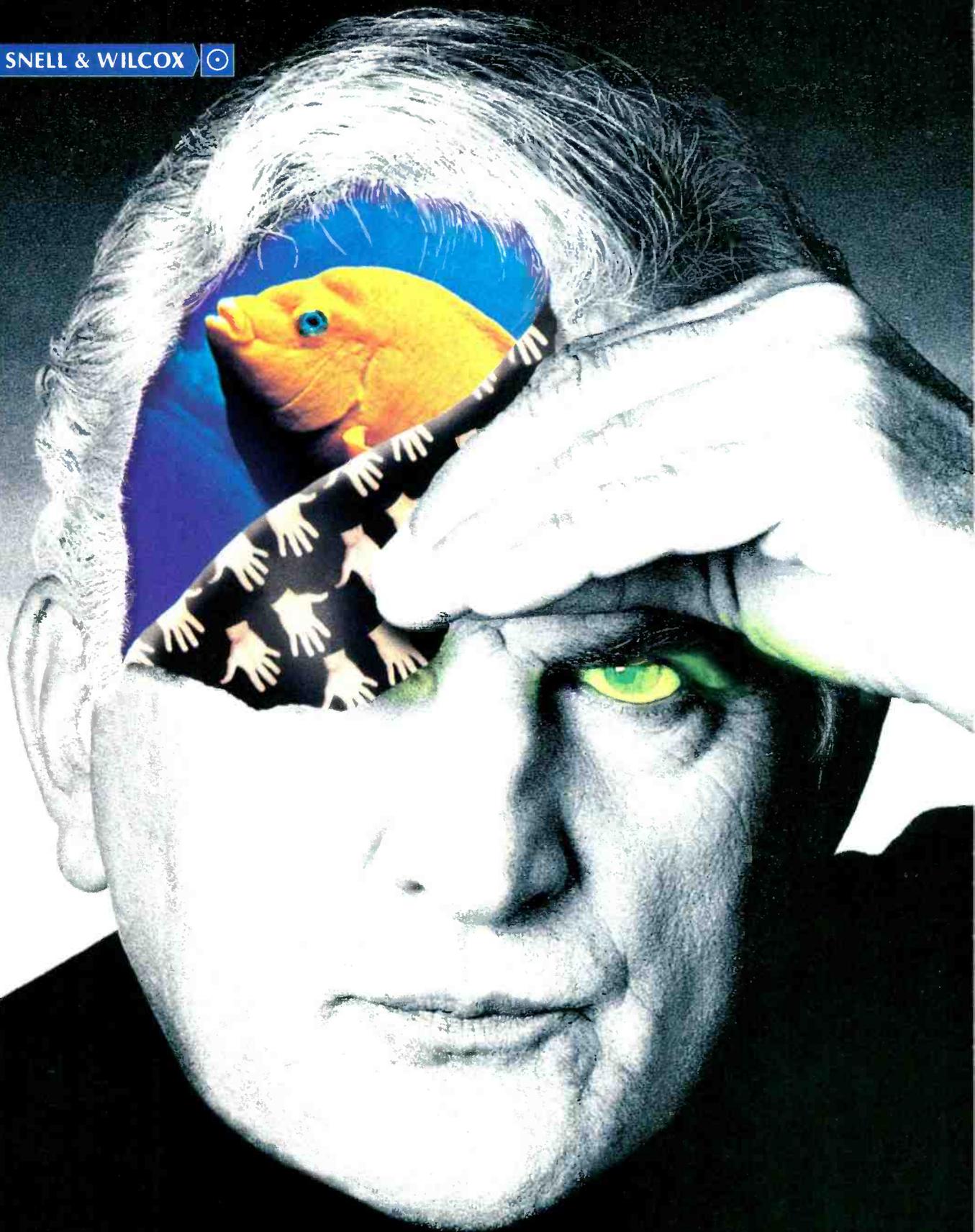


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How can he do it for the price?

Video compression

*Standards include MPEG-1,
MPEG-2 and yes, even MPEG-4.*



The Bottom Line: _____

As an increasing amount of information is encoded digitally, the amount of storage required will also increase. To make effective use of current and future storage and distribution systems, some degree of compression will be used.

Whether lossy or lossless, compression systems seek to reduce the amount of space needed to store information. The amount of degradation that results from the compression process is dependent on many factors; whether it is acceptable depends on the application. _____ \$

Digital technology has already transformed the workplace – PCs, word processors and facsimile machines are commonplace. At home, digital audio has become widespread since the advent of the compact disk (CD). The last analog stronghold in the consumer market is video. VCRs, along with broadcast and cable television, provide only analog video. Even the consumer video laser disk is an analog device. Now, however, the arrival of standards and key technology components holds the promise of digital video.

With digital technology comes interactivity and the ability to edit video in the same fashion we currently edit text, graphics and sound on personal computers. Multimedia, digital television, video-on-demand and video databases all require video in the digital domain. Broadening acceptance of those technologies requires effective compression standards and components.

Looking back in analog

Clarifying the current situation calls for a brief review of analog. Analog video standards define the number of frames per second (29.97 for NTSC and 25 for PAL) and the number of lines per frame (525 for NTSC and 625 for PAL). Video signals also contain a blanked portion that is used for synchronization but is not displayed. Consequently, not all lines, nor all parts of every line, contain active video. To convert to digital, the video signal is sampled along each of the active video lines (486 for NTSC and 576 for PAL). A common rate is 13.5MHz, defined in CCIR-601 and used for D-1 VTRs and the new video-CD format for compressed video.

When employing the CCIR-601 sampling rate of 13.5MHz, there are 720 active pixels per line (NTSC and PAL) and 8- or 10-bits per sample. For efficiency, each color sample is coded in YUV space; Y is the luminance (black-and-white) information and U and V are two color-difference signals known as chrominance components. Typically, each chrominance component is sampled at half the luminance rate or 6.75MHz. The resulting bit rate for NTSC (and

PAL) broadcast television is:

- Luminance (Y):
720x486x29.97x8 = 83,896,819 bits per second
- Chrominance (U):
360x486x29.97x8 = 41,948,410 bits per second
- Chrominance (V):
360x486x29.97x8 = 41,948,410 bits per second

Total bit rate is 167.79Mbits per second (Mb/s) – the bit rate required to handle 4:2:2 digital video.

The state of technology

Believe it or not, practical distribution channels, not committees, mandate that video be compressed (and by how much) to maintain real-time throughput. For example, video-CD and single-speed CD-ROM drives presently support up to 1.4Mb/s transfer rates. So, a 120:1 compression ratio must be achieved. While wide-bandwidth communication pathways such as cable television can sustain 6Mb/s, that still computes to a 28:1 compression ratio. And, of course, the compression process must also address audio.

To maintain synchrony of video and audio, a common system clock is used by video and audio encoders (compressors). Decoders (decompressors) then use the timing information to schedule audio and video presentation on the decode/playback side. That is the basis of the International Standards Organization (ISO) Moving Picture Experts Group (MPEG) compression algorithm. The standard (ISO No. 11172) is published in three parts:

- Part 1: System (audio/video multiplexing)
- Part 2: Video
- Part 3: Audio

By contrast, motion-JPEG (M-JPEG), is not in itself a standard but an extension of the JPEG still-image compression standard only addressing the video component. Many of the problems experienced by users concerning portability of M-JPEG streams stem from the methods used to include audio in the datastream. Because the location of the audio varies from one unit to the next, decoder problems are common.

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Standards: MPEG-1 and MPEG-2

The Moving Picture Experts Group has defined two compression algorithms: MPEG-1 and MPEG-2. This has led to substantial confusion. A common misconception is that MPEG-2 is a replacement for MPEG-1. Nothing could be further from the truth. Rather, each algorithm is specifically targeted at different bit rates; MPEG-2 at higher rates than MPEG-1. However, there are no firm constraints

in either algorithm, and it is possible to run MPEG-1 video at an extremely high rate, or MPEG-2 video at an extremely low rate. The essential difference between them is the incorporation of field-based motion prediction...so, back to the theory.

Analog video is interlaced. Each frame consists of two fields; thus, the field rate is twice the frame rate. The two fields are vertically displaced. Vertical resolution becomes 486 (or 576 for PAL) lines for a static scene and halved (to 243 or 288 lines) for dynamic scenes, where the temporal resolution of a moving image is doubled (to 59.94Hz or 50Hz for PAL).

Given the human psychovisual system's forgiving nature, we tend to tolerate reduced vertical resolution in movement, see the average of the two fields, and get a perception of higher vertical resolution in stationary objects.

The compression algorithms

The MPEG-1 algorithm is targeted at CD rates (approximately 1.5 Mb/s) and based upon the observation that at high compression ratios, better output quality is achieved by incorporating a "spatial decimation" step. In Figure 1, the CCIR-601 curve corresponds to compressing video at full input resolution (720x486). As the compressed bit rate is reduced, output video quality gradually declines, down to roughly 5Mb/s, where it drops off rather steeply. Conversely, the SIF curve is unable to provide equivalent quality at higher rates, but when the bit rate falls below about 3.5Mb/s, it outperforms the 601 curve. SIF is a reduced resolution that is obtained by decimating the (720x486) input to 360x243 prior to compression. (Note that only 352 pixels are actually processed due to the

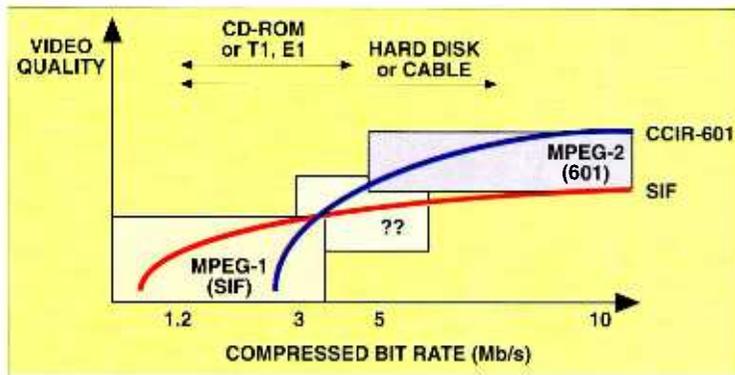


Figure 1. Quality levels of MPEG-1 and MPEG-2 vary according to the bit rate involved. MPEG-1 is optimized for a low bit rate (<3.5Mb/s), while MPEG-2 is optimized for bit rates greater than 5.0Mb/s.

MPEG algorithm's detailed structure). So, optimal choices are: MPEG-1 at SIF resolution for CD-ROM-based and communica-

MPEG decoding is fully defined, but encoding is not. Encoders, however, must produce valid bitstreams decompressible by any MPEG decoder.

tions purposes where the bit rate is less than 3.5Mb/s and MPEG-2 at CCIR resolution when bit rates exceed 5.0Mb/s. In between is "no man's land," driven by quality and financial considerations. MPEG-2 compression and decompression is costlier than MPEG-1, but the results are more acceptable, provided the bit rate is high enough.

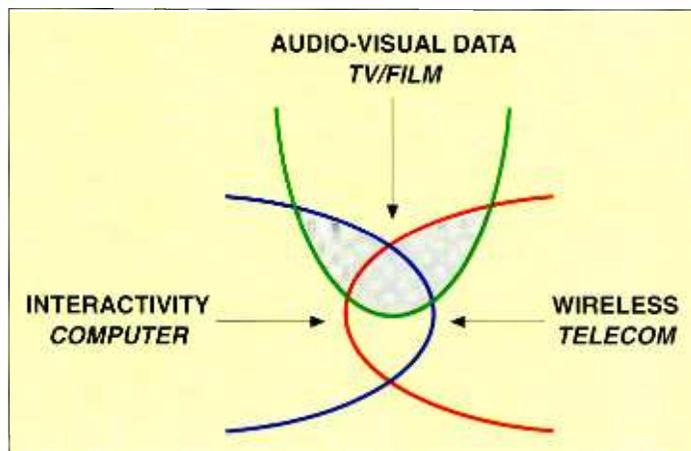


Figure 2. As various aspects of the TV/film, wireless and computer industries converge, MPEG systems, especially those using MPEG-4, are expected to be used in certain market segments (shaded area).

Although MPEG-1 can be run at high bit rates and at full CCIR-601 resolution, it processes frames, not fields. That fact limits attainable quality even at data rates >5.0Mb/s and was responsible for motivating development of the MPEG-2 algorithm that can handle individual fields. However, to take advantage of that capability and produce finer pictures, the MPEG-2 algorithm must run at higher frame rates and with interlaced input. When MPEG-2 is employed

at a low bit rate and reduced SIF resolution, the significant additional cost and complexity of an MPEG-2 encoder is wasted and does not produce any better quality than an MPEG-1 SIF encoder.

Practical considerations

MPEG clarifies the syntax for storing and transmitting compressed data; decoding is fully defined, but encoding is not defined. That fact notwithstanding, all conforming encoders must produce valid MPEG bitstreams that are decompressible by any MPEG decoder. This is the key strength behind MPEG. By allowing encoders to affect proprietary but compliant algorithms, different mechanisms are plausible. In other words, if two encoders are each fed identical video signals and equivalent output rates are maintained, there is no guarantee, nor even an expectation, that the compressed streams or the decompressed video quality will be the same.

MPEG-4

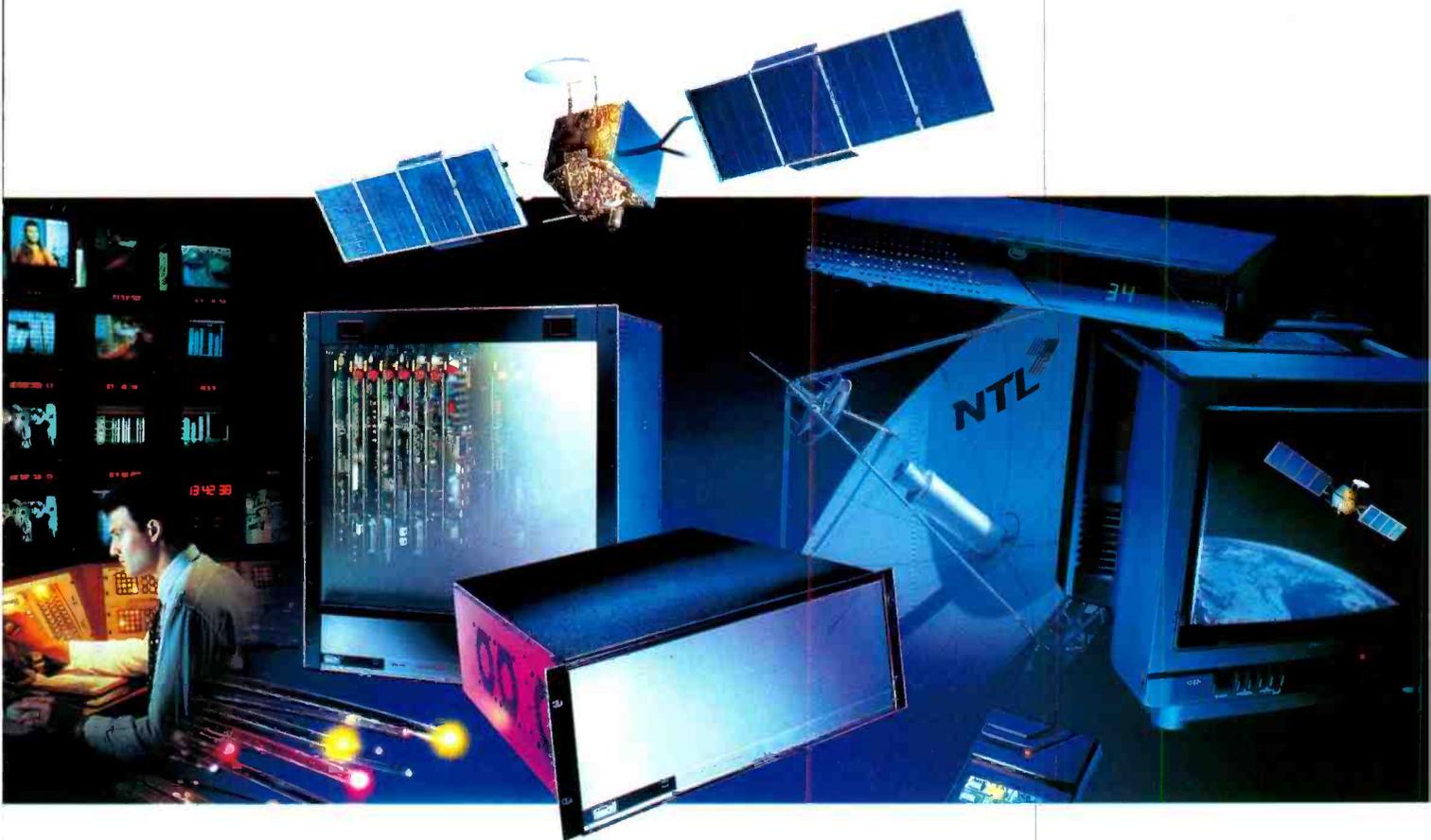
As if there isn't already enough potential for misunderstanding MPEG-1 and MPEG-2 digital video compression algorithms, the stage is now being set for even more. The Moving Picture Experts Group is actively working on MPEG-4 and anticipates that standard's completion in 1998.

According to its Call for Proposals, MPEG-4 is intended to provide, through its structure, complete solutions for audio-visual applications (see Figure 2), plus an ability to cope with newly emerging coding technology. To achieve those objectives, the CODEC is foreseen to be comprised of four elements:

- The MPEG Syntactic Description Language (MSDL)—an extensible language, sup-

NTL MPEG-2 Video Compression

Tried, Tested and Trusted



Two years ago NTL set the pace for digital broadcasting with the launch of System 2000, the world's first video compression system based on the MPEG standard.

NTL MPEG systems are now widely in use by television broadcasting operators all around the world giving substantial operational benefits in applications that include broadcast contribution links, distribution to cable headends, satellite news gathering networks, business television and even distribution to terrestrial television antennas.

Now, NTL has launched System 3000, based on the tried and tested technology of System 2000 but enhanced to be compliant with the European DVB standard and the MPEG-2 (Main Profile at Main Level) performance specification.

System 3000 also gives broadcasters additional capabilities including the ability to broadcast up to 18 video channels within a single satellite transponder, statistical multiplexing and various telecom networking capabilities.

This diversity of applications using NTL's established technology means that fully compliant MPEG-2 systems are now being shipped to solve broadcasters' networking problems without the uncertainty of how the system will perform.

When you can't afford to take risks, don't settle for anything less.

Contact Barry Crompton for more information.
Telephone +44 1703-498042.

NTL Advanced Products Division 34 A-C Parham Drive Boyatt Wood Ind. Est. Eastleigh
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NTL

Circle (24) on Reply Card

Broadcast quality and compression

By Paul Taylor

The specter of compression for many people conjures up an image of taking Shaquille O'Neal, shrinking him to the size of Herve Villachaize, then reconstructing him to emerge as Quasimodo. Not only has he lost size and bulk, but he has lost his color and turned ugly. This is a normal reaction for people with limited compression experience. As computer-based digital images become more acceptable in the broadcast industry, more and more companies are touting their ability to use compression technology to achieve a quality level comparable to BetacamSP. This is all well and good, but a quick look at the specifications rarely supports this claim.

Broadcast quality

What is "broadcast quality" and how is it achieved using today's compression schemes? Broadcast-quality images, either digital or analog, must provide a certain degree of resolution. Most televisions have a maximum resolution of 350 TV lines. Broadcast-quality signals must provide that level of resolution at the TV receiver. Today's delivery methods are largely analog and, therefore, cause signal degradation. Providing 350 lines of resolution at the receiver requires increased resolution at the modulator input. Signals that undergo multiple generations of analog processing require additional resolution at the start because of loss through the processing chain. Digital signals can begin the process with less resolution than analog images because a digital processing chain will not cause the processing losses of an analog system. However, digital signals are still subject to losses in the delivery chain.

Broadcasters are discovering that some computer-based systems do not live up to claims of broadcast quality and cost-effective storage. Video output cards may provide high pixel resolutions, but if their bandwidth is limited, it is all for naught when high-quality video is desired. High usable bandwidth is

needed, and this generally requires large buffers and high throughput. Even today's PCI bus can be limiting if for no other reason than it must also provide a path for ongoing CPU and peripheral communication.

To maintain image quality in computer systems, bottlenecks must be eliminated throughout the signal path. Because of its limited sustainable throughput, one common approach is to get the video signal off the computer bus. Moving video data directly between the video I/O card and the storage device not only provides a path free from bottlenecks but also frees the bus for other necessary traffic. In many instances, this type of architecture also makes it easier to upgrade the basic system.

Compression misconceptions

One common misconception about the failings of compression systems is that with the limitations of current storage devices (capacity and transfer rate), it is difficult to get levels of compression low enough to maintain high-quality video. It is a logical assumption that the lower the compression ratio, the better the image quality. In fact, there is a point of diminishing return and the increased data is simply eating up recording time with no apparent quality improvement.

Despite what is advertised, in theory, a compressed image can look as good as an uncompressed image. The main difference is that the uncompressed image contains the raw data, while the compressed image contains data that simply represents the image. Assuming the compression system can properly deal with all the bandwidth of the original image, the end product should be the same. Compressed images simply require less bandwidth to transport and store. ■

Paul Taylor is operations manager for Fast Forward Video, Irvine, CA.

porting selection, description, and downloading of tools, algorithms and profiles.

• **Tools** — techniques that become accessible via the MSDL or are described using the MSDL.

• **Algorithms** — organized collections of tools that provide one or more specific functions.

• **Profiles** — combinations of algorithms constrained to address a particular class of applications.

Those components will also outline how elementary datastreams are to be parsed and processed (i.e., syntax and semantics in a standard like MPEG-1 and MPEG-2). Furthermore, while the objects are mainly linked to solving particular problems and applications, the MSDL is expected to resolve generic issues allowing MPEG-4 to cover more applications and coding requirements. The MSDL, therefore, is the core of the MPEG-4 standard.

As a bit-efficient generic programming language, the MSDL is intended to describe all kinds of multimedia information taking feedback into consideration. Its three gener-

al levels imply at least three facets in a typical MPEG-4 communication: 1) a configuration phase, 2) a transmission phase, and 3) an instructional phase.

At the start of a call, encoder and decoder will exchange configuration parameters and determine whether it is possible to initiate data transfer. By the configuration phase's end, both terminals will be instructed regarding the ensuing datastream. During the instructional phase, the compressor will send the decompressor missing data or provide it with a location where data can be found. This will make the system potentially independent of any standardized object set. During the transmission phase, data will be sent in the format specified by the other two phases. Note that the three phases can occur at any time in a communication. The configuration phase will be an adaptation tool that can take place any time — not solely at the beginning of the communication process.

In the MPEG-4 standard, there will be only one language, namely the MSDL, that will:

- Negotiate configuration of the decoder.
- Describe the components' (tools and algo-

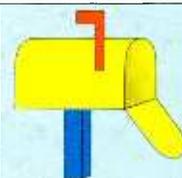
rithms) profiles and the links among them.

• Download missing components in a hardware-independent mode tailored to audio-visual applications.

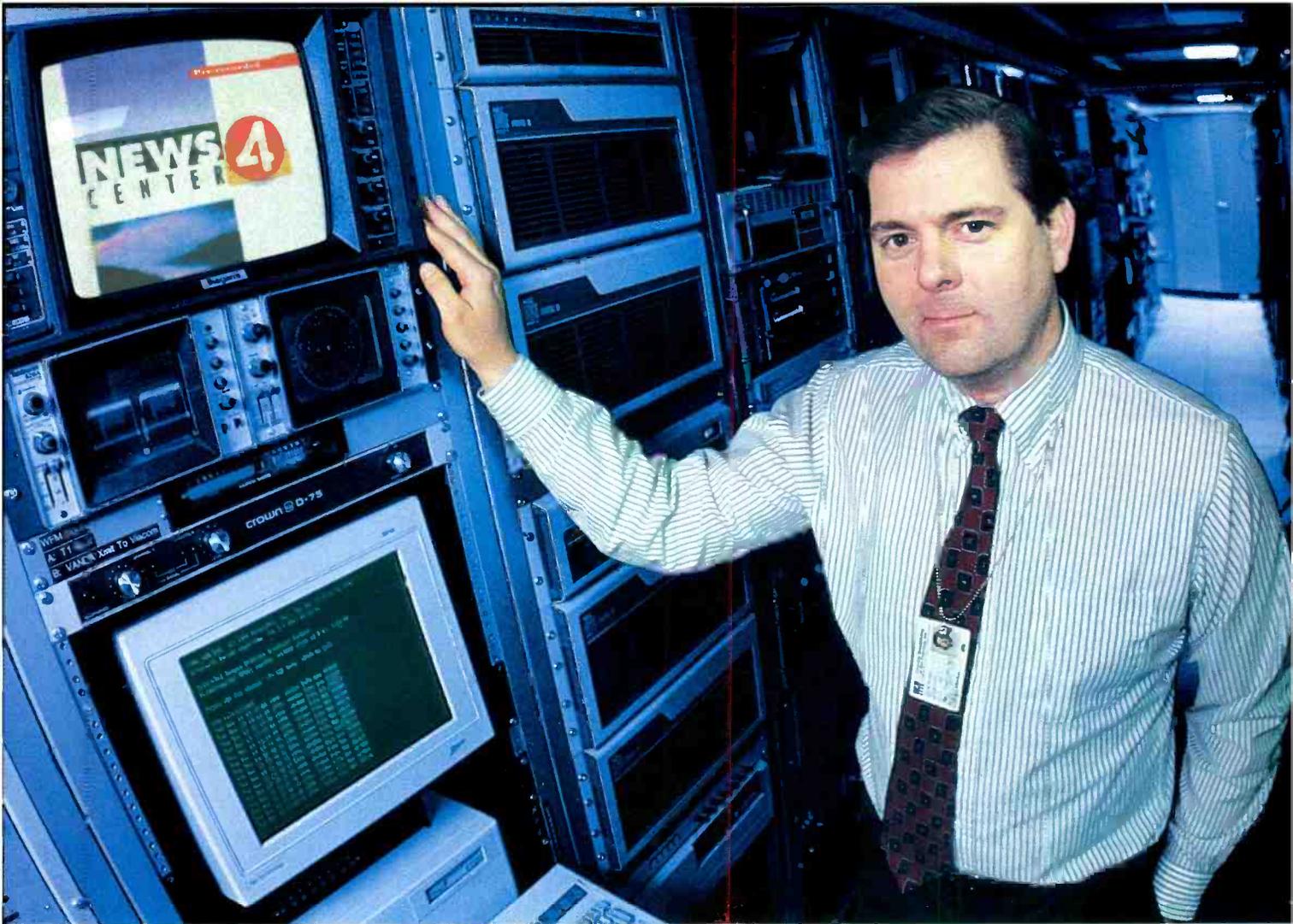
• Govern the transmission according to pre-defined syntax and semantics.

For every perceived deficiency in the MPEG standards, developers are out there at work, tackling the problem as an opportunity. There are many exciting issues to be explored, the majority of which are certain to be discussed in London at the Second Annual European Video & Image Compression Conference. Conference particulars may be secured from BIS Strategic Decisions (Luton, Bedfordshire, UK) at +44-(0)1582-405678. ■

Lee J. Nelson is an industry analyst and independent systems consultant based in Falls Church, VA.



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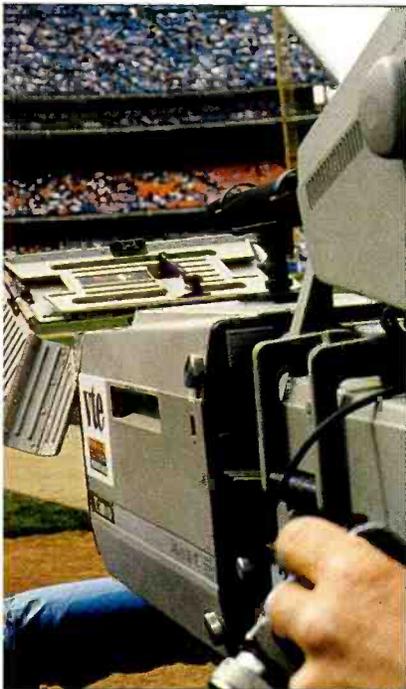
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Circle (25) on Reply Card

Camera accessories

Accessories are some of the tools, toys and treasures of the video industry.



The Bottom Line:

Today's high technology seems so all encompassing that it is easy to forget that sometimes it's the little things that can make or break a production. The right accessories can make the difference between a cameraperson willing to go the extra mile and one who barely makes it through a shoot. Having the right equipment can make all the difference. §

Above photo: A unique lens shade that is fully adjustable and mounts on any lens without drilling holes. Options include a quick-release mounting system and a shotgun mic mount. Photo courtesy of Blaine Lentz Lighting Associates.

Camera accessories are to video production what utensils are to cooking...they may not be the main event, but good luck working without them. An egg becomes a soufflé, and a shot becomes a statement.

There's a world of ENG/EFP camera accessory tools, treasures and toys to be had, which are continually improving your ability to shoot more, better, faster, lighter, easier, in any format, and in every conceivable circumstance. Here's a look at some new items shown at NAB '95 that you might want to put on your wish list.

Sharp and steady images

Professional expectations and technology demand much more of lenses these days. Light weights, durability and optical quality are just the beginning. As camera manufacturers rush to meet new format requirements, lens suppliers are keeping up the same pace.

Fujinon now has incorporated its V-Format aspect ratio conversion technique into several of its V-Grip series hand-held zoom lenses. This new approach lets you use the same lens with the new switchable-ratio cameras and compensates for the reduction in angle of view. Zoom speed can be varied from one to five seconds on this inner focus design series, and the V-Grip adjusts from 3° to 17°.

Angenieux also addresses 16:9 compatibility with its new lightweight AIF (assisted internal focus) lenses, specifically the 15X8.3 AIF. This model integrates a UV filter as a standard feature, and the AIF lets camera operators perform a fast zoom, check their focus, and return to the memorized frame with a bit of thumb pressure on a single switch.

Canon fans are assured compatibility with the company's new Digi-Super 70 lens. With its redesigned control system, this lens presents a zoom ratio of 70X.

If weight is your buzzword, consider Nikon's new Compact Quality Series. Comprised of three different lenses, the lenses all have zoom speeds of 1.2 to 8 seconds, adjustable manual zoom torque, aspheric lens implementation,

and the safety net of an expressed loaner for the life of the lens. The S20X8 weighs 1.55kg, the S9X5.5III weighs 1.7kg and the S15X8.5III weighs a mere 1.2kg.

Erasing the bumps, jerks and vibrations in ENG and EFP shooting falls under the realm of image stabilization. You can approach the problem in two different ways; by stabilizing the platform that the camera and lens are mounted on or by stabilizing the optical image. Steadicam, Tyler Camera Systems and Wescam all address platform stabilization. The tried-and-true Schwem Gyrozoom Lens mounts right on the camera and stabilizes the optical image whether you're shooting from a car, helicopter, boat, bike or donkey.

Professional expectations and technology demand much more of lenses these days.

Shedding some light

In recent years, much more attention has been paid to lighting. Technology has made great strides in several directions resulting in a larger number of options and reduced constraints. Portable lighting products weigh less, attach quicker, are energy efficient, and are proving more versatile for atypical locations.

LTM's three new 200W HMI lighting kits go the extra mile for strenuous location filming around, under or over the world. These lightweight hand-held kits (the Sungun 200 S/E weighs in at five pounds, including head and electronic ballast) are AC- and DC-compatible and come with a full set of accessories.

If you are running on a tight schedule and need a quick soft-box, Lowel-Light's new portable Rifa-Lite 3-product line (500W, 750W and 1,000W) may be the answer. These lights are self-contained, open like an umbrella and don't re-

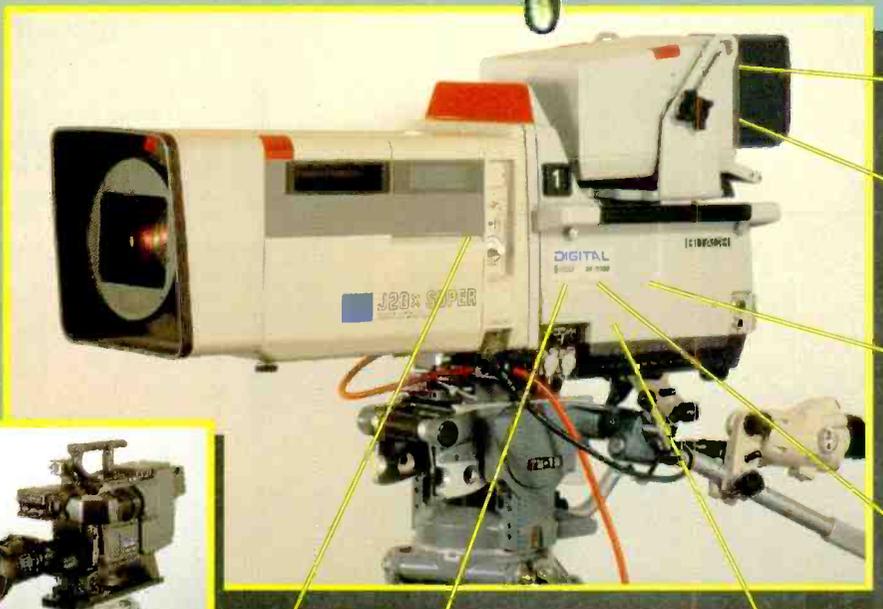
Buy a digital camera or else.....

Or else you may be stuck with a camera left behind by digital technology

As we all know, communications, video, information...everything is going digital. Isn't it time cameras did? Today's digital camera not only outperforms the best analog can offer but sets new benchmarks in video quality, features, stability and reliability. The days of the analog camera are numbered because digital offers too many advantages to be ignored.

With DIGITAL advantages such as a new video transparency, flesh tone detail to soften facial blemishes, precision detail correction, precision transfer of setups between cameras, a plug-in memory card to recreate exact setups weeks or months later and serial digital outputs for D-1 and D-2/D-3 VTR's, now is the time to consider what all cameras will be.....DIGITAL.

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quire a separate fixture. The frame has been strengthened and even the reflector shell is made of soft reflective Nomex. Bringing more of the manufacturing in house, Lowel has dropped the Rifa-Lite pricing considerably, making it even more attractive.

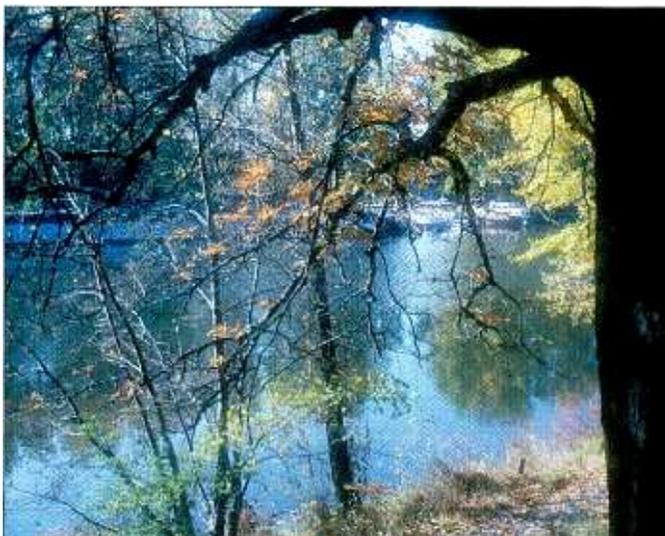
For setup speed and accessibility, consider Frezzolini's NT1 bracket system that offers a fast, easy way to get your lights on your camera. It piggybacks on the back of a camcorder, and your light and battery can just be dropped in. The company also is getting ready to introduce the Frezzi Day Arc. This mini-fill arc light (reportedly the smallest in the world) can be clamped on, tapped in or attached to on-board brick batteries. It produces the equivalent of 120W using one-quarter the power and has a bulb life 10 times that of the norm.

One of the biggest technology leaps in lighting has come in the development of fluorescent lighting. Historically, the problems inherent in fluorescent lights including noise, flickering, color rendering and bulkiness have made them impractical for ENG/EFP purposes. With the new SRGB technology and some re-engineering, many of these problems have been addressed, making fluorescent lighting viable in many ENG/EFP applications. The soft-light quality and significantly lower heat output and power requirements make this type of lighting an attractive alternative.

Videssence, Strand Lighting, Balcar and Light-Tech offer these new fluorescent systems for studio applications. Videssence is just now bringing out the lower-priced VID-LITE line, which is much more appropriate for field work. The construction is lightweight rugged plastic composite, and the fixtures measure 21" x 4" x 11." They are available in 78W, 117W and 192W, and are sold individually or in two or three light kits with all necessary accessories. Lamps are available in 3,000K, 3,200K and 5,500K and last up to 10,000 hours. With 39kHz cycling (vs. 60Hz on standard fluorescents), flickering and strobing effects are all but gone, and you can achieve good stable values of red, blue and green.

Kino Flo also produces an increasingly popular line of portable, durable fluores-

cents with their own 3,200K and 5,500K lamps that are full spectrum in color. Available in one to 10 lamp fixtures, they range in size from nine inches — great for elevators or car interiors — on up to the interconnecting 10-lamp Wall-o-Light for a large continuous flow of light. The plastic casing on the fixtures acts as a reflector and barn-door system when open and a protective storage case when the shoot is complete.



Daytime scene without (above) and with (below) Tiffen's Black Pro Mist No. 5 filter.

Charge!

The key word for batteries these days is "intelligent." Through various means and to different degrees, you can now gauge the status of your power supplies much more effectively.

Anton Bauer is currently working with major camera suppliers in providing an accurate readout of your battery's status right in the camera's viewfinder for the lithium-ion Dionic battery system. The sys-

tem will incorporate microprocessors within the batteries and chargers for control during usage and are half the size and weight (or double the capacity) of NiCads.

Frezzolini has the built-in Energy Gage intelligent system for its NiCads. For on-the-spot monitoring of on-board and in-board batteries, the system displays a measurement of available charge in a battery with the push of a button during use.

During charging or discharging, it turns on automatically so you can immediately tell when the process is complete. It's also temperature- and current-compensated for an accurate read no matter what your location or climate conditions.

PAG's MC124 intelligent 4-channel battery charger works with all NiCads in the 4.8 to 14.4V (1ah to 7ah) range. This system uses a serial port for connection to laptop or desktop PCs, and comes complete with upgradeable software that gives you full information right on your computer. An LCD display indicates the number of cells operating and the charging current loaded for any battery under process. The system can even restore lost storage capacity to tired batteries.

Filters and matte boxes

Ever burnt your fingers pulling out filters? Lowel-Light has a new pop-up filter removal system with a conical snoot that holds gobo patterns and can support barndoors on the front. It uses a one-sided yoke for 360° tilt without getting the cord caught and easier access for changing bulbs.

Tiffen has the eye-catching, affordable FilterFlex matte box that works with internal and external focusing lenses on ENG and EFP cameras. It's lightweight and accepts 4-

inch-wide filters in any standard length without requiring filter frames. There are two 360° independently rotating filter stages and fingerwheels for filter control.

Filters are often essential in correcting lighting problems and in creating moods. The variety of available filters is seemingly endless and continually growing. If you haven't already discovered it, Tiffen's Black Pro Mist special effects lens is worthy of mention for generating a film look to your

video. It subtly reduces contrast, takes the harsh edge off excess sharpness and lets you fine-tune the contrast and mood of your images.

Holding it all up

Support equipment hasn't been left behind in the race for technological improvements. Again, the trends in lighter weights, extended durability, easier setup and greater versatility rule. These issues are crucial because EFP, and especially ENG professionals, may have little control over the type of terrain they need to work on and little time for setup.

The new aluminum alloys and carbon-fiber materials being used have had an enormous impact on the weight factor and the amount of punishment that these products can endure. New locking systems and attachments have shortened setup time, and the minimum and maximum heights have increased for added versatility in capturing those low-to-the-ground or overhead shots.

Miller Fluid Heads is continuing to improve its broad range of ENG and EFP support products with the choice of air-

craft-grade aluminum alloy or carbon-fiber construction on its tripods. The company has revised its spreader systems, added above-ground spreaders for its Series II tripods, improved the rubber feet, top and leg castings, and introduced a new locking mechanism that prevents accidental over-tightening of the leg-lock mechanism.

Sachtler has jumped into a new realm with its Video18/20 sensor heads. Supporting up to 44 pounds on the 18 and 59 pounds on the 20, these tilt heads use electronic controls and LED displays to provide quick and precise camera balancing. If you are doing a nature shoot in the morning and an interior interview later in the afternoon, you can quickly change your camera, lens, lighting, batteries, etc. using a single head and get a perfect balance in no time at all no matter what the configuration is or who is doing the shoot. The heads fit any 100mm bowl base and feature a +90° tilt range, a 7-step drag system on pan and tilt, and a longer camera-balancing platform for easier setup.

When you're looking for something lightweight, Cartoni has the Alfa fluid head system that weigh as little as 12.5 pounds

(head and aluminum legs) and supports from 16 to 22 pounds. Mounting is quick and precise thanks to a quick-release sliding base plate and three presettable counterbalance tilt angles. The aluminum legs use non-slip locks, and the heads are equipped with a telescoping handle and a 90mm bowl base. Cartoni also has Beta heads (supporting up to 33 pounds) available in aluminum or carbon fiber, which are particularly good for cameras with built-in recorders. The Delta fluid heads, supporting up to 42 pounds, are well-suited for dockable camcorders with large battery packs and fully rigged EFP cameras. The Deltas also carry two LED displays that indicate precise counterbalance and tilt drag values as well as an illuminated leveling bubble.

For those big jobs, Vinten TSM has the Vector 70 head that supports up to 154 pounds. It has an illuminated leveling bubble, pan-and-tilt brakes and controls, a locking wedge adapter and a +60° tilt range.

O'Connor's new 1030S head is the same

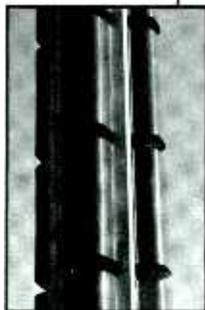
Main article continued on page 58

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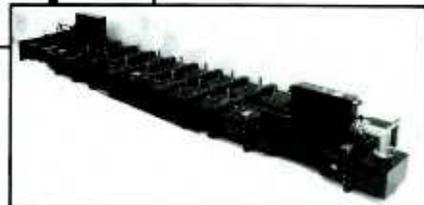
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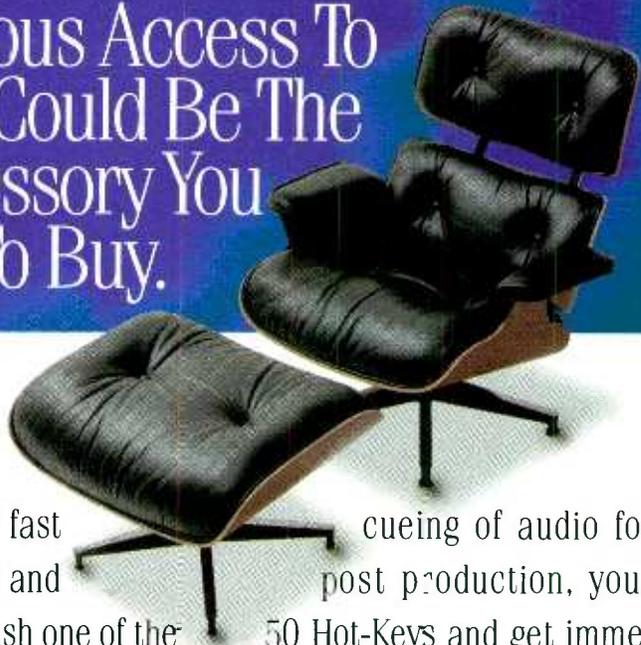
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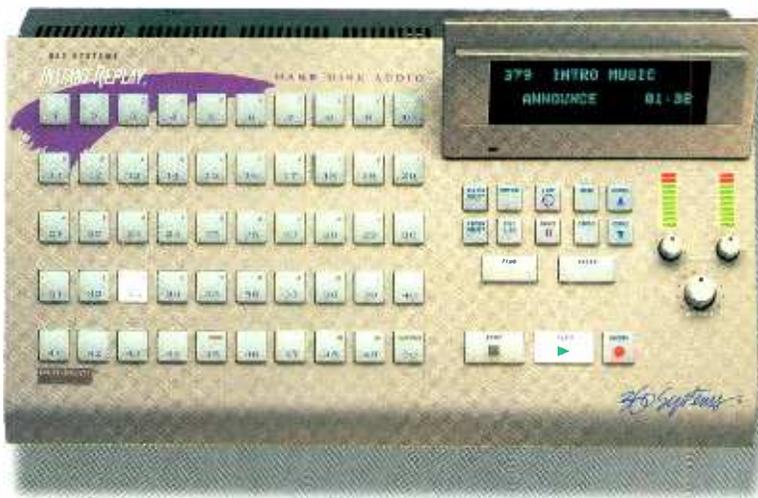


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Expand your field of view with wide-angle accessories

Wide-angle accessories enable creative shooters to get more from their existing video zooms. By altering the optical characteristics of popular zoom lenses, these tools dramatically expand their range and, therefore, usefulness. To assist you in choosing the right wide attachment for your particular shooting requirements, here is a brief survey of the wide-angle accessories available for popular EFP and ENG lenses.

Fixed or zoom-through?

Wide-angle accessories can be divided into two classes: fixed focal length adapters and zoom-through converters. Wide-angle adapters are designed for use with a zoom lens set at its shortest focal length. With one of these in place, a zoom lens performs as a wide-angle or superwide-angle fixed focal length lens. (Focus is accomplished using the lens' macro function.) When the adapter is removed, the lens functions as a zoom once more. In contrast, zoom-through wide converters are perfect for situations that require a wider angle of view and the ability to zoom. Converters may seem more useful than adapters because they allow zooming, but zooming is not required — or even desirable — in many wide shots. Fixed adapters offer considerably wider angles and lighter weight, and generally cost much less than converters.

Wide-angle adapters

Particularly cost-effective for capturing wider views with

your video zoom are the wide-angle adapter sets offered by Century Precision Optics and Film/Video Equipment, Inc. After more than a decade on the market, these compact, lightweight 2-piece sets have become the industry standard. The .7X attaches to the front of a video zoom lens to increase coverage by 30%. Adding the .5X superwide to the .7X produces coverage 50% greater than that captured by the lens alone. When attached to a lens that zooms to 9mm, for example, the .7X shortens the effective focal length to 6.3mm. Supplementing the .7X with the .5X superwide adapter further alters the wide end of the lens to just 4.5mm. Canon, Fujinon and Nikon also make wide-angle adapters for use with their lenses. The Nikon and Fujinon wide attachments reduce the effective focal length of the respective zooms by a factor of 0.7 for 30% more coverage. The .75X Canon attachment offers a field of view 25% wider than the lens alone.

The use of aspheric surfaces in a single-element adapter makes it possible to widen the field of view dramatically with minimum distortion, reduced chromatic aberration and increased edge resolution. Such aspheric elements are typically difficult to design and expensive to manufacture. Century Precision Optics' .6X Double Asphere wide-angle adapter is the exception made possible by the aspheric expertise of Tinsley Laboratories, Century's parent company. Its .6X Double Asphere was created especially for use with the newest generation of ENG/EFP video zoom lenses. Its 40% increase in coverage changes a 15x8 lens into a supersharp

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4.8mm fixed focal length lens.

Zoom-through converters

Wide-angle converters are the best way to expand a lens' angle of view when the shot requires a zoom as well. Wide converters are available from Fujinon, Canon, Nikon and Century Precision. Added to the front of a zoom lens, they effectively shorten focal length while maintaining full zoom capabilities. Attach an .8X to the front of a lens for 20% more coverage. For example, when added to an 8.5-119mm lens, the .8X wide converter alters the focal range to 7-98mm. This can be especially advantageous when shooting in confined quarters. Wide-angle converters not only expand the field of view, but also reduce minimum object distance (MOD), allowing the camera to move closer to the subject while maintaining focus.

Fisheye adapters

When you need to get the widest possible angle of view along with



Changes in perspective that result when fisheye adapters are used. Same camera location with (above) and without (below) a fisheye adapter. Photo courtesy of Century Precision Optics.

pronounced barrel distortion, add a fisheye adapter to your zoom lens. Canon, Nikon and Fujinon all offer fisheye adapters for their lenses, and Century Precision Optics recently introduced a super fisheye adapter. A fisheye's tremendously wide field of view suggests a myriad of creative possibilities — from panoramic vistas that seem to stretch to the edge of the earth, to comical forced perspective close-ups in which an actor's distorted features seem to pop through the video screen. While extreme telephoto shots tend to flatten the subject against the background, the fisheye exaggerates depth, pulling nearby objects closer and causing distant objects to recede into the background. Fisheye adapters are characterized by extreme barrel distortion, which bends straight lines within the frame and causes the horizon to appear curved.

The right tool for the job

To choose the right wide-angle accessory, look at the shooting situations you are likely to encounter.

Continued on page 58

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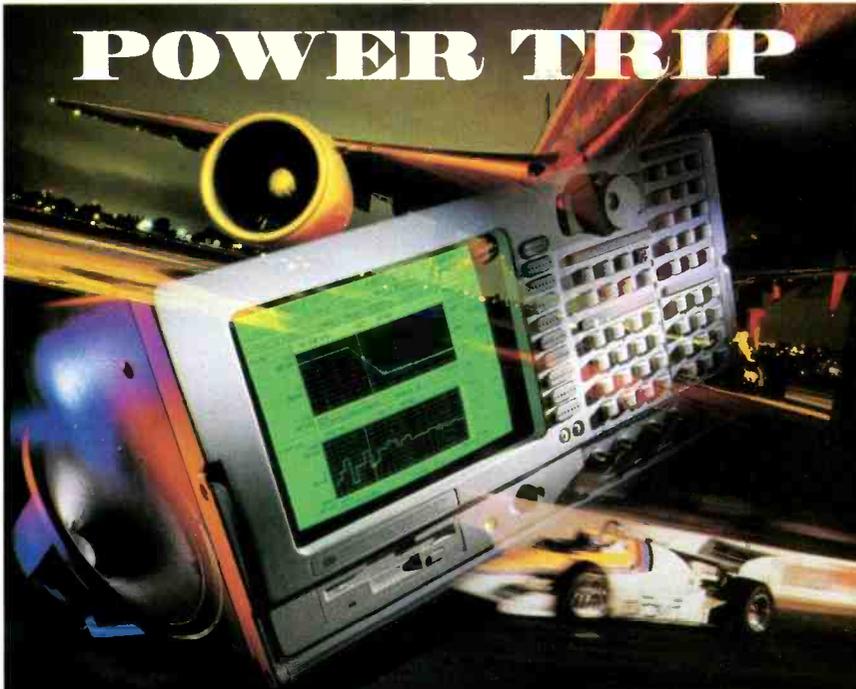
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Expand your field of view . . .Continued from page 57

If you will be shooting an interview in a cramped setting, for example, zooming will be much less important than including necessary items in the frame — so grab a wide-angle adapter, not a converter. For run-and-gun news coverage, a wide converter offers a wider view and the ability to zoom. To explore the architecture of a downtown building, the rectilinear fidelity of a .6X Double Asphere makes it the tool to use. If the shoot dictates an exaggerated wide view, with barrel distortion and really deep focus, you'll want to add a fisheye. Having the right accessories on hand can extend your camera's capabilities, without the expense of additional zoom lenses. ■



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Continued from page 52

weight as its "B" series partner, but supports almost 50% more in weight with greater counterbalance capacity and a +60° tilt range. The 1030S was designed for crews working with relatively heavy Beta systems, full 16mm and lightweight 35mm production packages with or without prompter packages. O'Connor also goes lightweight with its new 25L 2-stage carbon-fiber tripod that weighs in at 6.5 pounds (with the spreader). With an adjustable spreader and a maximum height of 66 inches and a minimum of 15 inches, you get a lot of added versatility in a compact package.

Bogen has enhanced its line of support equipment with its new carbon-fiber tripods, monopods and heads. Its 510 model is a 3-position fluid head that carries a 19-pound weight limit and a +75° to -70° tilt range. For quick action shots, the company has a lightweight (1 pound, 3 ounces), 3-section automatic monopod extending from 24.5 inches to 65 inches. Using a grip-action release, you can automatically adjust the top section up or down 19 inches. Bogen also carries a nifty suction grip that adheres to any non-porous surface and includes a camera support and an adjustable pole for added stability.

Gitzo has also moved to carbon fiber on some models. Along with its full line of standard and performance tripods and heads, the company has introduced the Mountaineer Monopod weighing only one pound and offering a height variance of 22 inches to 65 inches.

A versatile alternative to any monopod is the Hansare & Hansare Duopod. This compact aluminum option has a second quick-action adjustable fold-out leg with a steadying footplate for added support. This leaves both hands free for camera adjustments. At its full height, the Duopod gives you a 68-inch reach.

These are just a few of the latest highlights that are available today. There is also a whole world of new-and-improved dollies, jibs, cranes, remote systems and other accessories that further enhance your ability to shoot anything...anywhere. There is general agreement between users and suppliers regarding trends and a rapid push from both to continue stretching technologies to meet these increasing demands. ■

Chris Leonard is president of Traxlecom, an industry-consultant company, in Englewood, CO

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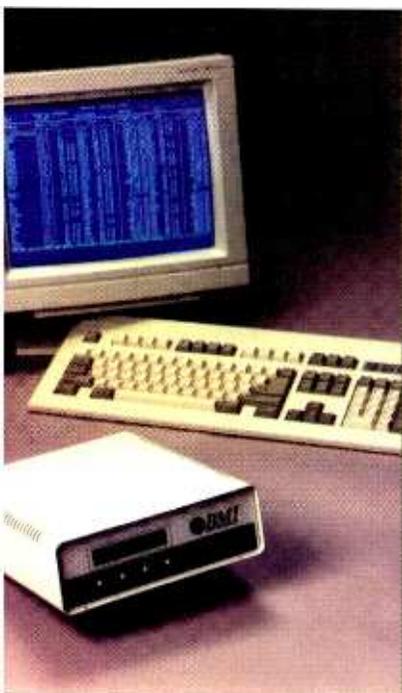
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EDS and datacasting

Taking those first small steps into the world of digital broadcasting.



The Bottom Line: _____

With the rapid pace of technological change today, it may be time broadcasters look beyond the limited-picture delivery system occupying their 6MHz channel and think more in terms of usable spectrum. With a new attitude geared toward over-the-air information delivery, it will be possible to cultivate the type of growth the industry needs to make the transition into the ATV era. _____ §

With the upcoming change to ATV receiving all the attention, it is no surprise that the current uses of the broadcast signal as a digital delivery medium have been overlooked. In many instances, we are sitting like beach bums on the most valuable piece of property in the area while the high-rises of the cable and DBS industries tower around us. Several equipment manufacturers have begun to address these issues and are attempting to merge the past with the present and take those first small steps into the world of datacasting.

Background

Vertical blanking interval (VBI) insertion has been allowed by the FCC for some time. However, in 1970, the FCC took a firmer hold on these ancillary transmissions. The commission's concern for possible degradation of the NTSC standard led the FCC to require that new processes be submitted and approved, which was the first step in the control of digital broadcast technologies.

Two transmission methods emerged from the 1970 decision. The first was the opening of line 22, the first line of active video. It was believed that the overscan of most home sets would mask the data flickering. In 1985, Telescan Inc. and Ad Audit Inc. developed a line 22 insertion scheme approved for broadcast. The system conveyed information, such as time of day, length of commercials and presence of audio and video. Broadcasters imposed two stipulations on the new system: That they were informed of the information's presence and retained ultimate control. The second transmission method qualified in 1992 was a bit more daring. It was determined that a 240b/s signal could be inserted into a limited area of the bandwidth so as not to disturb the picture. Just as the computer industry developed faster data rates, the FCC is now forced to redefine this delivery medium. Various systems are in use today that are varied not only in method, but content and intent as well.

Systems currently in operation

Faxcast is a New York-based company that has extended its data-delivery system worldwide. The company operates on a single-point multidistribu-

tion scheme that allows the timely delivery of fax, data and text files. Faxcast decided to improve on existing technology rather than reinventing it, modifying its signal to fit the delivery format of the target.

The company's strength is the versatility of delivery method. The Faxcast system starts with the information provider, which could be any fax machine or PC hooked up to its system. The information is sent by modem to the Data Collection Center where 1,776 disk arrays traffic the data. Specialized Faxcast software and equipment insert the data into the VBI. At the destination point, a customized Faxcast receiver with an addressable module picks off the appropriate data and routes it to a PC, postscript printer or fax machine. The receiver even contains a smart switch that allows it to work in conjunction with other delivery systems.

In the United States and Canada, Faxcast has chosen to use the VBI delivery system. Anyone connected to the service receives software and a standard V.32 modem. The information to be transmitted is sent to Syracuse, NY, where it is data filed, stored and formatted. It leaves Syracuse in the form of encrypted NABTS data, arriving in Raleigh, NC, where it is converted to FM2. Faxcast is currently delivering its signal to the five owned-and-operated NBC affiliates along with two Canadian stations.

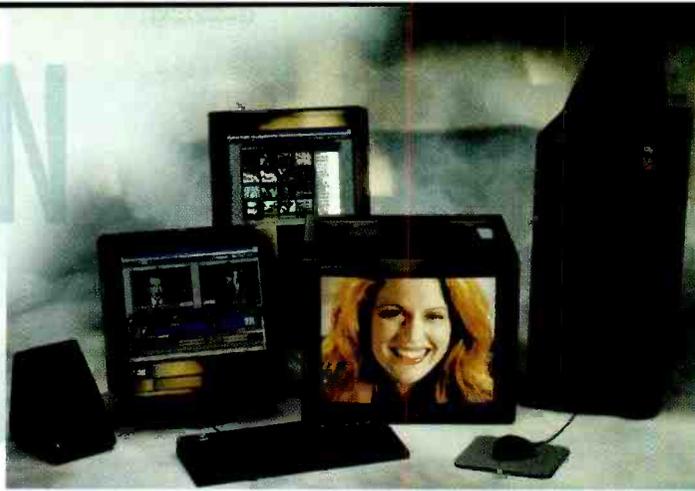
Faxcast can effectively deliver 15.3kb/s on a single line in both fields. The receiver can accommodate up to three lines, providing a maximum delivery rate of 45.9kb/s. Currently, Faxcast is operating on a single line and has options for the other two.

Ken Bronfin, general manager of NBC Data Network, has been put in charge of incorporating Faxcast into the NBC network feed. Currently, NBC's VHF stations in the top 25 markets reach 50% of American households. Delivery is also realized via cable using the VBI in NBC's cable service, CNBC. This delivery reaches approximately 60 million homes.

Another Faxcast delivery method is direct via satellite. Users are supplied with a receiver tuned to the visual carrier of the supplier. The receiver is equipped with 1MB of memory and a fax, PC and printer port for multiple applications.

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wireless high-speed data delivery. These two companies have teamed up to transmit multimedia information over WavePhore's TVT1/4 system and Channel America's satellite footprint. They have already contracted with 87 affiliate TV stations nationwide and their service is dubbed the "Information Skyway." Negotiations are under way to include the service in the newly formed Canadian Skyway Network.

WavePhore has taken a different approach to data insertion. Instead of using the video as the insertion point, it incorporates the data into the RF, inserting it into a narrow 300kHz band above chroma at 3.9MHz and the 4.2MHz aural notch. The digital waveform is converted to analog, summed and rasterized. Then it is inserted at a low level to allow minimum degradation, which does make recovery a problem. The modified digital signal is injected and broadcast as a single sideband slightly to the video side of the notch. (See Figure 1.) The signal is bi-phased to ensure separation from the video and rounded to remove artifacts. WavePhore has been able to realize a 384kb/s net rate with forward error correction using a 1/4T1 delivery scheme.

The system has been proven compatible with the NTSC signal. The -20dBmV insertion level added from 3.9MHz to 5MHz ensures no co- or adjacent-channel NTSC interference. WavePhore's TVT1/4 system was tested for a 10-month period on Channel 3 and in a 9-month trial on Channel 45.

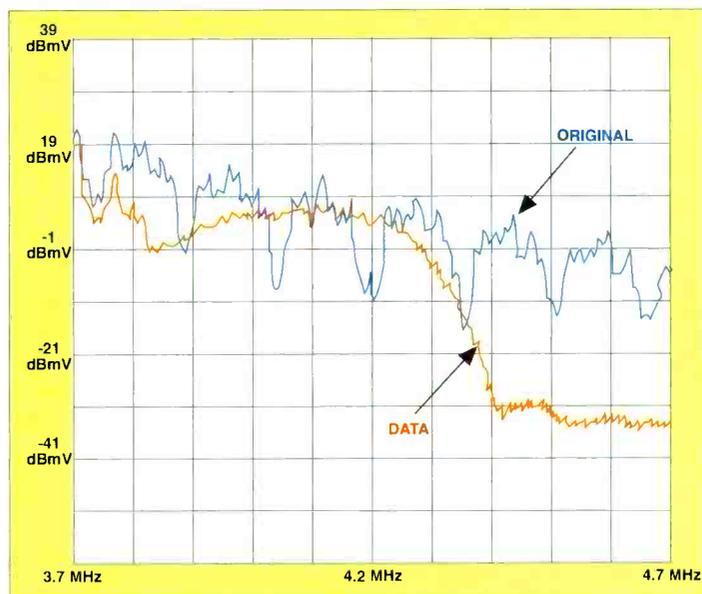


Figure 1. WavePhore video spectrum with and without data. (Courtesy of WavePhore.)

Both tests took place in the Phoenix area with no complaints from viewers or station operators. The system was also in continuous operation on Channel 13 in Las Vegas during NAB '95. There, it was integrated with closed-captioning, VBI and ghost canceling with no adverse effects.

An extensive test was performed on Channel 45 at five different locations in Phoenix during November 1993. The data signal was switched in and out on request and automatically at 5-second intervals. While the test procedure ran, a search was made for noise patterns, noise increase, color change, ghost/echo, areas of sudden color change and aural noise and distortion. The WavePhore TVT1/4 system operated successfully within the A contour. It also has proven its performance

up to the B contour with antenna and terrain affecting reception. Stationary and mobile multipath rejection is minimized by use of an adaptive baseband equalizer, which has proven to provide signal integrity at distances up to 60 miles provided a 45dB S/N level is maintained.

WavePhore recently signed an agreement with Intel. The two companies will jointly explore the incorporation of TV-delivered data to personal computers. WavePhore is developing a chip set that will aid system marketing by making it easy to integrate into existing hardware.

The National Datacast Network, a subsidiary of PBS Enterprises Inc., is comprised of about 250 independently owned PBS member stations, making it the largest data broadcast system in operation. Although it uses PBS as a delivery medium, National Datacast has contracted with each station separately for data delivery.

National Datacast supplies a data bridge at each participating station. Customers deliver the information by normal means to PBS in Alexandria, VA. PBS inserts the data into the VBI and sends it via satellite to all of its member stations. PBS is in the process of converting to a compressed digital satellite delivery system that may allow it to expand its data delivery service. When the conversion takes place, the VBI will be replaced via digital carrier. Among the variety of data services being delivered is StarSight Telecast, which delivers an area-specific, on-screen

Compression equals expansion

By Richard Gerdes

The transmission of data through media historically reserved for television creates new communication pipelines with bandwidth-limited data rates. Like nature abhorring a vacuum, people will find a use for every bit that can be passed through these new channels, which will create demand for even higher data rates. Although, in the future, the technology of adding data to a TV signal will have predictable breakthroughs in the fundamental data rate limits, the use of compression technology expands the fundamental data rate immediately.

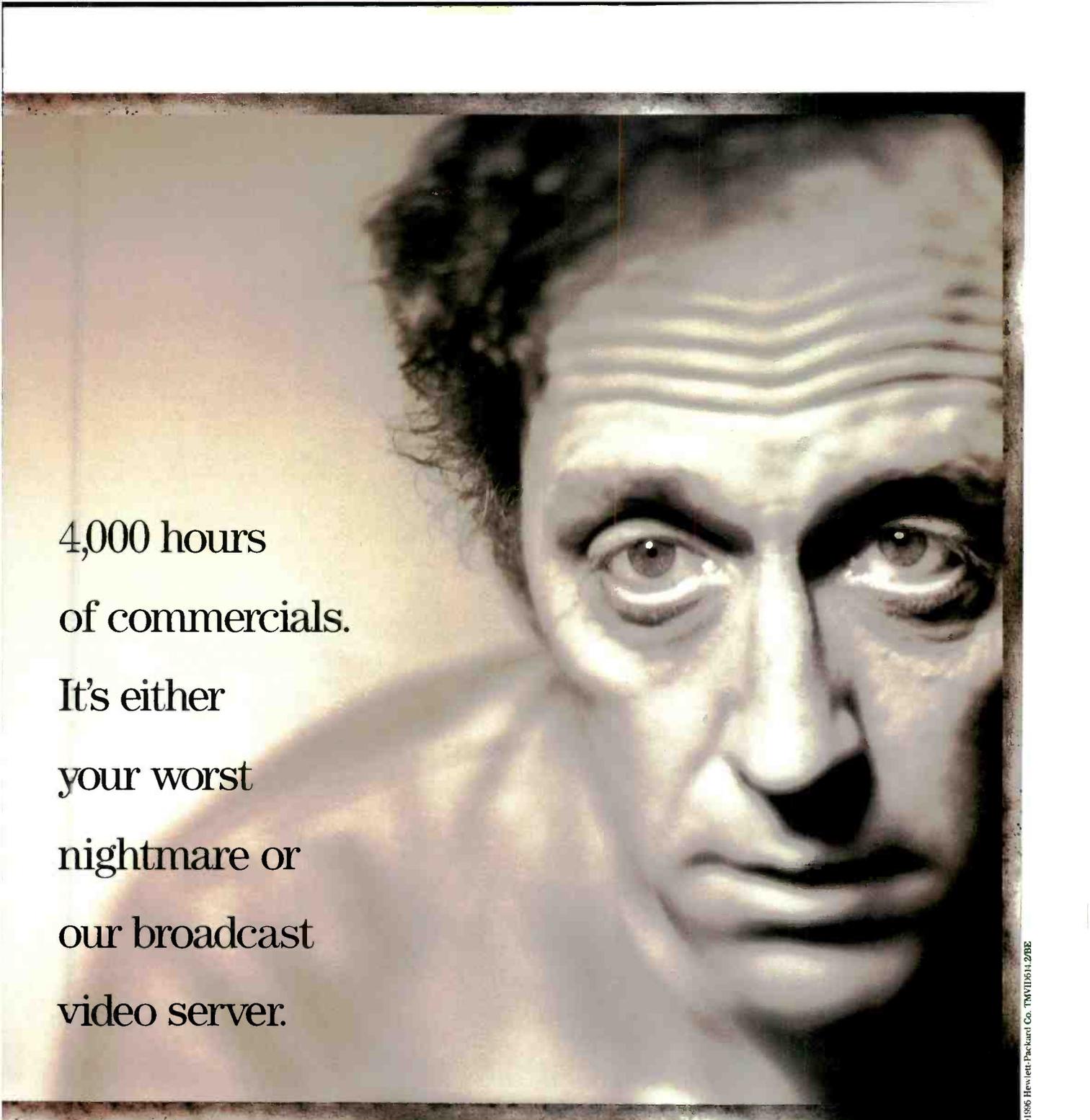
Compression comes in two basic categories: lossy and lossless, terms that are quite descriptive of the nature of these compression types.

Lossy compression, where information is permanently discarded without being missed (at least that's the plan), works well for audio and video. Added to existing data-on-active-video products that are passing 384kb/s, a modest 4:1

compression will create a full T1 data rate channel suitable for high-quality audio.

Lossless compression, where no information is lost, is perfect to expand the bandwidth of all existing and new data transmission systems. Many hardware compression products now available will effectively double the available bandwidth. Available compression hardware can expand existing data rates up to eight times, which is the equivalent of two T1 channels for the data-on active-video systems. Lossless compression for audio now exists that can provide a completely transparent, full data rate, stereo audio channel for the data-on-active-video systems. Compression is a companion technology that expands the data rate capability of TV data delivery systems. ■

Richard Gerdes is director of engineering for Singularity Corporation, Scottsdale, AZ.



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viewing guide to provide viewers with updated program schedules.

Interactive Network, currently active in five markets, is a service that augments the video and audio of a channel. Subscribers are able to play along with game shows, sporting events and TV shows. A data feed from San Jose is sent directly to those markets. The rest of the PBS stations get a feed from the VBI for demonstration. At the same time, it is sent to selected FM stations for a secondary mobile source. The control unit that converts the information is actually a small PC. (See Figure 2.)

The PC stores information compiled while the viewer is playing the game, then it's sent to San Jose via MCI packet network where it is compiled and compared. After the game is over, a short call to the network hub allows the player to qualify to win a prize. The tally process takes only five minutes and the winners and scores are sent back over the air so players can compare scores.

Digideck Inc. is currently testing its "D-Channel" technology on WWOR-TV in Secaucus, NJ. The "D-Channel" signal operates continually throughout the active video, unnoticed by the viewer. Digideck's QPSK data carrier is placed 1MHz below the picture carrier some 30dB to 36dB below the video at peak-of-sync. (See Figure 3.) The transmission rate of 700kb/s nets 525kb/s after correction.

The robust performance of Digideck's system is attributed to the fact that it is an out-of-band transmission. The company believes the freedom of operation without the possibility of host channel interference gives it an edge. The "D-Channel" testing at WWOR is an application test only. Digideck has not explored the business applications of its system.

SilentRadio is one corporation that has not been so quick to desert the VBI in favor of other carrier-based systems. SilentRadio's network of 1,000 sites has been a profit center since 1982, and it is the largest network using the VBI. The company has just begun marketing its new data encoder, which provides one of the most advanced point-to-multi-point data-distribution systems available.

SilentRadio's system includes an "intelligent" inserter. The VIP102A has four RS-232 ports to import data formats in addition to closed-captioning. The inserter is versatile, allowing any combination of line and field groupings and buffering the delivery through 16Mb of RAM. The other end of the system is the VIP103A encoder. Additional editing software makes this unit a post-production captioning center. A special video modem puts the package together and places it in the VBI.

SilentRadio's goal is to partner with local

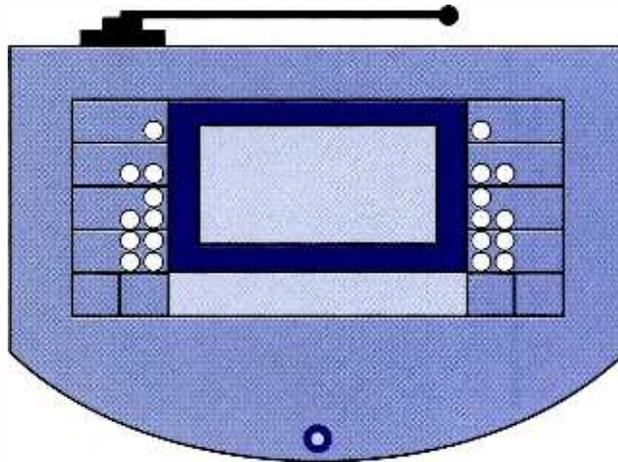


Figure 2. The Interactive Network's control unit is part laptop and part mobile data receiver. The keyboard is hidden under a pullout cover.

broadcasters to develop financial opportunities. The company believes its flexible user-based system will allow hardware to be customized to meet individual needs. Local advertising, home gaming and voice-to-text are just a few of the services it hopes to provide.

En Technology Corporation, founded by the owners of PC Connection Inc., is yet another entry into the datacasting arena. PC

The commission is adamant that the licensee exercise control and retain responsibility for the information being broadcast.

Connection is a highly successful hardware and peripherals marketer, and PCTV is the leading producer of technology TV programming. PCTV is best known for the PBS show *Computer Chronicles*. The company's plan is to incorporate En into current and future PCTV programming and expand its viewing audience. PC Connection will continue to provide fulfillment and customer service.

The new product, a data transmission system code-named "Malachi," is aimed at combining the world's most powerful popular entertainment and information technologies — television and computers. This link between the home computer and the home TV set has been demonstrated over the air to broadcasters in most major markets and has met with little objection.

En Technology's system allows broadcasters to choose how much of the broadcast signal they wish to use as they send the data. Data can be sent in the VBI or any portion

of the active picture area. The data rate increases as more of the active picture area is used. The "smart" ISA board for the home PC (or external box for a Macintosh) allows the computer to match the recovery rate to the transmission. Every board has a unique addressable 2-chip set that can be used to verify the source of the captured data. In addition, the system is secure and uses Data Encryption Standard (DES) algorithms, the only government-approved methodology of encrypting data. The transfer is hundreds of times faster than a traditional modem and delivery can be a trickle or a deluge, depending on the size of the file and the space the broadcaster is

willing to provide. The process can be embedded using En Technology's video data inserter on any video source and will even hold up on a VHS recording.

There are multiple uses for this new technology. En Technology envisions such things as home delivery of free "unlocked" software that can be purchased while the customer is watching a demonstration on television. Advertisers could enhance their commercials by providing coupons, brochures, giveaways, dealer locations and other information that could be delivered to the computer in the time it takes to view a 30-second spot. Magazines, newspapers and catalogs could be sent to the users and updated constantly. Multimedia newscasts, weather reports and box scores could also be sent digitally throughout a newscast. The product will be available late in 1995, and will retail for less than \$100.

En Technology also is working on a tunable ISA board for 1996 that will allow operation independent of the customer's television. In addition, the company is marketing hardware for broadcasters and video producers to allow local insertion.

Yes! Entertainment Corporation approached the FCC in 1993 with another data-insertion scheme. The Yes! system consists of a pulse amplitude signal from 7.5IRE to 100IRE beginning 9.1 μ s after the beginning of the horizontal sync pulse and ending 10.36 μ s after horizontal sync. This provides it with a 1.26 μ s window from line 22 to line 257 on each field of video. One pulse per line on the system allows for 14.160kb/s, which is used to carry coded information. Yes! is planning to use this audio to activate a "TV Teddy" toy bear that would decode the audio and "talk" to a child during the TV broadcast.

FCC opinion

In May of this year, the FCC posted its opinion on the subject of digital transmission within the video portion of the signal.



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The FCC believes broadcasters should proceed with caution in this area. Although this kind of technology will expand and enhance the use of the existing spectrum, the commission believes it must be done within a regulatory framework. One thing is clear, the commission is adamant that the licensee exercise control and retain responsibility for the information being broadcast. Sufficient monitoring and legal documentation must be maintained.

The FCC is also aware that open-ended technology could lead to system compatibility problems. It warns that while the "licensee-is-responsible" policy gives the broadcaster flexibility, it can also cause cumulative effects, possibly causing signal degradation. The commission is concerned that new viewing technology,

such as picture-in-picture, may cause viewing problems in "overscan" VBI delivery

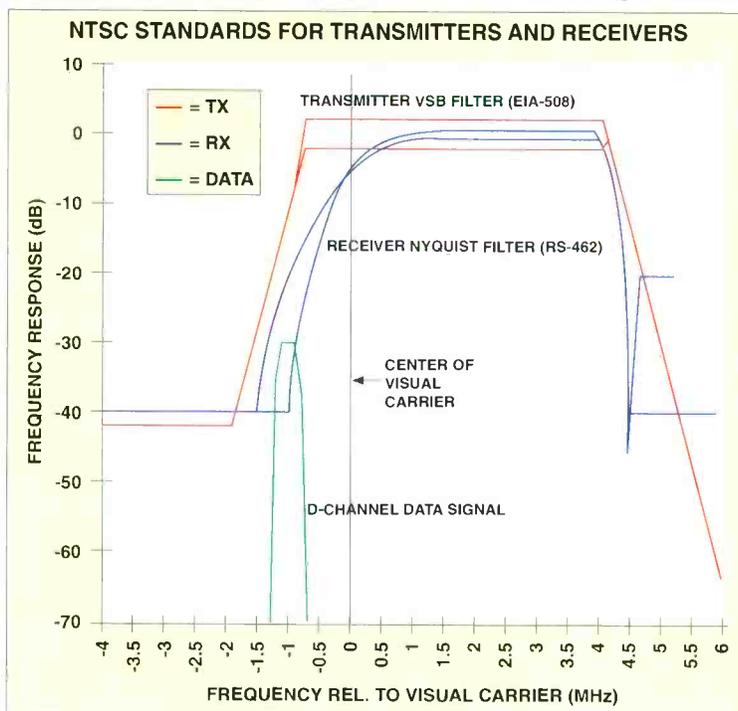


Figure 3. Frequency characteristics of Digideck's "D-Channel" transmission scheme (green) currently under test at WWOR-TV.

systems. The agency also pointed out that distortion and adjacent-channel interference

from "subvideo" systems should be monitored closely. The licensee must retain the option to strip the data. In an overscan situation, the offending line can easily be deleted with no apparent effect on the picture. Another question raised by the FCC concerns the blanking out of subvideo causing objectionable degradation.

The commission encourages the use of TV signals for transmission of data and the development of new technology. It is open to the idea of adopting standards that might become essential to the incorporation of mass decoding circuitry into receivers. The National Data Broadcasting Committee, formed in 1993, will recommend a technical standard for high-speed data broadcasting using NTSC.

The FCC is determined to remain open. It does not want to enact a rule that would give any company an unfair advantage. The FCC

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realizes that by sanctioning a single company's technology, it would be the only system with FCC approval. On the other hand, if the commission allows the market to decide, it must define the parameters that determine "discernible" interference.

NDBC report

The Evaluation and Testing Groups of the National Data Broadcast Committee (NDBC) have recently filed their findings on the WavePhore and Digideck systems. The committee has termed these data broadcast systems "NTSC+." The NTSC+ tests used random noise, impulse noise, static and dynamic multipath signals to measure the "desired" and "undesired" effects with respect to the NTSC signal. The bit error rate, along with audio and video degradation, were measured at varying power levels. Video characteristics, such as response, group delay and differential phase and gain, were carefully scrutinized.

The WavePhore and Digideck systems were laboratory tested through the exciter stages of transmission. Digideck produced a continuous 700kb/s with 525kb/s realized while the WavePhore system transmitted a burst bit rate of 599kb/s with 384kb/s realized. Both systems performed well below the sideband emission limits. WavePhore showed

better performance in the out-of-band measurements for upper and lower channels.

In the subjective picture-quality tests, two observers viewed three different sequences on 16 different receivers. The sequences were presented with strong and weak signals with data both off and on. In these tests, Digideck was observed as having "imper-

The FCC realizes that by sanctioning a single company's technology, it would be the only system with FCC approval.

ceptible" degradation while WavePhore was between "imperceptible" and "perceptible, but not annoying."

Instrumentation tests indicated that in the area of gain and group delay, the WavePhore system was more attenuated and had significant loss of upper sideband chroma components. Chroma delay (12.5T) was also more closely met by the Digideck system. Random noise measurements exhibit-

ed a 16dB better cliff-effect threshold in favor of the Digideck system. Digideck also exhibited a better immunity to impulse noise and recorded better immunity in adjacent- and co-channel interference.

The NDBC concluded by saying that neither system created more adjacent- or co-channel interference to NTSC than a conventional NTSC signal. The committee advised additional tests in such areas as transmitters, coverage, HDTV interference and translator operation. It concluded the report by recommending field tests.

These systems now in use, and others that will spring up in coming years, need to be acknowledged and carefully watched by broadcasters. We are the end users of this new medium and it's our responsibility to management and to our viewers to make the most of this new opportunity. ■

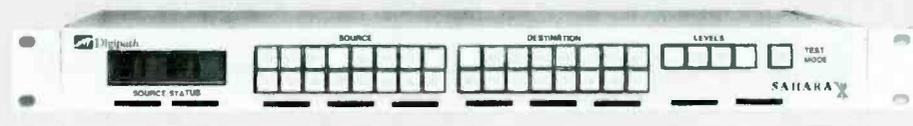
Steve A. Rowell is assistant chief engineer for Meredith-owned WOFL-TV, Orlando, FL.



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1995 salary survey

The salary survey is about more than just salaries....

Salaries rise and fall, budgets get cut, staff is reduced — but the one trend that remains constant is the importance of continuing education and training. Whether through on-the-job training, college courses, seminars, workshops or SBE certification, education is the key to keeping pace with technology and new equipment. The broadcast industry is evolving at a rapid pace and expanding knowledge and skills are essential for moving forward.

Salary basics

However, salary is still the bottom line, and this is how salaries stacked up across the board this year. In Table 1, engineering salaries are divided into five categories by job title: Executive/General Management, VP/Director of Engineering, Chief Engineer, Staff Engineer and Operations Management. The survey results are summarized by TV Top 50 and below Top 50 categories.

Executive/General Management salaries stayed the same or decreased slightly over 1994. The estimated Top 50 salary remained the same as 1994's at \$75,000+. The below Top 50 salary dropped a substantial amount by approximately 20%, from \$62,500 in 1994 to \$52,500 in 1995.

For the VP/Director of Engineering category, salaries increased by more than \$3,000 this year in the Top 50 category; from \$72,000 to \$75,000. The below Top 50 saw a decrease of \$1,500, from \$47,500 in 1994 to \$46,000 this year.

The Chief Engineer salaries saw a fairly significant increase of more than 10% over last year. The estimated median salary for the Top 50 category is \$58,571 compared to \$52,500 in 1994.

Staff Engineer salaries saw a decrease in the Top 50 category of more than 7½% to \$45,000. The below Top 50 category saw a modest increase of more than 4% to \$32,333 this year from \$30,909 in 1994.

Operations Management salaries for the Top 50 stayed constant this year at \$45,000. The below Top 50 saw an actual increase of \$3,125 rising to \$33,125.

The Bottom Line: —
Every October, the salary survey is a much-anticipated read. But it's more than just numbers on how much money you're making and whether you're making more or less than last year. It's about people like you and their concerns about the fluctuating broadcast industry. The salary survey is about more than just salaries; it's reflective of the mood of the industry. **\$**

Table 2 summarizes salaries for cable and production personnel in four categories with the following job titles: Executive/General Management, VP/Director of Engineering and Chief Engineer, Staff Engineer and Operations Management.

In the Executive/General Management category, cable saw a slight decrease over last year from \$55,000 to \$53,570. Production salaries held their own over last year staying the same at \$61,667.

The VP/Director of Engineering and Chief Engineer salaries for cable remained constant over 1994 at \$53,333. Production dropped \$2,917 over 1994, with the 1995 estimated median salary dropping to \$53,750.

Staff Engineer salaries showed an increase over last year in both cable and production categories. Cable showed a slight increase at \$36,000 over 1994's estimated median salary of \$34,286. For production, 1995 saw an increase of \$2,500 from \$42,500 to \$45,000.

The Operations Management cable category increased slightly this year from \$31,875 to \$33,500. Production showed a major decrease of more than 15% over last year. The estimated median salary dropped from \$43,333 to \$37,222 in 1995.

The salary tables are on page 72.

Survey details

The Intertec Corporate Marketing Research Department mailed surveys to 2,500 *Broadcast Engineering* subscribers on June 15, 1995. The subscribers were selected on an "nth" name basis. The research department received 752 usable surveys, resulting in a 30.1% response rate.

Editor's note: The complete results of the 1995 Salary Survey are available in bound form. The data is displayed in tabular and graphical form for easy evaluation. Copies are available for \$75 each. Contact Susan Link at 913-967-1969 for more information on how to obtain the 1995 Salary Survey. Details about the research methodology are available to any reader. Contact the BE FAXback line at 913-967-1905 for a copy of the details.

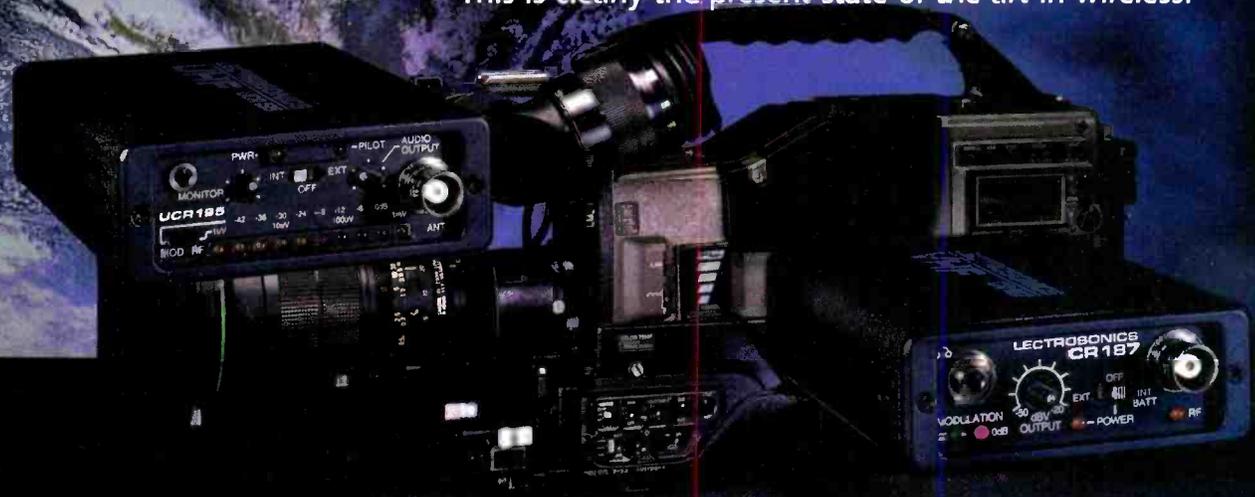
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Base = ALL BROADCAST RESPONDENTS	EXECUTIVE/GENERAL MANAGEMENT			VP/DIRECTOR OF ENGINEERING			CHIEF ENGINEER			STAFF ENGINEER			OPERATIONS MANAGEMENT			TOTAL
	Top 50	Below Top 50	Sub-total	Top 50	Below Top 50	Sub-total	Top 50	Below Top 50	Sub-total	Top 50	Below Top 50	Sub-total	Top 50	Below Top 50	Sub-total	
Less than \$15,000	0%	2.9%	1.5%	0%	0%	0%	0%	0%	0%	0%	2.4%	1.2%	2.2%	7.4%	5.1%	1.7%
\$15,000 to \$24,999	3.2%	5.7%	4.5%	0%	0%	0%	0%	7.1%	4.0%	2.4%	19.5%	10.8%	0%	16.7%	9.1%	5.9%
\$25,000 to \$34,999	0%	11.4%	6.1%	0%	16.7%	7.8%	4.7%	28.6%	18.2%	21.4%	48.8%	34.9%	26.7%	33.3%	30.3%	20.5%
\$35,000 to \$49,999	12.9%	25.7%	19.7%	12.2%	47.2%	28.6%	20.9%	32.1%	27.3%	31.0%	29.3%	30.1%	31.1%	37.0%	34.3%	28.5%
\$50,000 to \$74,999	32.3%	34.3%	33.3%	34.1%	30.6%	32.5%	60.5%	30.4%	43.4%	42.9%	0%	21.7%	24.4%	3.7%	13.1%	28.5%
\$75,000 or more	51.6%	20.0%	34.8%	53.7%	5.6%	31.2%	14.0%	1.8%	7.1%	2.4%	0%	1.2%	15.6%	1.9%	8.1%	14.9%
Estimated Median	\$75,000+	\$52,500	\$63,571	\$75,000+	\$46,000	\$61,429	\$58,571	\$42,727	\$50,357	\$45,000	\$32,333	\$36,000	\$45,000	\$33,125	\$37,727	\$45,000

Table 1. Engineering salaries for TV Top 50 and below Top 50 stations.

Base = NON-BROADCAST RESPONDENTS	EXECUTIVE/GENERAL MANAGEMENT			VP/DIR. OF ENGINEERING & CHIEF ENGINEER			STAFF ENGINEER			OPERATIONS MANAGEMENT			TOTAL
	CABLE	PROD.	SUB-TOTAL	CABLE	PROD.	SUB-TOTAL	CABLE	PROD.	SUB-TOTAL	CABLE	PROD.	SUB-TOTAL	
Less than \$15,000	0%	0%	0%	0%	0%	0%	0%	2.1%	1.3%	2.0%	3.9%	2.9%	1.2%
\$15,000 to \$24,999	3.3%	0%	1.6%	2.2%	2.8%	2.4%	21.9%	8.3%	13.8%	19.6%	13.7%	16.7%	9.5%
\$25,000 to \$34,999	10.0%	11.8%	10.9%	15.2%	11.1%	13.4%	28.1%	25.0%	26.3%	35.3%	25.5%	30.4%	21.3%
\$35,000 to \$49,999	30.0%	17.6%	23.4%	30.4%	22.2%	26.8%	31.3%	20.8%	25.0%	21.6%	35.3%	28.4%	26.2%
\$50,000 to \$74,999	33.3%	47.1%	40.6%	30.4%	44.4%	36.6%	18.8%	39.6%	31.3%	15.7%	17.6%	16.7%	29.9%
\$75,000 or more	23.3%	23.5%	23.4%	21.7%	19.4%	20.7%	0%	4.2%	2.5%	5.9%	3.9%	4.9%	11.9%
Estimated Median	\$53,570	\$61,667	\$58,125	\$53,333	\$53,750	\$53,181	\$36,000	\$45,000	\$40,500	\$33,500	\$37,222	\$35,333	\$43,871

Table 2. Engineering salaries for cable and production facilities.

The numbers tell all

Table 3 shows a definite increase in salaries of those engineers who have SBE certification. Our research shows that only one out of three engineers is SBE certified. The numbers show that it pays to be certified.

Following are the salary differences between being SBE certified and not being SBE certified in the four categories shown in Table 3:

- An SBE-certified VP/Director of Engineering salary is \$12,500 higher than that of a non-certified VP/Director of Engineering.
- An SBE-certified Chief Engineers salary is \$9,166 over its non-SBE-certified counterpart.
- An SBE-certified Staff Engineers salary is \$1,000 over a non-SBE-certified Staff Engineer.
- The SBE-certified salary for all Engineers is \$11,591 higher than the salary for non-SBE-certified Engineers in the same category.

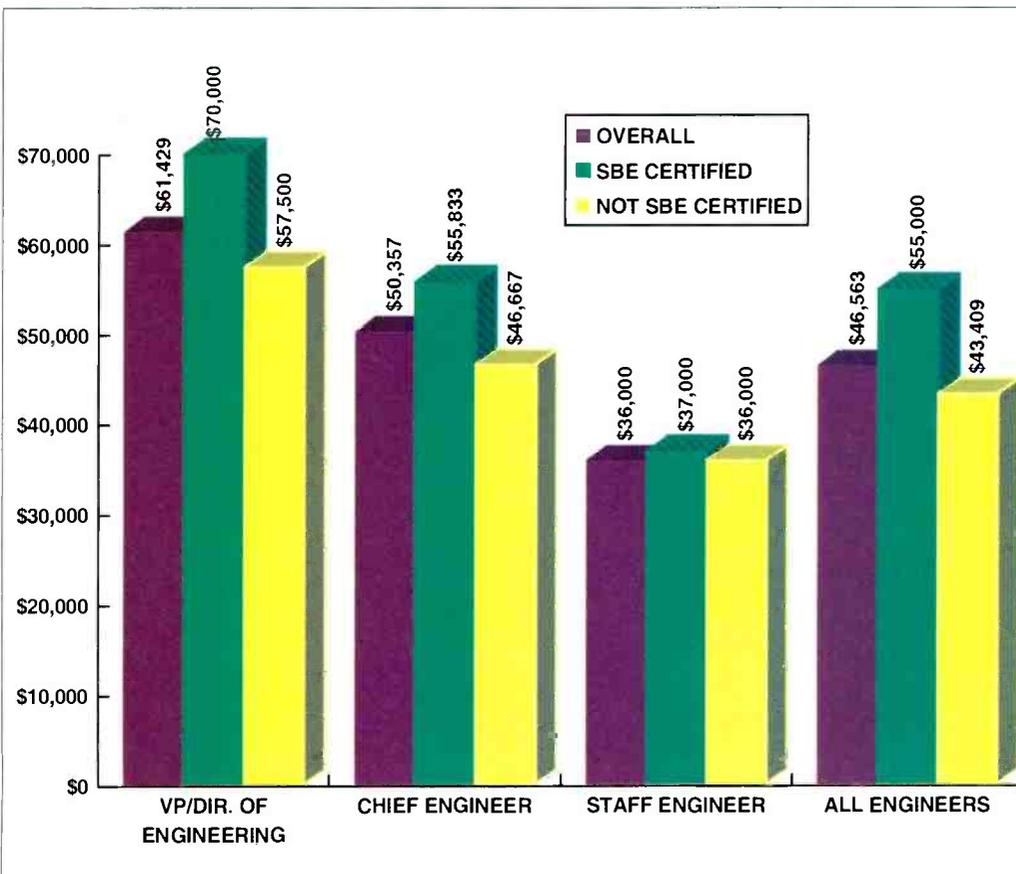


Table 3. Engineering salaries compared with SBE certification vs. no SBE certification. Getting SBE certified really pays.

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Respondents respond

(on trends, problems and opportunities)

Here's what some respondents from our 1995 Salary Survey had to say:

Executive/General Management, Top 50

- I fear some reduction in quality if too much deregulation takes place. I have always felt broadcasters had some obligation to serve the public interest.
- Where will funds come from to support two stations for HDTV? Where will the construction funds come from? Does the public really care about HDTV?

VP/Director of Engineering, Top 50

- All engineers need to become more computer-literate to keep up with the new technology and equipment.
- I believe there will be plenty of job opportunities for those with good technical skills and experience.
- I see opportunity in spectrum conservation and multicasting; HDTV is still up in the air and distribution methods are going to be hot items.

Chief Engineer, Top 50

- Knowing RF and computers is the key to job security.
- The future is automation run by computers and networks. Be willing to change and let

computers into your life, so you can continue to work in the broadcast world.

Chief Engineer, below Top 50

- Keep on top of all the new equipment coming out.
- We need better training for people in engineering.

In the next one to five years, great opportunities exist for broadcast, cable and production facilities as marketers of data services and not just analog entertainment.

Staff Engineer, below Top 50

- To remain a valuable asset as a broadcast maintenance engineer, you must be computer-literate.

Operations Management, Top 50

- Technical advances in equipment are exciting, but the necessary training to operate them is not always available. More comprehensive training "off-air" will translate to fewer mistakes "on-air."
- Broadcasters need to invest in the employees who understand this business, its potentials and weaknesses for the future.

Executive/General Management, production

- It's difficult for a school to keep up with the changing technology to prepare students for what they might find in the real world. They could end up in some old-fashioned analog-only environment, or they could wind up in a supermodern digital-only location. Which do we teach?

VP/Director of Engineering and Chief Engineer, cable/production

- Older engineers need retraining on some aspects of the profession, such as the new digital technologies.
- With expansion of new technologies, digital, HDTV, data transmission and telco involvement in cable, opportunities will be opening for engineers.

Staff Engineer, cable/production

- It seems that good video professionals are difficult to find. College-educated people have great design skills, but lack repair and maintenance experience. We need educated, competent people that know how to use tools and test gear.
- We can either keep up with technology or work elsewhere.

Operations Management, cable/production

- The broadcast industry needs more training facilities/schools or programs.
- Staying current with emerging technologies is increasingly difficult.



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Managing the risks

Between RF radiation and its legal risks, broadcasters are doubly exposed.



The Bottom Line: —

While government and private agencies continue to stall and pass the buck on revised radio frequency radiation (RFR) standards, broadcasters find themselves in a quandary. Not only are many broadcast workers exposed to RF radiation every day, but their employers are often the subjects of litigation from a public increasingly alarmed by unseen technological forces. Keeping up with RFR regulation remains a challenge for every transmitter owner. — \$

The RF energy produced by broadcast stations has been the subject of much study about how it may affect the public health. This is why, in 1982, the American National Standards Institute (ANSI) first adopted a standard identifying the RFR levels to which it believed people could safely be exposed. The ANSI guideline was adopted by the FCC in 1985 and became the first basis upon which a broadcast station could be reviewed regarding environmental and health issues surrounding RFR impact.

Congress mandated the FCC to adopt an RF-protection guideline pursuant to the National Environmental Policy Act (NEPA). But the FCC adopted the 1982 ANSI guidelines only as an interim measure until the Environmental Protection Agency (EPA) set forth its own rules on RFR. The ANSI guidelines incorporate frequency-dependent radio protection guidelines over the electromagnetic frequencies of 300kHz to 100GHz.

ANSI guidelines are based upon the premise that RF energy is absorbed at some frequencies more readily than at other frequencies. For example, it is believed that the human body absorbs RF more easily in the 30MHz to 300MHz range than at lower frequencies. Each frequency range is given a different time-averaged exposure value based on the average exposure expected over a 1-hour period. ANSI guidelines are designed to eliminate adverse affects of RF exposure on the human body if followed judiciously. These guidelines refer to workers and to the public at large, and therefore, apply to all areas accessible to either group.

The risks

In basic terms, the further away a person moves from the source of electromagnetic frequency (EMF) or RF energy, the less exposure he or she will receive. (EMF is a general term encompassing all electromagnetic radiation, but it is often used to refer specifically to the lower-frequency radiation associated with power lines.) Prudent broadcasters will take steps to assure safety within accepted ANSI guidelines in addition to limiting the cumulative exposure of employees.

Regarding specific health risks, there are con-

flicting views at present. For example, a University of North Carolina study suggests a risk of breast cancer in female electrical workers, and Scandinavian epidemiologic studies support a childhood leukemia risk due to EMF exposures. A Swiss report tells of sleep disorders among those living near shortwave transmitters. Meanwhile, schools built under high-power electrical lines are discussing EMF studies and mitigation options, cellular phone use is being studied as a possible cause of brain tumors, and police radar is being labeled as a cause of cancer among those using portable units to detect speeding vehicles. There is also concern that cellular digital phones may interfere with pacemakers, and a study links Alzheimer's disease to EMF. Those who wear 2-way radios on a belt also report increased incidence of kidney cancer.

In June 1990, the EPA declared that low-level electromagnetic fields may promote cancer. The question is to which low-level field(s) can the cancer be traced if and when a "cancer cluster" occurs. EMF emanates from power lines, electric blankets, video display terminals, microwave ovens, TV sets, radios — practically everywhere in the typical home or workplace. So why should a broadcast station or the broadcast industry be especially concerned? Because if it knowingly or negligently acts in a manner that exposes its workers or the general public to a known or suspected health hazard, it may be held liable in court for monetary, and in some instances, even punitive damages. Broadcasters should note that, in some jurisdictions, violation of a statute is considered negligence *per se* — that is, negligence as a matter of law.

The standards

One way to reduce or avoid possible future damages is to maintain a workplace that is in strict compliance with federally adopted and state-mandated rules and regulations, and if feasible, to follow the ANSI/IEEE C.95.1-1992 guidelines — the most recent standard of record. (The Institute of Electrical and Electronic Engineers [IEEE] has also accepted the ANSI 1992 guidelines.) Although the FCC has not adopted these new guidelines as of this date — the 1982 ANSI standards remain the FCC standard at present — in order to limit possible

In & Out.

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liability, it is always more prudent to apply the most recently set (1992) standard.

The FCC had been waiting for the EPA to set an interim standard, which was given a promised release date of July 1995, before determining whether it would adopt the 1992 ANSI standard in part or as a whole. But the EPA subsequently decided not to adopt an interim standard. In spite of this, FCC staff tentatively expect to draft a recommendation for the commissioners on revised RF radiation regulations by the end of 1995. (One apparent problem with the 1992 ANSI standard involves the difficulty broadcasters might have in measuring exposure levels.)

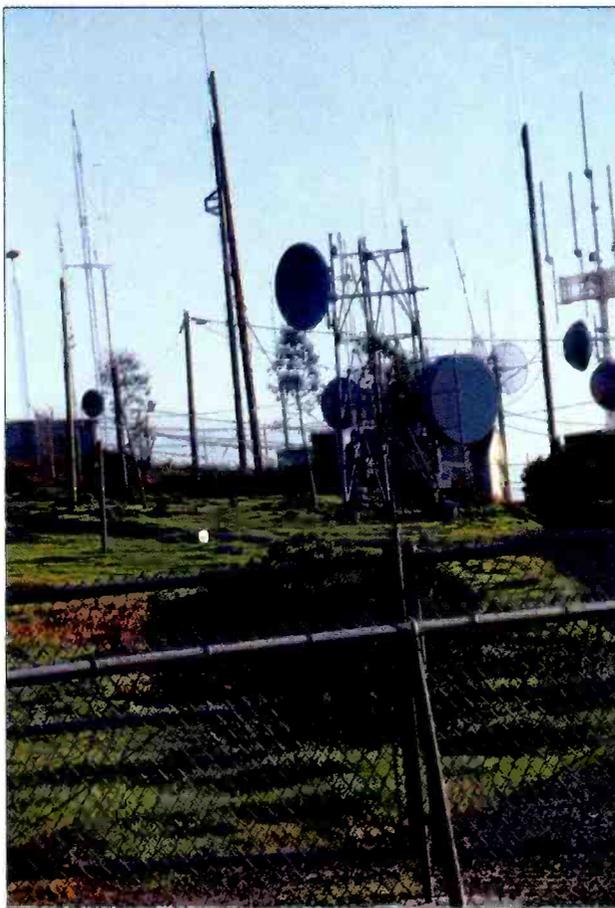
The rules

Generally, it is the broadcaster's responsibility to protect the general public and its workers from unsafe levels of RF radiation. Where there are multiple RF contributors, all stations must reduce power or cease operation to comply with the guidelines and ensure safety. However, it is the holder of the tower license who bears ultimate responsibility for the composite power emanating from the tower or source.

Areas of high exposure must be fenced, warnings must be posted, and for ultimate safety, the transmitting site should be in a remote location. When leasing tower space, there must be sufficient information in the lease to ascertain the RF emission output by those leasing at the site. All licensees at the site must be protected, and there should be a master plan regarding the manner in which protection will be afforded. This means rules should be posted at the site and clearly spelled out in the lease.

Each site should be measured for RF radiation and using worst-case calculations, a consulting engineer should determine if the site meets or exceeds the recommended guidelines. Everyone entering the tower site must be protected and/or warned and trained on how to proceed safely. ANSI and IEEE also require that all standards be reviewed every five years for reaffirmation, revision or deletion, and that broadcasters keep abreast of changes in the standard.

The ANSI/IEEE standard is a general standard and is not directed at a particular industry. The standard considers averaging time for induced-current microwave exposures, whole-body and partial-body exposure vs. organ-dose exposure and low-level exposure *in vitro*. There is no guarantee regarding long-term exposure. The only argument you can make when faced with a lawsuit based on long-term exposure damage is a defense



This multitransmitter microwave site has no warning signs posted.

of acting reasonably based on the current available data.

The Occupational Safety and Health Administration (OSHA) has not adopted a standard with relation to RF or EMF radiation exposure. The only pertinent OSHA rule is that a broadcast station must maintain a safe and healthful workplace free of recognizable hazards. Lock-out/tag-out devices must be used where appropriate, hazards must be identified, training for safety must be undertaken, and there must be annual reviews and testing of procedures. Accidental exposures must be prevented, and a safety program must be in place.

Findings of liability

If the broadcaster knows or should reasonably know that a danger exists, then the broadcaster owes a reasonable duty of care to employees and to the public at large. If the broadcaster does not exercise a reasonable duty of care, and if an individual is thereby injured, then that individual will have a cause of action against the broadcaster for negligence.

The broadcaster also owes the employees and the public a legally recognized obligation to avoid unreasonable risk. If this duty is breached, and if the broadcaster is found to be the legal or proximate cause of damage, then the broadcaster will be held liable. If the

broadcaster's actions are deemed willful or wanton as to the duty of care owed, then punitive damages may be in order.

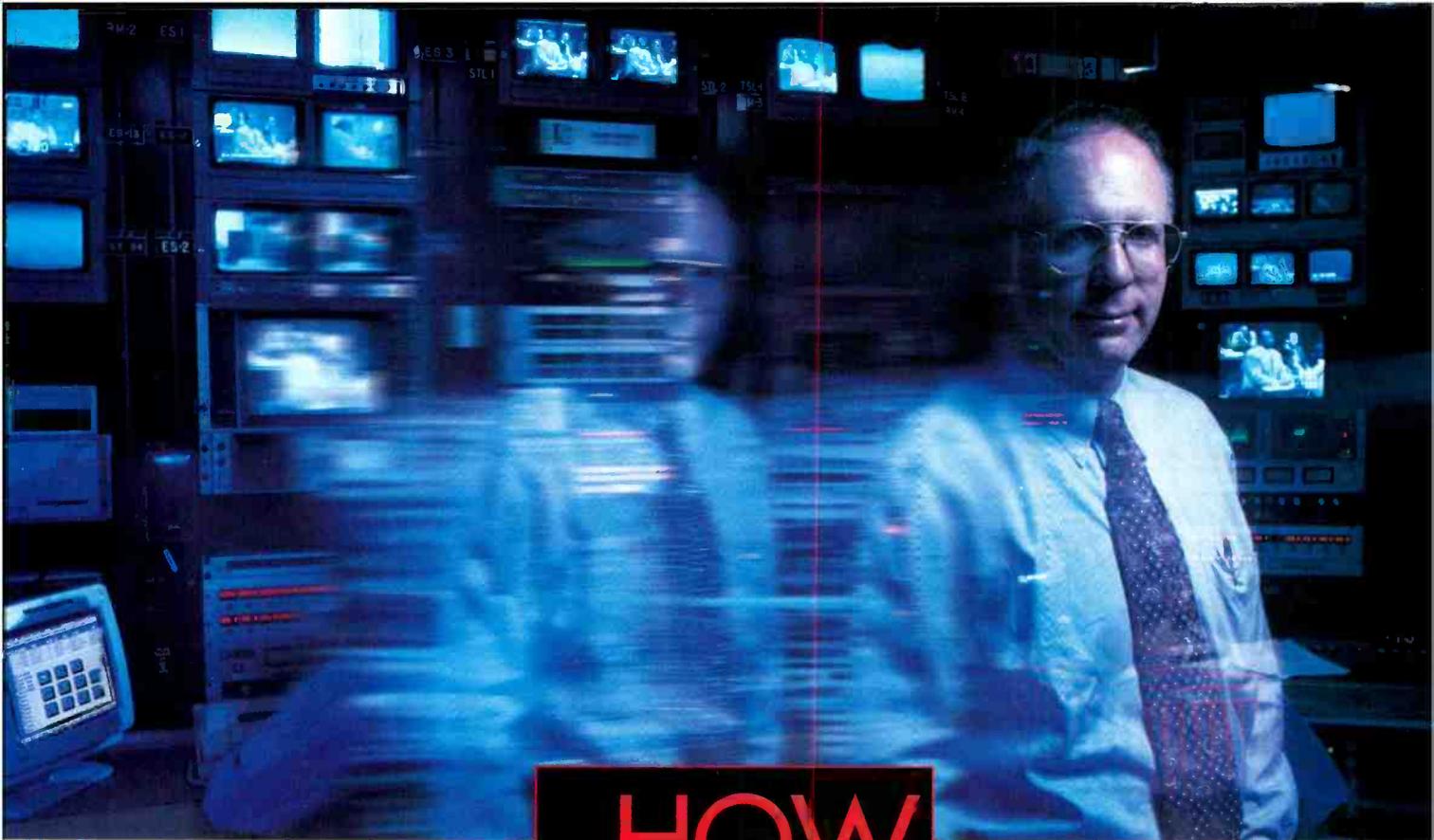
This leaves the broadcaster in a quandary. The standard is merely a guideline, and where standards conflict, the most prudent course is to follow the strictest standard. If a worker develops a cancer or other condition which he or she attributes to EMF exposure, unless the worker can prove gross negligence by the employer, the worker will likely be limited to benefits under Workers' Compensation laws if he or she can link the injury to the workplace.

But is there any possibility that the broadcaster could be held to a higher standard than the state and/or federal standard and be found liable for negligence toward its workers and/or the public? The answer is yes. If a viable stricter standard is found to exist, the broadcaster may be held to a higher standard of care than the accepted, current published standard or law. For example, the U.S. Air Force at the Kirkland Air Force Base in New Mexico adopted standards and RF limits stricter than the 1982 ANSI standard, as did Hughes Aircraft, a subsidiary of the General

Motors Corporation. Some of these adopted limits were 100 times stricter than the 1982 ANSI/IEEE standard. This means an exposed individual could use one of these studies to argue that the broadcaster knew or should have known that the 1982 ANSI adopted standard offered insufficient protection, and therefore, the broadcaster was negligent and breached a duty of care.

The standard imposed will be "the reasonable man standard," which is a fictional standard based on a reasonable individual standing in the shoes of the defendant broadcaster. The question posed by the court will be whether this hypothetical person, faced with all the facts and circumstances available, would have acted in the same manner as the defendant broadcaster in the same or similar circumstance.

The argument that exposure comes from many sources may not protect the broadcaster. In general, *joint tortfeasors* are jointly (together) and severally (separately) liable for all plaintiff's injuries. Joint tortfeasors are two or more persons acting in concert to produce a single result, and are two or more individuals or entities whose independent acts of negligence combine or concur to produce a single result. Therefore, if a broadcaster is found to be a contributing cause of damage to a person or persons exposed to EMF hazards, he or she will be liable.



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Q: As Director of Engineering at Tribune Broadcasting, you're in the midst of updating your entire system. How do you deal with the pressure?

A: *Carefully.*

Q: Right. So did you choose the Louth ADC-100 automation system to bridge to disk or give you future flexibility?

A: *Yes.*

Q: Meaning you liked Louth's ability to control all types of different devices?

A: *Yes.*

Q: And you weren't worried about any problems with propri-

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etary automation software or choosing any disk vendor you wanted?

A: *No.*

Q: So if you were to give advice on how to make the transition to disk, without worrying about where your station goes in the future, what would it be?

A: *Louth.*

Q: And what about the multi-casting environment?

A: *Louth.*

Q: Of course, you'd still need a media management and traffic interface system to tie it together. Any final words of advice?

A: *Louth.*

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Damage control

A number of actions are recommended to minimize potential damages. The tower at the transmitter site should be marked by appropriate warning signs. The grounds should also be marked by appropriate warning signs, and painted lines, signs and/or fences should be placed around high-exposure areas.

Common sense should dictate a few other rules: Do not create high RF levels where people are, or could reasonably expect, to be present. Prevent people from entering areas in which high RF levels are necessarily present. Do not have workers engage in tasks on a hot transmitter or tower. Turn off the power when working in dangerously high-exposure areas. Use a protective RF suit, such as one made from a material called *Naptex*.

In office areas, do not place computers where backs or sides expose workers to EMF. (The backs and sides of computer terminals generally have greater EMF output than the fronts of the units.) Better yet, replace terminals with portable LCD units that do not radiate high EMF. EMF penetrates walls, so place monitors, computers and other equipment on outside walls where possible, or in an area that radiates through to a storage area rather than through the wall and onto other operating personnel.

ATV will also have an impact, and its effects on RFR will have to be considered.

Have all areas of the broadcast facility tested in order to determine high RF areas and then take appropriate measures toward reduction of EMF field radiation.

Have all employees that are at risk sign a statement that they know and understand the risks and the rules regarding safety standards around high RF areas. Assumption of the risk is a defense to a cause of action for negligence, although it will not protect the broadcaster from a fine by the FCC, or from license suspension for an unsafe workplace.

Advanced television (ATV) will also have an impact, and its effects on RFR will have to be considered. The issue of tower exposure to workers when installing ATV equipment must be carefully regulated by the broadcaster so workers are not unduly exposed to RF radiation. Reducing power, performing installations only during off-air hours and the use of RF-protective clothing must be evaluated and used to maximize safety levels. Review safety rules with all workers and follow all safety procedures to the letter.

Further governmental action

The EPA is still considering what to do regarding RF radiation regulation. The EPA had been critical of the 1992 ANSI/IEEE standard and recommended that the FCC not adopt its new 2-tiered standard (for controlled vs. uncontrolled environments).

The EPA has not even adopted the 1982 ANSI/IEEE standard, which has been in place for more than 10 years, and it did not fulfill its earlier promise for an interim standard by July 1995. Many groups have criticized the EPA for not sufficiently studying the issue and for backing down and changing its position regarding EMF dangers. These groups believe that this lack of action is based on political pressures.

A White House advisory committee known as ERMAC called for RF radiation research more than 20 years ago, but the research was never done. The public anxiety has grown along with the RF waves that permeate our society. Put a cellular phone up to your ear and wonder, "Am I assuming the risk of brain cancer, or am I justifiably relying on the representations of the cellular phone industry that this item is consumer-safe?" Arguments abound that there is not enough data to properly assess the risks, yet where are the studies? The question then becomes, "How will liability be assessed?"

The Electromagnetic Energy Association (EEA) recommends that FCC RF standards in conflict with state regulations be preempted by the state regulation even if the state standard is less restrictive. The EEA maintains this is necessary to meet society's goals, because more restrictive standards impede development of communications systems and new technologies. The general rule in such conflicts is that federal law prevails over state law where state law imposes a less restrictive standard, but that a state is free to impose a standard *more* strict than the federal standard. If the EEA has its way, the state standard will supersede the federal standard, even if the federal standard is more restrictive. This would overturn a long-held system of law, mandating that the strictest law prevail, whether it be state or federal law. Ironically, the common-law concept of negligence will not be overturned, and in the long term, this could actually impose more problems for the broadcaster in terms of legal liability.

Some final suggestions

As a broadcaster, you are always a potential target for litigation. Although it's true that wrapping yourself in an electric blanket is similar to being enveloped in an electromagnetic field, the consumer can turn off the electric blanket at will. The general public has no control over your transmitter. (You also are broadcasting at a higher and potentially more dangerous frequency.)

What happens if your transmitter was once in a remote site and now finds itself in the midst of a densely populated area? Based on the *law of nuisance*, a lawsuit can be brought against your station to have the transmitter site relocated. This law is 2-pronged: There may be a private nuisance that is an interference with a plaintiff's use and enjoyment of land, or there may be a public nuisance that is an interference with the rights of the general public.

One way to avoid legal action is to keep the neighbors happy.

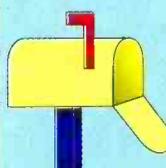
The law of nuisance does not accept the "I was here first" defense. If there is a nuisance, it must be corrected. If that nuisance is the emission of RF radiation, unsightliness of the site, or another reason, the broadcaster will be forced to take corrective action. This corrective action may include the relocation of your transmitter, and the cost must be borne by the creator of the nuisance. The creator of the nuisance may also be required to pay the attorneys' fees of the individual(s) bringing the lawsuit.

One way to avoid this type of legal action is to keep the neighbors happy. Plant lots of trees around the site. Keep the site well manicured, painted and attractive. Plan for the future and look for an alternative transmitter site as the area becomes more populated, just in case. Answer all questions posed by worrisome neighbors in an informative and reassuring manner.

When considering liability, it is a sad but true fact that business weighs the costs of safety against the risks and costs of liability. The broadcaster is no different. At the very least, broadcasters must know the current standard and stay abreast of the current rules and regulations regarding EMF and RF exposures. As the standard of "the reasonable man" changes in the future, broadcasters will need to keep up and comply with it at all their facilities. ■

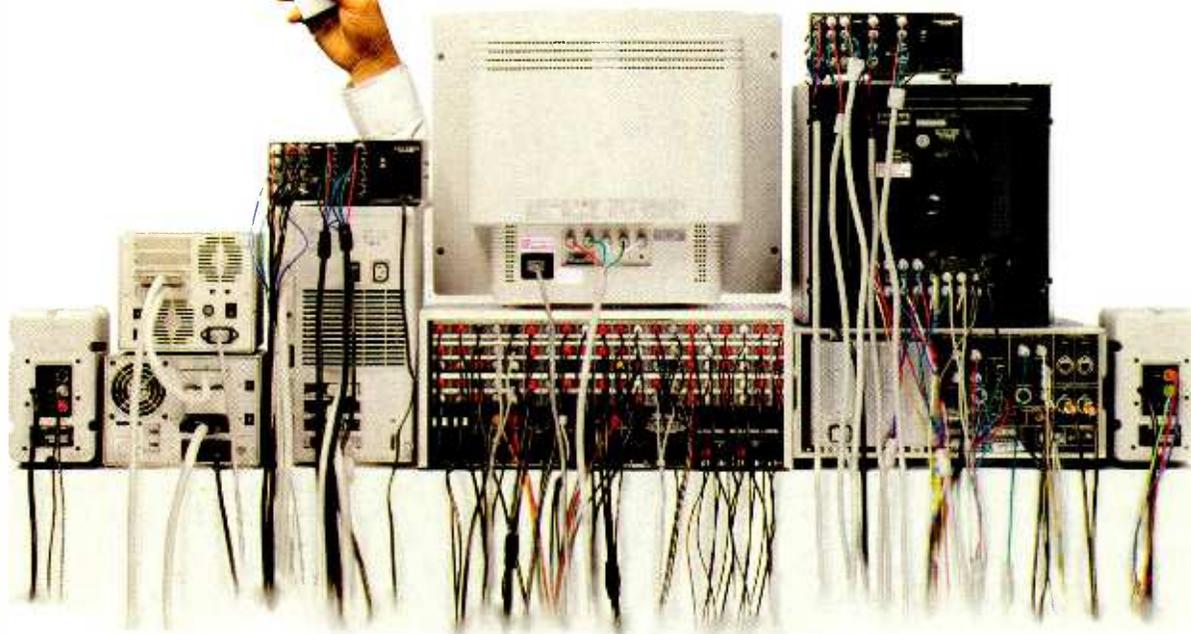
Editor's note: The above is a general statement of law. It is the opinion of only one person and is not intended to give specific advice. Laws vary from state to state. For specific advice on any area of the law, please consult your own attorney.

Penny Sirna Weigand is an attorney in Jamul, CA.



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Frequency coordination for the 1996 Olympics



Frequency coordinators are solving their problems long before the Games begin.

The Bottom Line: —

The convergence of broadcasters on Atlanta next summer for the Olympic Games will present a worst-case scenario for coordination of broadcast auxiliary spectrum. Therefore, it's a good case study on frequency coordination, which is important in every market, all the time. The impact of this process on programming should not be overlooked. _____ \$

No one disputes the power that the Olympic Games in Atlanta will possess. There is clear evidence that these centennial games will easily eclipse all previous Olympics in terms of TV coverage and performance.

Equally formidable is the RF spectrum coordination effort that the Games will require. The airwaves will have to accommodate more than 500 wireless microphones, 25,000 2-way radios, tens of thousands of cellular phones and hundreds of video links around the city of Atlanta. Achieving this is a monumental task, but an essential one — the 3,000 hours of coverage and the audience of more than three-quarters of the world's people mean that the Olympic's frequency coordinators cannot afford to fail.

Frequency coordination for this event has been handled early and aggressively by the committees established to implement it. The parent committee — the Olympic Frequency Coordination Committee (OFCC) — focuses on the needs of the Atlanta Committee for the Olympic Games (ACOG), and is responsible for overall frequency coordination. The OFCC's major subcommittee is the Olympic Broadcast Frequency Coordination Committee (OBFCC), which is responsible for coordinating the use of all radio and TV broadcast auxiliary spectrum. The committee interfaces with and is comprised of local radio and TV broadcasters, local vendors and the Atlanta FCC field office.

Why is frequency coordination such a problem?

One of the most difficult tasks is getting an accurate picture of existing local frequency usage. Although a smaller market can live with

the hit-and-miss procedure that we are all too familiar with, the database of a large market must be accurate. Every state has a frequency coordinator, and most large cities also have their own coordinator. These coordinators must maintain an active listing that includes frequency, user, contact person, power, path and location. Unfortunately, on more than one occasion, broadcasters have been unhappily surprised by an emergency call from their STL operator complaining that another broadcaster had been permitted on their assigned frequency and path.

The author recommends that every market, large or small, maintain a working database of all broadcast auxiliary stations in periodic or continuous usage, including maps of all fixed microwave locations and all local community antenna relay service (CARS) locations. (The latter band, at 12.7 to 13.2GHz, is shared between cable and broadcast licensees.) Formal frequency-coordination procedures are the only means of maintaining order in the available spectrum.

Although many broadcasters use similar transmission systems, they all use antennas of differing gains. When a typical dipole or unity-gain antenna is used in close proximity to a high-gain antenna 12.5kHz away, the unity-gain system will be captured, because receiver AFC circuits will lock onto the stronger signal. Therefore, antenna characteristics must be considered to fully understand the effects on the total system.

Spurious, overwide or overpower transmitters cannot be detected until they actually radiate. Therefore, a pre-event screening will help detect any obvious transmitter anomalies while there is still time to repair or replace a defective device. For example, all RF equipment used to cover the Space Shuttle take-offs and landings is now being

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carefully checked by NASA or Air Force authorities. In this case, equipment must be carefully tested to meet spurious emissions requirements, which ensures that the media does not interfere with the shuttle's safe operation. Therefore, in these large media events, though it is burdensome, it is always better to be on the safe side and test every piece of RF-generating equipment, or at the very least, a sample unit, which will be operated to identify possible interference sources. This is currently the plan for the 1996 Olympic Games.

Antenna placement

"Bunching" of antennas during large news and sports events is often a serious problem. The probability of receiver intermod rises, as does the coupling between the transmission cables (if the antennas are situated in close proximity).

Good site management dictates the use of circulators and cavities to minimize the interaction between systems. Furthermore, the use of physically wide-spaced antenna sites will reduce these effects. The maintenance of the common power ground also is necessary to reduce RF noise. For the Atlanta Games, the Interference Subcommittee will do its best to determine the optimum antenna placements and multiplexing scenarios.

Communications

The key to successful frequency coordination is good communications. A coordination repeater, often a 450MHz/455MHz pair, can be one of the most valuable pieces of equipment used to coordinate frequencies and determine the cause of interference.

If a frequency outside the 450MHz/455MHz region is used, you must ascertain that all local broadcasters can procure such radios. For the Atlanta Games, a dedicated 800MHz trunking system will be used for broadcaster communication and coordination.

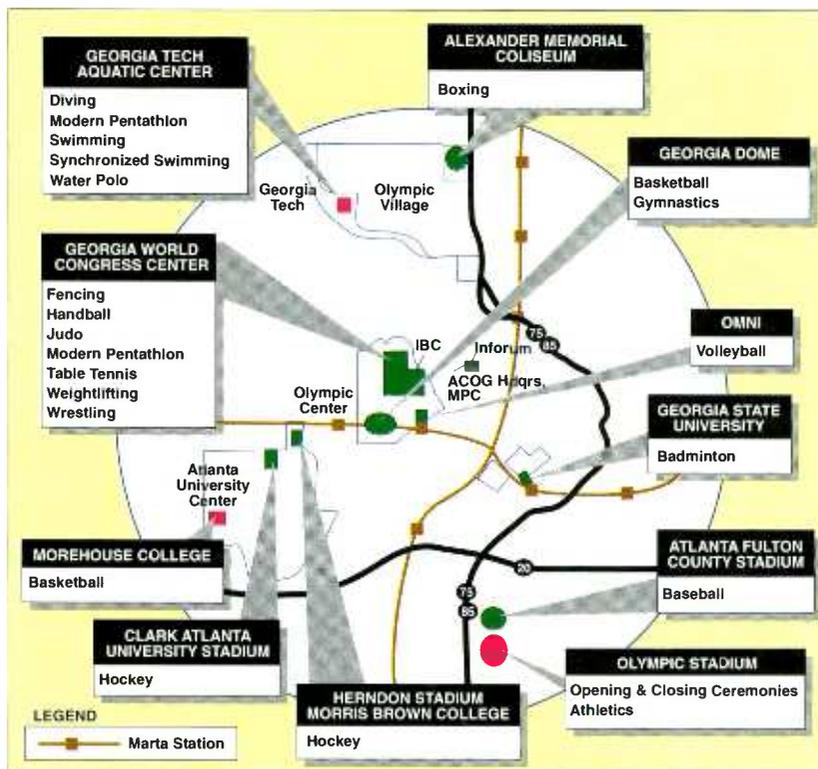


Figure 1. Broadcast auxiliary spectrum use will be at a maximum across the city of Atlanta, coordinating and backhauling simultaneous events from the many separate venues.

FCC actions

The OBFCC initially requested three actions from the commission. The first request was official designation of a frequency coordinator, due to the anticipated heavy demand for radio spectrum.

The second request for action asked for suspension of Section 74.24 of the FCC rules, which covers short-term operations. (It allows anyone with Part 73 license to operate within certain guidelines up to 720 hours without prior notification.) In order to prevent harmful interference to broadcast of the Games due to uncoordinated use of auxiliary broadcast stations on an automatic Special Temporary Authority (STA) basis, the OBFCC requested that Section 74.24 of the FCC rules be suspended within a 100km radius of Atlanta for a time concurrent with the operation of the

OBFCC as frequency coordinator. This would restrict all broadcast auxiliary licensees from operating within this zone and time period on any basis without prior notification and coordination of the OBFCC. The FCC has taken this action on numerous occasions in the past where it was deemed necessary.

The third request was the application for STA to operate in various radio spectrum bands not normally assigned for auxiliary broadcast purposes. This STA operation was requested on a secondary, non-interfering basis to holders of regular broadcast auxiliary authorizations, with all use coordinated through OBFCC in cooperation with the FCC, local broadcasters and other users.

Engineering studies were performed in support of these requests, and the commission granted all three.

Special operations

The 2GHz band, the most widely used band for ENG operations in Atlanta, is extremely crowded. Because of this, the commission granted special authority for broadcasters to operate video links in "other than the normal" broadcast auxiliary spectrum. The OBFCC targeted many different frequency bands, and the FCC's assistance in procuring sufficient spectrum was invaluable to the Olympic Committee.

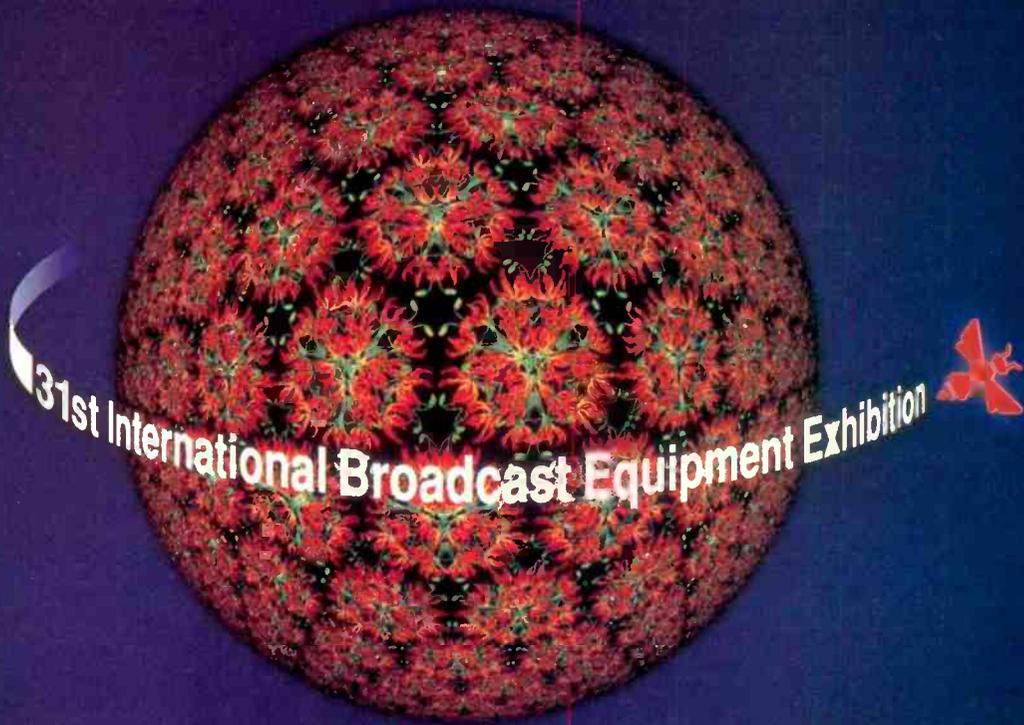
Spectrum shortages have caused ENG users to go to great lengths in designing reliable systems for the more congested markets. ACOG, working with the local broadcasters in Atlanta, conducted a series of 2GHz split-channel tests in an attempt to allow more users to share this valuable band. (It seemed clear that the 2GHz band would not support all who wish to use it at certain times and under certain circumstances in a given area.) The tests were conducted in 100° heat and 100% humidity, approximating worst-case conditions. Thanks to the knowledge and experience of the local broadcasters, the tests



Figure 2. Olympic venues will be spread throughout the southeast United States (and as far away as Washington, DC), but most sites are concentrated in and around Atlanta.

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were a success. Though split-channel operation may not work under all conditions, the Olympic Committee and the local Atlanta broadcasters understand how to operate in the 2GHz band in a split-channel mode. For this to work well, however, some optimization of equipment is typically required.

What crews should know now

The most important thing to know for anyone coming into town to cover the 1996 Olympic Games is *who to contact* in Atlanta prior to transporting equipment there, beginning April 1, 1996. (See "Excerpts from the FCC's Public Notice" below.)

Now is the time to firm up your station's plans for coverage. The Games are less than a year away, and the longer you delay your planning, the greater the likelihood that you may not be able to present the kind of coverage that you intended. ■

Louis Libin is director of technology for the National Broadcasting Company (NBC), New York, and co-chair of the Olympic Broadcast Frequency Coordination Committee (OBFCC).

Excerpts from the FCC's Public Notice on frequency coordination for the 1996 Summer Olympic Games

The 1996 Olympic Games in Atlanta will be the largest RF event ever held. In order to facilitate an interference-free event, the FCC reminds *all users* that all *transmitting equipment* must be FCC type accepted. Equipment questions can be answered by the Customer Service Branch of the FCC's Office of Engineering and Technology (OET) at 301-725-1585, ext. 300. FCC identification numbers can be checked by accessing the FCC's computer bulletin board, public access link (PAL) at 301-725-1072.

All domestic out-of-town radio users will need a Special Temporary Authority (STA) to operate at the Olympics. Domestic out-of-town radio users can request an STA from the FCC's Wireless Telecommunications Bureau at 800-322-1117 or 717-337-1311, ext. 411.

Foreign radio users may operate under a special STA granted to the Atlanta Committee. Current law prohibits foreign nationals from holding an FCC license or STA. Unlicensed operation is prohibited. Requests from foreign delegations should be directed to Ray Malone of ACOG at 404-224-1641.

As an alternative to 2-way radio, the FCC and the ACOG encourage the use of cellular telephones to reduce congestion as the radio frequency spectrum currently available for 2-way radio use is extremely limited.

Commercial and public broadcast frequency coordination will be handled by a special committee of the ACOG. The Olympic Broadcast Frequency Coordination Committee will be managing coordination of all auxiliary broadcast short-term operations. This temporary authority of the OBFCC supersedes applicable sections of FCC rule part 74.24 — Auxiliary Broadcast Short-Term Operations. Commercial and public broadcast transmitting equipment must be coordinated through the OBFCC. Contact Mike Smalls of the ACOG at 404-224-1400 or Louis Libin of NBC at 212-664-2746. ■



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TV transmitter maintenance basics, part 1

A station's transmitter facility is arguably the station's most valuable resource. Every second of every day's programming and advertising passes through the transmission system. Maintenance of these systems is critical to a station's well-being and financial success. Unfortunately, many stations spend some time off the air each year due to failures caused by maintenance items that 20 minutes, a rag and a vacuum cleaner could have taken care of.

The on-air basics

A TV transmitter facility is not difficult to properly maintain. Regardless of the type of transmitter, or its age, following a simple schedule of basic cleaning, checks and adjustments can prevent perhaps 95% of all problems. Set up a maintenance schedule that addresses the transmitter in order of highest failure rate to lowest, and simplest maintenance to most difficult. Set up a schedule that forces a specific interval between maintenance periods with simple maintenance being performed frequently and deeper work taking place at longer intervals. (See Figure 1.)

The first and simplest method of verifying correct operation and detecting problems is the periodic remote meter readings that your operators take every few hours. If you review these logs weekly, any negative trends will be easy to spot. In addition to these daily readings, plan a trip to the transmitter site at least once each week. During this visit, take readings on all meters and calibrate the remote control to agree with them. This is the time to perform an overall inspection of the system looking for damaged components and loose hardware, listening for new rattles and creaks from blowers and pumps, feeling for new vibrations, overheating cabinets, malfunctioning muffin fans and so forth. Take some of this time to break out a rag and some light cleaner and wipe down the accessible areas of all the cabinets, RF assemblies, switch panels, meter faces, etc. It is during this

type of simple inspection and maintenance, which should take no more than 30 to 45 minutes each week, that you will find most problems as they are developing.

Shutting down for deeper work

Once a month, plan on a comprehensive maintenance routine. This will be an off-air maintenance period of several hours and will focus on internal transmitter systems. During this maintenance, you will assess high-voltage areas of the transmitter, so plan on having at least two engineers present for the work. As with all power systems and high-voltage distribution, ALWAYS LOCK-OUT YOUR CIRCUITS, AND NEVER WORK ALONE.

Once the transmitter is safely off the air and shut down, open up the high-voltage cabinets, ensure that the components within are securely grounded and break out cleaning rags and a shop vacuum cleaner. (This, of course, assumes that you have a tube-type transmitter; solid-state rigs require different methods, but the same basic schedule can be followed.)

The high-voltage components within the transmitter cabinets will gather dust and dirt fairly quickly due to the negative charge, or corona, around the high-voltage terminals. This causes the positively charged dust particles floating about in the air to be attracted to the terminals, contactors, leads, insulators and other components. It is imperative that this collection of dust be removed on a regular basis. This dust is somewhat conductive, and with the voltages involved, allowing too much of it to build up on components will eventually lead to flashover, arcing and various "strange" high-voltage failures.

Go through the HV cabinets and vacuum all of the components within to remove the accumulated layers of dust. Use a rag

dampened with isopropyl alcohol or a similar residue-free cleaner to wipe down HV leads, load resistors, insulators and other components. While doing this, take a moment to look for any signs of carbon tracing, arcing, burned areas, cracked insulation on HV leads, etc.

Vacuum out or otherwise clean or replace all the air filters on the transmitter. Most transmitters make use of air blowers or fans to force air through the cabinets for component cooling. Usually, each cabinet will have more than one filter — one for the cabinet itself, and another for internal blowers to cool tube cavities and so on. Again, dust and dirt are the primary enemy, so filter cleaning or replacement on a regular and frequent basis is imperative.

Be sure to perform a complete calibration of all meters on the transmitter during this maintenance. Check all voltages, currents and power levels and ensure that the representative meters read correctly.

Check all of the safety interlocks and automatic shut-off circuits and monitors. Do this by actually operating the system involved. For instance, to check an airflow-monitoring circuit, actually cut off airflow to the monitored area by shutting down the associated blower or disconnecting a hose. This will cause the airflow switch itself to trip, simulating an actual failure. Perform a similar procedure for power meter trips, arc detectors, thermal sensors and so forth. Simulating actual failure is the only way to know for sure that the sensor in question is actually doing its job. Most transmitter manufacturers have suggested procedures for simulating these failures for test.

If you are operating a water-cooled transmitter, now is the time to check for leaks, sticky valves and non-functioning flow meters. Operate your backup pumps and heat exchangers, check for proper operation of auto-changeover controllers, relays and valves. Take a water sample and check for sediment, discoloration, foaming and odor. We'll cover more on water-cooling systems maintenance later.

This monthly maintenance is the time to repair all of the small problems that you have been logging during your weekly inspections. Order the parts you need as you find the problems weekly, and schedule any extra hands you may need to complete the repairs during this time.

Major maintenance

Twice each year, usually in spring and fall,

Task	Frequency	Daily	Weekly	Monthly	Semi-Annual
Check remote readings		+	+	+	+
Complete set of meter readings			+	+	+
Calibrate set of meter readings				+	+
System remove meters				+	+
Basic cleaning				+	+
Calibrate local meters				+	+
Interlock checks				+	+
Backup checks				+	+
Thorough system checks				+	+
Complete internal cleaning				+	+
Complete RF sweep				+	+
Cooling system cleaning				+	+
Mini-proof & power calibration				+	+

Figure 1. Basics of a typical transmitter system maintenance schedule.



J15ax8B IRS

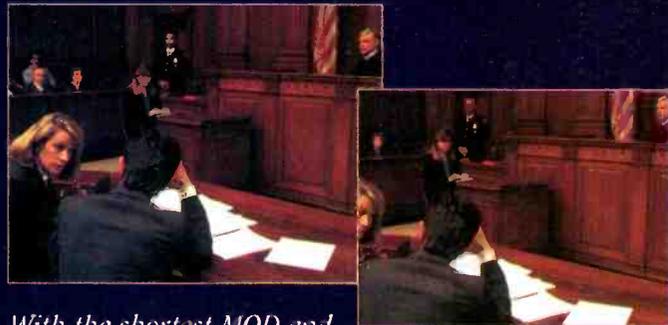
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schedule an extended shutdown period or several consecutive shorter periods to take care of major items. Most of these tasks will take two to three hours or more each to complete. This maintenance will include all of the weekly and monthly checks and adjustments. In addition, go through the entire system from video and audio input to the antenna, performing detailed checks as follows:

Complete system inspection.

- Security of nuts, bolts, screws, hangers, pipe unions, flanges, wire harnesses, terminal blocks, etc.
- Detailed visual inspection with in each cabinet looking for anything out of the ordinary; worn air or water hoses, signs of component heating (discolored components, circuit boards, etc.) loose pump or blower mounts, etc.

Complete RF system sweep.

- Check tube tuning and adjust as necessary.
- Using a network analyzer and/or TDR, perform an insertion loss test on your output RF components (hybrids, combiners, magic tees, filters, etc.) into your dummy load, note any discrepancies from previous measurements, make any necessary adjustments. Perform these same tests on your transmission line and antenna. This transmission line test should be done yearly without the antenna while the line is terminated into a known load.
- Perform an output peak-power calibration into the station's dummy load.

Once the system has been adjusted to maximum performance, perform a "mini-proof" going through the exciter, then the entire transmitter, with the basic test signals (multiburst, mod ramp, stairstep, broadband sweep, etc.). Take scope photos of the resulting demodulated waveforms for the file. At the very least, measure the parameters listed in Figure 2.

Keeping it cool

The cooling systems of high-power transmitters are critical to proper and safe operation of the transmitters. Keeping the cooling systems in order is at least as important as maintaining proper audio, video and RF system performance.

For air-cooled transmitters, check the control, warning and interlock systems as well as the condition of the physical blowers, fans, filter assemblies, hoses, ducting and so forth. Basic checks of these systems should

TEST	SIGNAL	REQUIRED RESULT (* IS FCC MINIMUM)
RF		
Carrier ratio	No modulation	*Aural 6.6dB below visual
In-band video response	Wideband sweep	As flat as possible to 4.2MHz
Upper sideband suppression	Wideband sweep	At least 30dB below V+200kHz desirable
Lower sideband suppression	Wideband sweep	*20dB below V+200kHz, 42dB below V+200kHz at -3.58MHz
VIDEO		
Field rate distortion	Stairstep	*<5% of peak visual
Video frequency response	Multiburst	<5IRE between packets to 3.58MHz desirable
Differential phase	Mod ramp	*<10°
Differential gain	Mod ramp	*<10%
Color phase and amplitude	FCC bars	*±10° phase, ±20% amplitude
Luminance linearity	Stairstep	<10% desirable
AUDIO		
Frequency response	50Hz-15kHz sweep	*Meets 75µs pre-emphasis curve
THD	50Hz-15kHz sweep	<2% desirable
AM noise	No modulation	-50dB minimum
FM noise	No modulation	-55dB minimum

These are the minimums, also desirable to check would be in-band spurs, ICPM, group delay, jitter, bounce and sync pulse rise times. If not transmitting in stereo, be sure to check that you are protecting the BTSC pilot frequency so you don't light the stereo light on home receivers. The FCC requirement for this is as follows: "Energy within ±20Hz of 15,734Hz shall not frequency modulate the aural carrier more than ±0.125kHz."

Figure 2. A "mini-proof" system performance check.

be made during the weekly and monthly maintenance routines. The semi-annual maintenance should include a complete cleaning and inspection of all ducting, replacement of all filters, checks of hardware condition, lubrication of fans and blowers and replacement of any worn hoses and gaskets. This maintenance period is a good time to perform static and dynamic pressure and flow tests on the main air systems as well.

For water-cooled transmitters, weekly and monthly checks of control, warning and interlock systems are critical — even small leaks can cause major problems if they occur inside amplifier cabinets or around control circuits. Imagine what happens if your pressure switch is malfunctioning, and you have a serious leak inside a cabinet. The pumps will continue to drain the sump tank until the float switch shuts them down, and in the meantime, you could have nearly 100 gallons of cooling water and glycol inside your transmitter.

The semiannual maintenance is the time that you will perform your water system cleaning, flush and fill. All major transmitter and tube manufacturers recommend regular flushing of water-cooling systems. Most transmitter and tube manufacturers recommend running cooling systems with some amount of ethylene glycol in the system year round — even in summer and in warmer climates. In areas where there is freezing weather, glycol is required in the winter in higher concentrations.

Water-cooling system flushing will usually consist of bypassing the tubes, draining the system, filling with clean water and a soap solution, heating the solution and pumping for a specified period, then rinsing with clean water several times and finally filling the system with new, clean distilled or deion-

ized water and the specified concentration of coolant. If a vapor-cooling system is in use, then no coolant is added to the water.

The specifics of this flush will vary with your transmitter model and manufacturer. Be sure to dispose of your used coolant in accordance with local regulations.

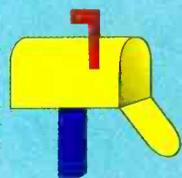
In addition to the flush, the semiannual maintenance routine will include a complete and thorough inspection of all plumbing in the system. Checking for leaks is the most obvious and one of the most important things to check for, but the overall condition of pipe, hangers, valves, fittings and solder joints is equally important.

Make it a routine

The basic story of effective transmitter maintenance is regularity and consistency. Develop a schedule that covers the fundamentals frequently and allows deeper maintenance and repair at regular intervals. These simple actions can ensure, except in cases of unforeseen disaster, a virtually trouble-free relationship between you and your transmitter facility.

Next month, we will discuss recommended tools and test equipment to perform effective transmitter maintenance as well as some of the specific differences in maintenance between transmitters of different types and technologies and options available for updating an older system. ■

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Panasonic DVCPRO

One of the latest developments in recording technology is a unified specification for home-use digital VCRs created by the HD Digital VCR Conference. Colloquially named DVC, it began with some of the most powerful companies in electronics: Sony, Philips, Thomson, Matsushita, Hitachi, Toshiba, Sharp, Mitsubishi, Sanyo and JVC. Their collective expertise produced a revolutionary system with several primary components: a compression standard, a tape format and a family of 6.35mm (1/4-inch) cassettes. The complete specification was finally approved in December 1994, and the consumer format was recently announced as "DV."

The most striking development is the playing time of the small cassettes. Cassettes the size of audio cassettes hold more than two hours. However, no less important is the compression scheme. Careful analysis of the trade-offs among compression artifacts, motion strategy, data rate, subjective picture performance, robustness and multi-generation performance produced a system with a hierarchy for standard and high-definition recording — all within a compact assembly.

An early decision was to reduce the chrominance sampling rate to 3.375MHz. This allowed two significant advantages: The compression system could operate intraframe; i.e., there would be no motion artifacts because each frame would stand on its own (unlike MPEG, for example), and frame-accurate control, editing and system integration would be facilitated. The compression ratio could be reduced to 5:1, assuring that compression artifacts would be kept to a minimum and the "payload" data rate held to about 25Mb/s. It cannot be overemphasized that the compression scheme is a completely defined standard, agreed upon by the consortium. Not only can it be packaged in two integrated circuits, making compact field equipment possible, but, because it is well-defined, au-

dio/video file exchange is possible between equipment of various manufacturers.

The broadcast format, DVCPRO, capitalizes on the developments of the consortium as described earlier. The large (L) 123-minute cassette is the same size as the DV standard cassette, and the medium (M) cassette holds 63 minutes. The total data capacity for the L cassette is approximately 23GB. Metal particle tape increases format robustness and allows longitudinal recording that is not possible on metal evaporated tape. This allows a cue audio track, as well as a traditional control track (CTL) to be recorded. The control track enables fast servo lock-up and frame-accurate editing with short prerolls. By reviewing the format, it is easy to see why DVCPRO video looks so good — the 13.5MHz sampled data of the luminance or Y component means the "sharpness" is the same as D-1, D-5 or Digital BetaCam. The 1.5MHz chrominance bandwidth is equal to BetaCam-SP, but less than D-5, making it comparable to the component analog formats, but not in the D-1 or D-5 league.

Recording format

The format "footprint" is shown in Figure 1. Spaces are allocated for editing (G areas are guard zones) in each of the tracks. Tracks are split into four sectors: an ITI (insert and track information), audio, video and subcode. Part of the subcode area is for auxiliary data and is used for time code.

Each frame is recorded as 10 tracks (525/60) or 12 tracks (625/50). The cue track on the upper tape edge and the control track (CTL) on the lower tape edge are conventional linear tracks. Color-frame information is part of the recorded CTL track, decreasing color-frame detection time. Six heads (two erase, two record and two playback) are mounted on the scanner, which is only 21.7mm in diameter (about the size of a quarter). Scanner rotation is about 9,000rpm.

The ITI sector provides optimum tracking control during insert editing and determination of the exact timing of the editing gap. During operation, the erase head is positioned two tracks ahead of the record/reproduce heads, thereby preventing a reduction of track width at points other than the editing point. Software prevents erasure of the ITI sector when the record/playback heads are reading the ITI sector. ITI tracking control is also used during the playback of home-use DV recordings, which lack the DVCPRO control track. When an insert edit is performed, reading the ITI sector allows for determination of the editing gap timing to compensate for minor deviations in the recorded track. The 3600-bit ITI sector is comprised of the ITI preamble, start sync block area (SSA) section, track information area (TIA section), and the ITI postamble. To detect the precise head position on the track, an identification code is recorded in the SSA sec-

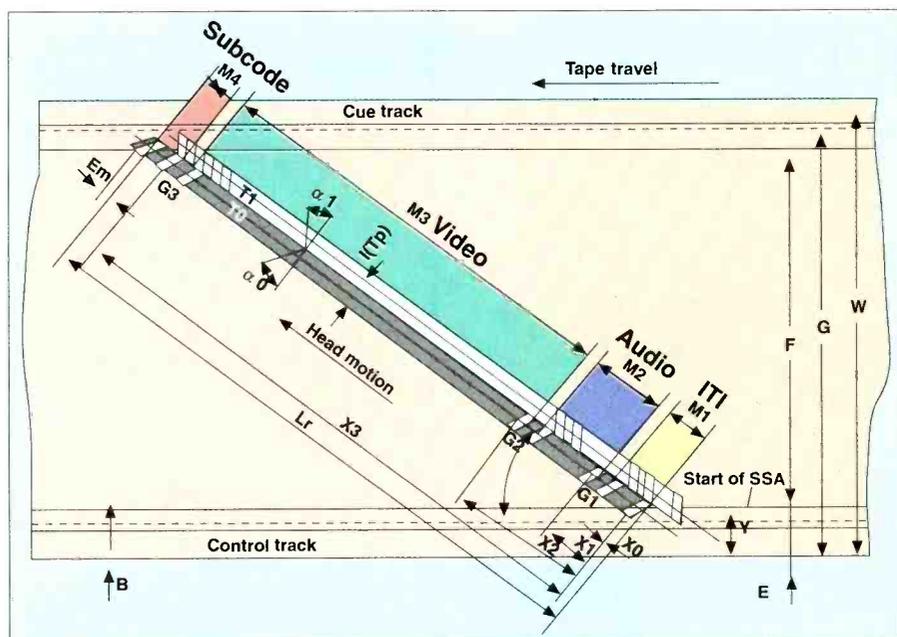


Figure 1. Location of the helical scan and longitudinal tracks on the 6.35mm tape.

Above photo: The DVCPRO family includes several camcorders, a field recorder and a laptop editor.

tion. The TIA section contains an application ID, which provides additional information about the track content.

Audio

The stereo audio signal is sampled with 16-bit precision using a 48kHz sampling frequency (locked to video), as described in the AES/EBU standard. The audio block recording consists of continuous recording of five tracks in the 525/60 system or continuous recording of six tracks in the 625/50 system.

The audio sector consists of an audio preamble, 14 data sync blocks and an audio postamble. Actual audio information is stored in the audio data block and additional information is recorded in the audio auxiliary (AAUX) block. The audio signals are shuffled for each of the audio blocks. Audio samples are separated into three series (3n, 3n+1, 3n+2) across the tape width and are separated into two tracks longitudinally, as well. In this way, samples are dispersed on the tape with a predetermined separation distance to improve correction capability and robustness.

Video

The video sampling structure is the same as described in ITU-R Rec. 601 for 4:2:2 component TV signals. Each color-difference signal is digitally filtered to reduce the number of color-difference pixels 50% to produce 4:1:1. The 720 luminance pixels and 180 pixels of each color-difference signal per line are processed as shown in Figure 2. This sampling structure has proven to be more than adequate, and is discussed in more detail below.

The video sector consists of the video preamble, 149 data sync blocks, and the video postamble. The compressed video signals are stored in the video data block, with closed-caption data, a VITC replication and other information stored in the VAUX block to implement desired functions.

Compression

Before recording, the luminance and color-difference pixels are grouped into DCT blocks for compression. These DCT blocks are further organized into macro blocks and super blocks. The DCT blocks are constructed from eight horizontal pixels and eight vertical pixels, with the exception of color-difference signals positioned at the right edge of the screen. There, the DCT blocks are constructed from four horizontal pixels and 16 vertical pixels. Each macro block consists of four luminance DCT blocks and the two corresponding color-difference DCT blocks. Each Super block consists of 27 macro blocks. Overall, pixels in one TV frame are divided into 50 super blocks, 10 vertical and five

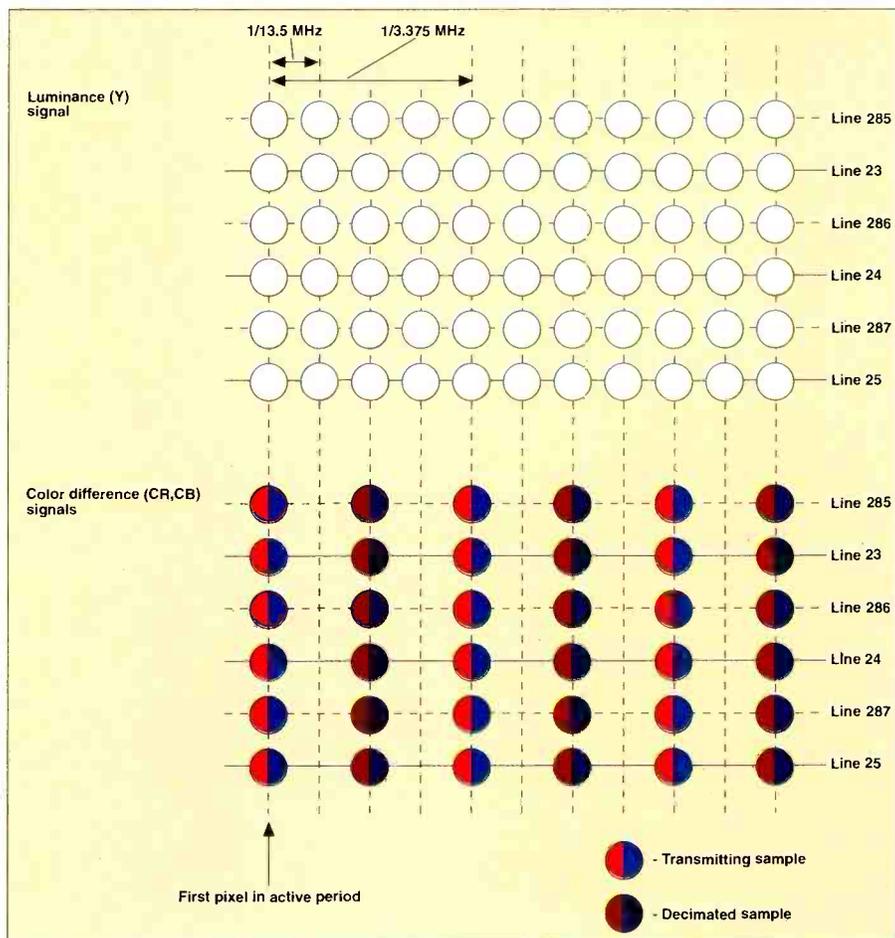


Figure 2. Sampling structure used by the DVCPRO chipsets to obtain 4:1:1 from an incoming 4:2:2 signal.

horizontal, for 525/60 and 60 super blocks for 625/50. A video segment on tape consists of five macro blocks that were gathered from different areas of the image. This allows shuffling to be performed in macro block units.

To improve the picture quality, the DCT processing has two distinctive operational modes. For pictures with little field-to-field difference, 8-8-DCT processing is performed; for fields with large changes in

To improve the picture quality, the DCT processing has two distinctive operational modes.

content, the 2-4-8-DCT mode is used. This adaptive process is a strong point of DVCPRO, and produces images better than you would expect from 5:1 compression. During the DCT process, the data in each DCT block is converted into one DC component and 63 AC components.

The compression system selects quantization for each macro block from 16 quantization tables. First, each of the DCT coefficient blocks is classified into one of four classes using several different parameters beyond the scope of this article. Second, the AC coefficients within the DCT block are divided into four general areas; each area is identified. The quantization process uses the class number and the area number to create the quantization number. The quantization table is selected so that the amount of data after both the quantization and the subsequent variable-length coding exactly equals the data space allocated for each video segment. The process is reiterative, and the quantization table number is included in the datastream to create a feed forward, fixed data-length compression system.

After quantization, the data is further reduced in volume by applying 2-dimensional Huffman variable-length coding, so that one or more successive AC coefficients within a DCT block are coded into single-length code. In this step, the information, including the number of successive AC coefficients quantized to zero ("0") and the absolute value following the successive zero coefficients are simultaneously coded.

The actual data obtained after variable-length coding are formatted in the video sector data area. Each compressed video segment consists of five compressed macro blocks. The DC component is stored within the DC region and the AC components are fundamentally stored in the AC region within the same DCT synchronization block. However, when the amount of data is larger than the amount in the allocated region, either empty AC regions within the same sync block or empty AC regions within the same video segment can be used. This, too, contributes to the overall image quality. When the synchronization blocks of compressed data are recorded on tape, the order is changed such that fast forward or rewind modes provide sufficient information to make a recognizable picture.

Subcode

The subcode sector consists of the subcode preamble, 12 data sync blocks and the subcode postamble. The LTC replication and other information is stored in the subcode data block. To reproduce the subcode data at high speed, the length of the sync block in the subcode sector is shorter than that of the audio sector or video sector. This allows time-code recovery in

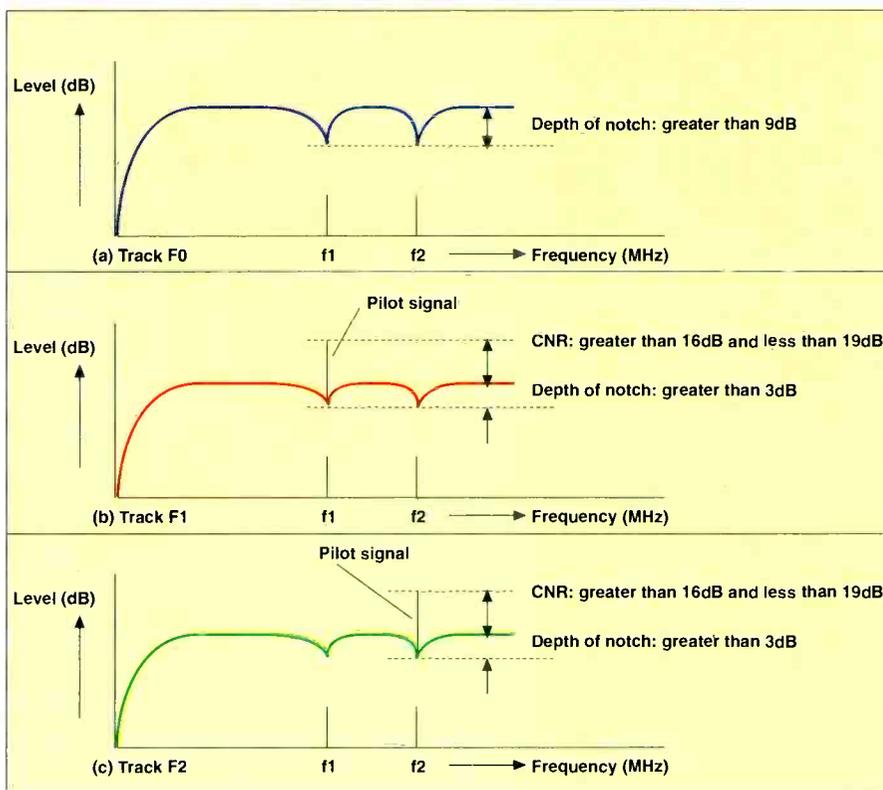
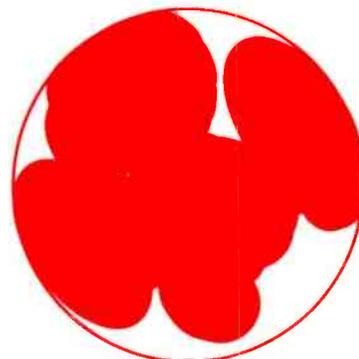
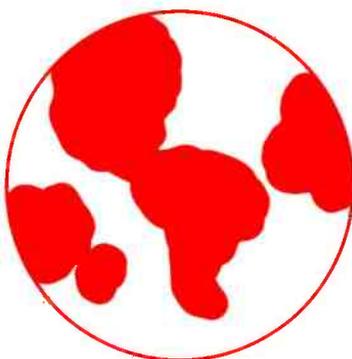


Figure 3. Frequency characteristics of the recording spectra used in the DVCPRO recording process.



high-speed search and space for auxiliary data to be carried with the audio and video for future applications.

Modulation

The randomizing 24-25 modulation and interleaved NRZI processes are performed on the datastream to be recorded. The "0" or "1" in the "extra-bit" position is selected such that the maximum run length of "0" or "1" is less than 10. Additionally, a second criteria helps to obtain a predetermined frequency spectrum from among three spectrum types (F0, F1 and F2) shown in Figure 3. Recording is performed in a repetitive order F0, F1, F0, F2. This forms the ITI pilot signal to maintain precise tracking at the insert point. At playback, tracking can be performed by monitoring the pilot signal for tapes without control track.

Bandwidth

For standard definition, the internal signal structure is digital component 4:1:1 giving component transparency. However, there is a concern that 4:1:1 is inadequate for some post-production work like chroma-keying. By the analysis of signal bandwidths, you can see that DVCPRO can do anything Beta SP can do. While on the

subject of chroma-key, recognize that most field material is inserted into a key, not the source of the key edge or shape; i.e., when news footage is keyed behind the anchor-person, the key signal comes from the studio camera. In these cases, the bandwidth of the insert is relatively uncritical.

Digital inputs and outputs are standard 4:2:2, making it easy to interface to existing facilities. Incoming 4:2:2 is decimated to obtain 4:1:1 for recording. On playback, the 4:1:1 off-tape signal is interpolated to provide a quality 4:2:2 output signal. The analog output is developed from the interpolated data.

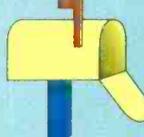
News production, like the total station or facility operation, must become more efficient, flexible and economical — simultaneously. Usually, these requirements are mutually exclusive. By granting to tape what it does best, DVCPRO shows that field acquisition can be made not only compact and cost efficient, but it can also produce quality pictures. This new technology has allowed the creation of a DVCPRO camcorder with excellent mobility — a camcorder with body weight of about six pounds, total operational weight of about 11 pounds and total recording time more than one hour. By capitalizing on the compact size of

this equipment and core technology, equipment like a "laptop-style" field-edit system and a compact field recorder will allow field production without the transportation difficulties and expense traditionally required.

Because a digital VTR employing DVCPRO technology can be connected to various other digital equipment such as a video server, non-linear equipment, digital optical disc recorder and quadruple-speed transfer equipment, a practical digital broadcasting environment can be created to integrate with the understandable operational desire for disk-based non-linear random access and release. ■

Phil Livingston is the assistant general manager, technology and systems development, for Panasonic Broadcast & Television Systems, Secaucus, NJ.

 For more information on the Panasonic DVCPRO, call 1-800-528-8601 and say that you saw the product mentioned in Broadcast Engineering.

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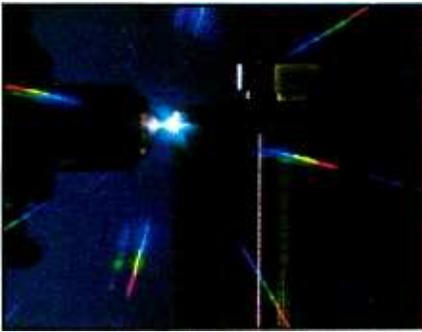
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Digital Equipment Corporation (DEC) has created the AlphaStudio broadcast system, a system that streamlines broadcasting video material in a network or TV station environment. All of the critical functions of video broadcasting — maintaining an inventory of video material, advance scheduling of material for air play, retrieving the scheduled material from inventory, producing a high-quality video signal for final air play and generating an accurate record of what was aired and when — are provided by a single integrated system.

The AlphaStudio broadcast system accomplishes these goals with a combination of computer technology, digital disk and tape storage and digital video techniques. Together, these factors provide a reliable video recording, storage and playback system that eliminates most of the costly, labor-intensive, maintenance-critical and unreliable elements of a traditional master control system.

Traditional vs. modern systems

Many components are critical to the proper operation of a TV station, but the VTRs stand out the most on the critical path. They are electromechanical devices with operating characteristics that inherently require constant attention to maintenance and adjustment. Automated tape library systems compound the problem. In addition to numerous VTRs, those systems also have robotic mechanisms for moving the cartridges around. And even when VTRs work perfectly, passing magnetic media over a play/record head inevitably involves wear and degradation of the recorded material.

The AlphaStudio addresses many of these issues by using proven digital technology to eliminate VTRs from the on-air stream, and by making large amounts of video information available on a random-access basis.

The system's operating philosophy is to treat the video as data, pure and simple. Digital video is brought into the system from a digital video recorder. The digital video data is transferred to the system's *video data repository*, where each segment of video gets treated internally as an ordinary data file by the interconnected DEC products and com-

Digital Equipment Corporation's AlphaStudio broadcast system

ponents that make up the bulk of the system. When it is needed — hours or days later — the video data gets transferred from the repository to the on-air playback output station.

Note the advantages over the traditional system: Tape drives are needed only on an off-line basis; they are required only for transferring a video clip into the AlphaStudio broadcast system, which can be done days or weeks before the clip is needed. A tape is played on a VTR only once. When material must come out of the repository, it is located and transferred automatically, with no human intervention — there is no need to manually identify, locate and transport a reel of tape, nor is there any need to manually load it onto a VTR in a time-critical manner.

Major system elements

DEC has partnered with two companies that have extensive experience in master control: Louth Automation and Columbine/JDS. These companies have established standard protocols for controlling the AlphaStudio broadcast system. The standards are much like traditional control protocols involving commands such as LOAD, CUE and PLAY. The protocols have been published, and other third parties who wish to control the AlphaStudio will be able to do so. Communications between the top master control layer and the AlphaStudio broadcast system are via RS-422 and Ethernet connections.

The system includes video and audio connections to the outside world. Each connection is a circuit board designed by Leitch Technologies, another of DEC's partners in developing this system. Each circuit board has a D-1 serial video input, a D-1 serial video output, two AES/EBU serial digital audio inputs and outputs and a SMPTE/EBU time-code input and output. Each interface board translates between the standard video/audio streams on one side and the internal DEC computer bus on the other.

In the middle (and an extremely big middle it is), you find the data repository. It is made up of many pieces, but basically consists of a computer and lots of storage. The master control level tells the repository to bring in, for example, a 2-minute segment of video. Once inside the machine, that segment of digital data is given a file name. At some time in the future, which might be minutes, hours, days or weeks, the master control level can recall that file by name and have the system play it back through one of the digital video recorder input/output stations.

New technologies used

The system is made possible by bringing

together assorted technologies that have matured over the last few years:

- Digital-to-analog and analog-to-digital video converters;
- Real-time JPEG video compression/decompression;
- VELOCITOR disk drives that can deliver data at uncompressed video rates;
- Redundant Array of Inexpensive Disks (RAID) technology;
- Improvements in disk-drive MTBF (up to 500,000 hours);
- The development of large-scale automated digital-tape archive systems (These systems handle dozens of terabytes of digital storage; at 6:1 compression, a terabyte represents 60 hours of video.);
- The development of off-the-shelf solutions to handling digital data at video rates (This system uses FDDI technology for internal data transfer; each FDDI channel can handle 10MB/s, with three bundled together to deliver the 27MB/s needed for an uncompressed D-1 video channel.);
- The development of computers fast enough to manage systems of this complexity and high-data throughput (This system uses DEC's powerful AlphaServer computers.); and
- The development of pure software techniques for managing large amounts of data.

Design considerations

In 10 years or so, if disk drives are 10 times faster and 10 times cheaper, the hardware of the system may actually be quite simple. But for the moment, cost and performance restrictions and reliability considerations make things a little more complicated.

First, there is the issue of computational power. The system must be capable of handling several simultaneous video-bandwidth I/O streams between the various subsystems, and at the same time, be able to perform the non-trivial task of keeping track of terabytes of information. The AlphaStudio broadcast system is controlled by one of DEC's powerful AlphaServer computers. It has the computational power and bandwidth needed to handle and transfer the large amounts of data involved.

Then there are the issues of storage, both in cost and in throughput. There are disk drives available now that can handle data at the 30MB/s needed by an uncompressed video/audio channel. Those drives are relatively expensive, and in the AlphaStudio broadcast system, are used only where needed.

On the other hand, RAID technology is cost effective for storing large amounts of data. But currently, it can't handle long bursts

of uncompressed video. This is where JPEG video compression comes in. The video I/O boards are designed to perform real-time JPEG compression and decompression. The level of compression for each piece of video is controllable. The system architecture of the AlphaStudio can be compressed about 6:1 without objectionable artifacts appearing on the screen, particularly by the time the signal reaches a consumer's TV receiver at home.

The system can be configured to handle both compressed and uncompressed video. Given this, DEC expects a mix of uncompressed and compressed material, with an overall compression across a typical broadcast day of at least 3:1 — well within the AlphaStudio broadcast system's abilities.

At present, however, disk storage is still too costly for staging more than about one day's worth of video at these data rates, so a less-expensive form of data storage is needed. The AlphaStudio can use several different configurations of digital tape archive systems for longer-term storage; such archives can store weeks of video. Most of the digital video data is stored in a multiterabyte digital tape archive. Video clips that are needed within the next few hours are transferred to a large RAID disk subsystem called the staging disk; uncompressed video clips are transferred to special high-speed disk drives short-

ly before they are due to be aired.

Potential beyond simple playback

The system can also be scaled down to the point where a single stand-alone digital video recorder channel stores 30 minutes of video. The attractive feature of such a recorder is that it offers instantaneous random access to any of the stored video. This could be a useful feature in a busy post-production environment.

The system offers utility in other applications, such as news production. In a fast-breaking situation, live feeds or raw videotape footage could go directly into the AlphaStudio broadcast system and the edited report can be prepared and aired in minutes without any videotape used in the editing process.

The system can also function as a tapeless delay element. For instance, incoming video can be stored and output 20 minutes later. The tail-end of the source material can still be coming in while the head-end is being played back — an impossibility on a VTR.

Completely digital master control is an idea whose time has come. Eliminating tape machines from the on-air playback process enhances reliability. Eliminating their constant need for adjustment and maintenance reduces costs. Using serial digital video links sim-

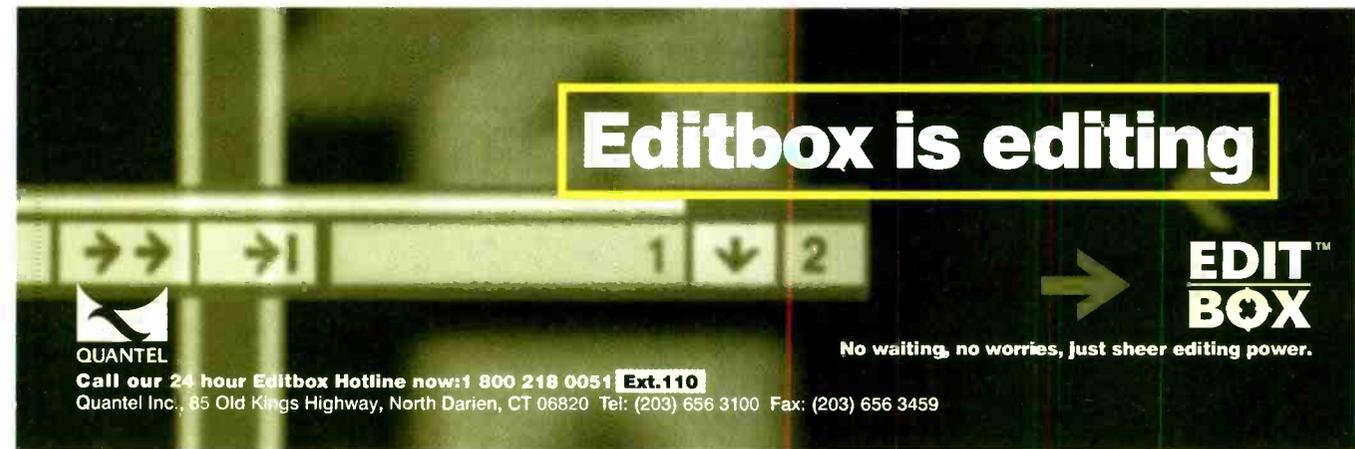
plifies many of the traditional timing and distribution problems. These improvements in efficiency come coupled with improved video quality — digital video obviously doesn't degrade with time and multiple playbacks, and the system inherently cuts down on a generation or two of recordings.

The whole process of preparing playlists can now be done, top to bottom, by computers communicating with each other. The final list of what was actually aired, and when, can now be generated by computer with total accuracy. The time-critical process of airing the final product takes place without intervention by human operators and without depending on VTRs at all. In short, DEC's AlphaStudio broadcast system offers enhanced reliability, enhanced productivity, and reduced cost in the field of broadcast production and master control. ■

Robert Dubner is president of Dubner International, Westwood, NJ.

 For more information on DEC's AlphaStudio broadcast system, circle (152) on Reply Card.

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Fiber optics in uncompressed digital broadcast applications

Fiber optics are a unique communications tool capable of solving several problems faced by broadcasters. Possible applications include microwave link replacement, broadcaster-to-MSO hand-off and live-event origination. A fiber-optic ring or multiple-point cascaded system in a major metropolitan area may accomplish all of these connections from the same fiber and video source with high-quality, cost-effective, off-the-shelf transmission equipment.

Applications

As a microwave link replacement, reliable fiber-optic transmissions can virtually eliminate FCC-compliance requirements and many other issues common with line-of-site communications between studio and transmitter sites. Video quality can easily meet 250-C short-haul standards and noise, because radiation and ingress do not affect fiber optics. Weather problems like rain fade are eliminated. Lightning damage is less likely because there is no conductive path between sites.

Another benefit is the bidirectional nature of fiber-optic transmission equipment that allows a single equipment shelf to act as receiver and transmitter, providing a return path for transmitter telemetry or quality monitoring. Additionally, line-of-site paths are not necessary for fiber optics between sites.

Another important application is the broadcaster-to-cable company hand-off. Many cable companies use off-air signals or a dedicated microwave link for input of local affiliates at their system head-ends. Several common problems associated with these methods can be eliminated or improved with the reliable, high-quality signal reception provided by fiber optics.

Live origination and event feeds to networks can also be improved using fiber optics. Dedicated links from the stadium to a broadcaster's studio and cable head-end can ensure high-quality video audio and data communications regardless of weather conditions and regulatory and political changes. A digital video, fiber-optic link

would also allow a high-quality event feed to be connected directly to the Vyvx baseband analog insertion point. Vyvx can then provide cross-continental transport to the network for worldwide distribution.

Digital equipment also allows for digital repeats. Once the analog video/audio is digitized, it can then be repeated virtually an unlimited number of times (unlimited distance) with little or no signal degradation. In addition to video and audio transmission, most digital systems provide for transmission of multiple media types. The convergence of multimedia technologies on common communications channels is occurring in many forms, including the uncompressed digital video transmission equipment. Equipment vendors are providing interfaces to many common signals for multiplexing with the video and audio. These include T-1, RS-232, RS-449 for Ethernet and others. These data channels can make use of these high-quality transmission systems and can be extended nearly unlimited distances to their destinations.

Signal quality

A major benefit of changing to fiber-optics transmission equipment is the improved quality of the received video/audio signal. Uncompressed linear pulse-coded modulation techniques can easily achieve EIA/TIA-250-C performance standards for short-haul transmission using 10-bit analog-to-digital conversion.

A variety of quality vs. cost and benefit choices are available to fit most requirements. Overall signal quality is based upon quantization theory for A/D conversions. Better than 67dB signal-to-noise ratio (SNR) is attainable with 10-bit equipment, and 8-bit systems offer better than 56dB SNR. In nearly all uncompressed systems, quality exceeds the 250-C standard. In theory, for each additional bit used in an end-to-end A/D-D/A system, an extra 6dB of SNR is realized. The approximate theoretical maximum signal-to-noise ratio for an 8-bit system is 60dB using 12.5MHz sampling rates and 84dB for a 12-bit system. If a system's architecture requires a double translation through the A/D-D/A process, like an ad insertion or baseband routing switch, signal-to-noise would be reduced by only 3dB because of digital quantization error.

The digital data link integrity is better than 10E-12 BER (bit error ratio). When

we speak of an optical link budget of 25dB, it needs to be quantified by a finite bit error ratio. So a receiver sensitivity specified in optical dB (-25dB) means with a bit error ratio of better than 10E-12 errors/bit.

Systems with a link integrity of much less than 10E-12 have a smaller margin for errors and will experience a "cliff effect" much sooner. This level of signal integrity puts the quality of optical transmission far above that which is discernible by the trained video engineer. Even the best video test equipment will be unable to detect much if any quantifiable noise due to transmission errors with a system of this quality. Trained engineers may be able to detect problems near 10E-9 BER with the naked eye. For that reason, 10E-12 BER is the recommended link integrity to allow a suf-

A major benefit of changing to fiber-optics transmission equipment is the improved quality of the received video/audio signal.

ficient safety margin. This also provides a greater degree of tolerance to component aging, temperature effects on fiber, lasers and other components and subsystems in the link.

The high bit error ratio also eliminates the need for expensive error correction. The end result is the engineer's primary concern to maintain the specified optical budget with a recommended 3dB to 4dB of margin. This keeps the capital equipment, testing and maintenance costs low and limited virtually to a module swap and spares issue.

Testing and verification

Testing of digital systems requires a bit more effort to obtain true signal-to-noise figures and other specifications of the 250-C standard. Shallow ramp testing is required. If analog quiet line testing techniques are used, we could cheat the test by merely adjusting the baseline slightly so as to control the toggling of the least-significant bit

Continued on page 102



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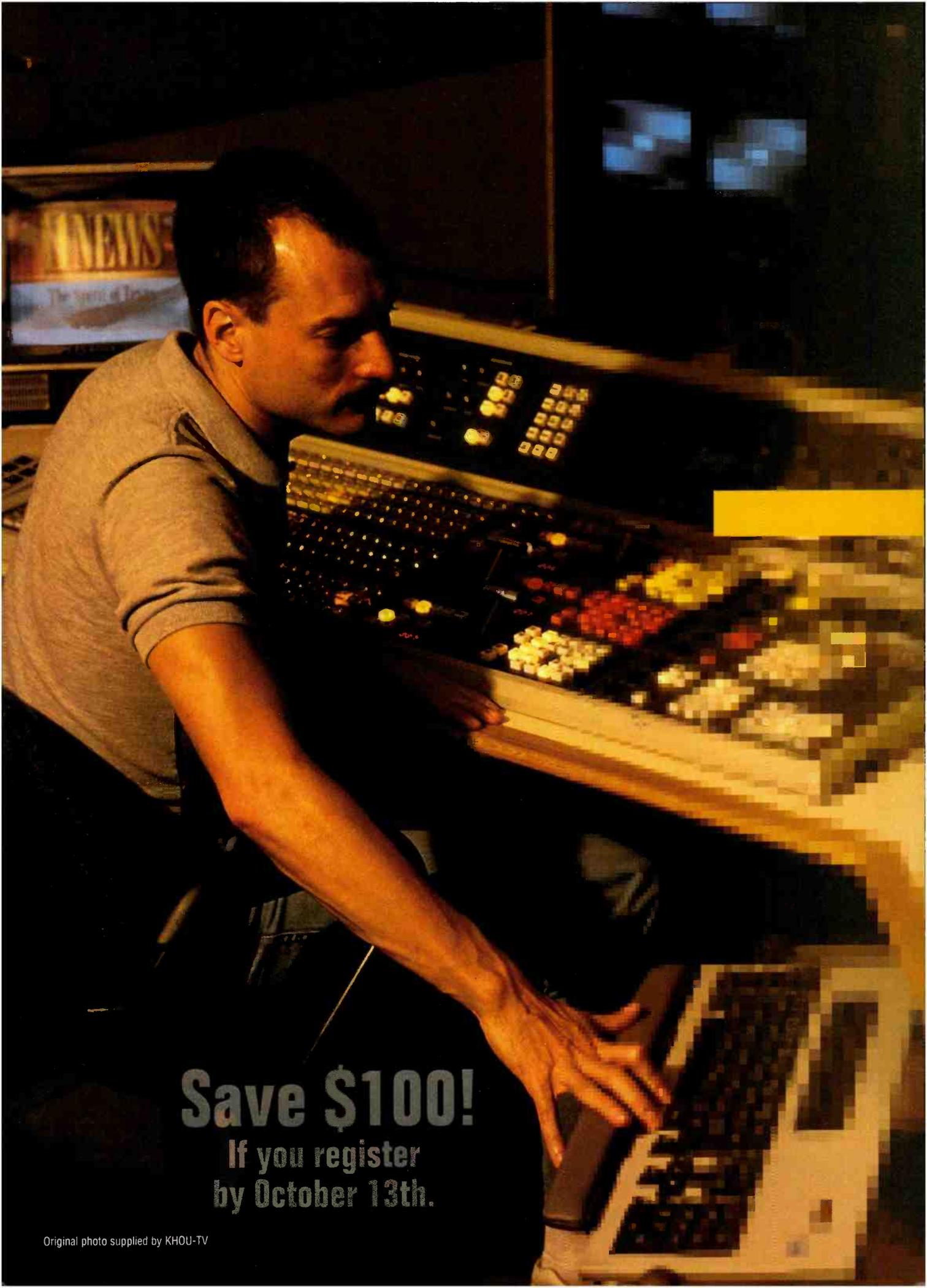
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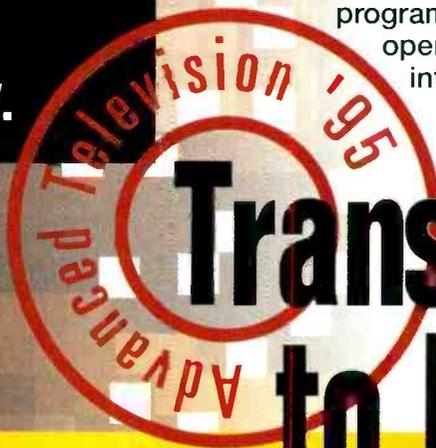
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in the A/D converter. This could result in a measurement with at least a +/-6dB error in signal-to-noise ratio.

The recommended procedure for performance testing digital video transmission systems is outlined in a proposed ANSI document titled "DS-3 Transport for Contribution Application of System M-NTSC Television Signals — Analog Interface and Performance Objectives." Although it was originally written for compressed DS-3 systems, it recognizes the need for a shallow ramp signal to properly exercise the least-significant bit in the digitizer, rather than the more common quiet line test.

Additionally, it recommends 10-bit digital signal generators that have a theoretical maximum signal-to-noise ratio of 72dB. Using a 10-bit signal source to measure the performance of a 10-bit uncompressed system is barely adequate at best. The alternative is to use an analog or 12-bit digital shallow ramp generator as a source with a signal-to-noise of 80dB or better. In this way, the test equipment is an order of magnitude better than the system under test, resulting in greater accuracy in performance measurements.

Reliability

Laser-based fiber-optic transmission equipment has reached the point of volume mass production and is extremely reliable. Virtually all of the electrical components are common RF and analog and digital parts available in commercial-, industrial- and military-grade versions. The electro-optical components, lasers and photo detectors, are being mass produced in

Laser-based fiber-optic transmission equipment has reached the point of volume mass production and is extremely reliable.

large volumes and are becoming some of the most reliable components in the system. The Fabry Perot lasers, for example, have on the order of 200,000 or 200k hours of MTBF, which equates to 20 years of reliable service. Informal surveys indi-

cate most outages are due to "backhoe fade" rather than the loss of a laser.

Fabry Perot lasers, which are the most reliable, produce about 1mW or 0dBm of optical power launched into a single-mode fiber-optic cable. The typical receiver sensitivity at -25dBm for PIN-type detectors thus yields an optical budget of 25dB. If we conservatively estimate dual-window fiber losses at 0.5dB/km, then our link is 50km. This simple calculation is conservative enough to yield ample margin for a reliable network design.

The bandwidth required for an uncompressed video/audio analog-to-digital conversion channel is roughly 100Mb/s. When several digitized channels are time division multiplexed for optical transmission, the baud rate over the fiber, assuming a 20% overhead for framing and link synchronization, becomes a Gigabaud with only eight video/audio channels. This is a trivial exercise for today's fiber-optic transmission equipment manufacturers.

Redundancy in optics is another benefit that can be realized with today's digital transmission equipment. Failures due to the more common fiber facility problems can be minimized or designed out of the

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system by taking advantage of built-in redundant lasers driving self-healing ring topologies or alternate path fibers. As an equipment software option, full status monitoring for remote control and alarms is also available as an option to many systems.

Digital vs. analog

The benefits of digital transmission are many and video can be transported nearly unlimited distances with little effect upon signal quality. Signal quality is primarily a function of quantization error and once accomplished, little else decreases the quality of transmission — not channel count nor distance traversed, not weather nor regulations. Many types of media may also be interfaced with standard digital equipment. In addition, there is no trade-off in channel capacity vs. transmission quality for digital equipment. Analog transmission quality suffers from each retransmission or remodulation, along with the channel count vs. signal quality trade-off. Digital-optical link budgets allow for transmission distances of greater than 50km (32 miles) without repeating.

Another benefit is the lack of adjustments and maintenance required for the digital equipment. If anything is truly "plug-and-play," it is the digital fiber-optic transmission equipment. With 75Ω BNC inputs for baseband video, balanced 600Ω audio screw terminals, and screw-on quick-disconnect FCPC connectors for the fiber and no adjustments necessary, it is simple to operate and install. Compare this ease of use with the setup and maintenance of a microwave system.

The most likely trade-off with digital systems is the "waterfall" or "cliff" effect. If a digital channel exceeds the maximum specified range of the link budget, it experiences a rapid signal loss. This is characteristic of "digital" and true regardless of the use of optics, RF or coax between transmitter and receiver. Fiber-optic transmission systems experience the cliff effect if the optical receiver sensitivity is exceeded. An analog system experiences a slow degradation in signal quality as communications link specifications are exceeded.

Fiber-optic cable

The most common and most economical source of installed fiber-optic cable continues to be the local cable company. Not only is the local MSO interested in taking a video feed from a broadcaster, but it is highly likely to be involved with a substantial upgrade or fiber rebuild within the system. Many architectures involve fiber being laid all over their communities for the fiber deep, fiber to the curb or fiber to the node topologies. Cable companies are laying fiber-optic cable containing 96 to

126 fiber pairs, not all of which will be used and lit up now. Many times fiber is available. Now is the time to make arrangements while the MSOs are in their fiber rebuild phases and retransmission consent agreements are still being hammered out.

Regulations require the local operator to carry the community's affiliate broadcast to its subscribers. It's also required that the drop to the subscriber must meet a 43dB carrier-to-noise ratio. It's in the best interests of the broadcaster, the MSO and the consumer to transport the highest-quality signal available with today's low-cost uncompressed digital video transmission systems.

Other sources for fiber are the regional Bell operating companies, the local utilities and competitive access providers that are springing up throughout the nation. It has yet to be seen if these alternatives can provide an economical source of fiber for quality video services, especially point-to-point topologies as required by the broadcasters.

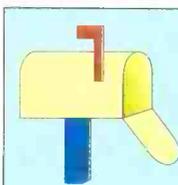
Cost

The cost for proprietary digital uncompressed video transmission equipment can run as low as \$3,500 per channel for several multiplexed channels on an end-to-end basis. At the higher end, cost can run from \$7,000-10,000 per channel for 10-bit, 250-C short-haul-quality equipment with software control and status monitoring. Compare this to the cost of a microwave system or a single-channel compressed DS3 codec. The cost of a DS3 compressed codec is on the order of \$14K per end and does not include the optics. In addition, compressed signal quality cannot be comparable to the high quality of uncompressed technology.

There are many possibilities available for high-quality video transmission using uncompressed fiber-optic transmission equipment. Total costs considering initial capital equipment, maintenance and installation are low when compared to existing technologies. Equipment reliability and link integrity are extremely high, and with the availability of fiber-optic cable from MSOs in your area, you can now seriously consider this economical/technical improvement for your transmission needs. ■

Tomie J. Doty Jr. is an application engineer and marketing product manager of the Intran product line for Iptek, Carlsbad, CA.

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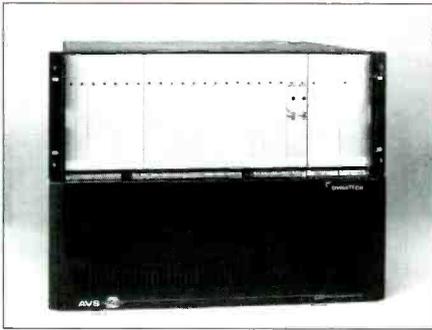
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Dynatech AVS-2 router

facility. By the early 1990s, much of the technical facility had become "vintage" 1979 technology. In the past few years, CBN has undertaken an upgrade process to implement more current technology.

The pace of technological change is directly proportional to the availability of capital in the industry. Yet, whatever its speed, it tends to be too rapid for the comfort of financial wizards and too sluggish for technicians and engineers. All of these parties have been involved in the updating of CBN's facilities, and the most challenging portion of the renovation to date was the process of approval, specification, selection, design, installation and implementation of a central master routing system.

In the beginning

The original routing switcher in CBN's Studio Headquarters Building (SHB) was a 100 x 80 unit with one level of video and two levels of audio. Long overdue for replacement, it was dealing with an environment that had grown to include more than 100 VTRs, a dozen cameras in two studios, seven editing suites, six channels of DVE, standards conversion, cassette duplication and a satellite earth terminal that supports three full-time cable networks and more than 400 additional uplinks and downlinks per month.

Before any design or specification could begin, corporate management had to be persuaded that the purchase of a "behind-the-scenes" device like a router should become a top technical priority. Items like DVEs, switchers, ENG cameras and digital tape machines were understood more easily, and the results of those purchases were readily apparent in the product. After several months of discussion and deliberation, however, the master router project received final approval, and the process was under way.

The first step was to define the requirements for the system. There was a great deal of discussion on whether the system should be configured for analog or digital signals. Considering the sheer magnitude of analog devices currently on-line, the system would need to function in the analog domain, at least initially. The most basic and essential requirement was that the switch must pass all of its signals transparently, a luxury CBN had not previously enjoyed.

The operating systems and software needed to be reliable and flexible, without intimidating the end users with its complexity. By the same standard, the control panels had to be intuitive to the users and capable of rapid response to the changing needs of production, post-production, duplication and syndication projects. The system architecture had to be a

Performance at a glance

- Flexible routing system with transparent performance
- Single-stage and straightforward switcher architecture
- Practical and manageable system density
- Configurations are easily edited and modified
- Fail-safe control system, protected by redundant CPU
- Fast, intuitive and easily mastered control panels
- Software provides ready access to many system features

When the Christian Broadcasting Network's (CBN) International Communications Center in Virginia Beach, VA, began broadcasting in the spring of 1979, its headquarters housed a state-of-the-art teleproduction

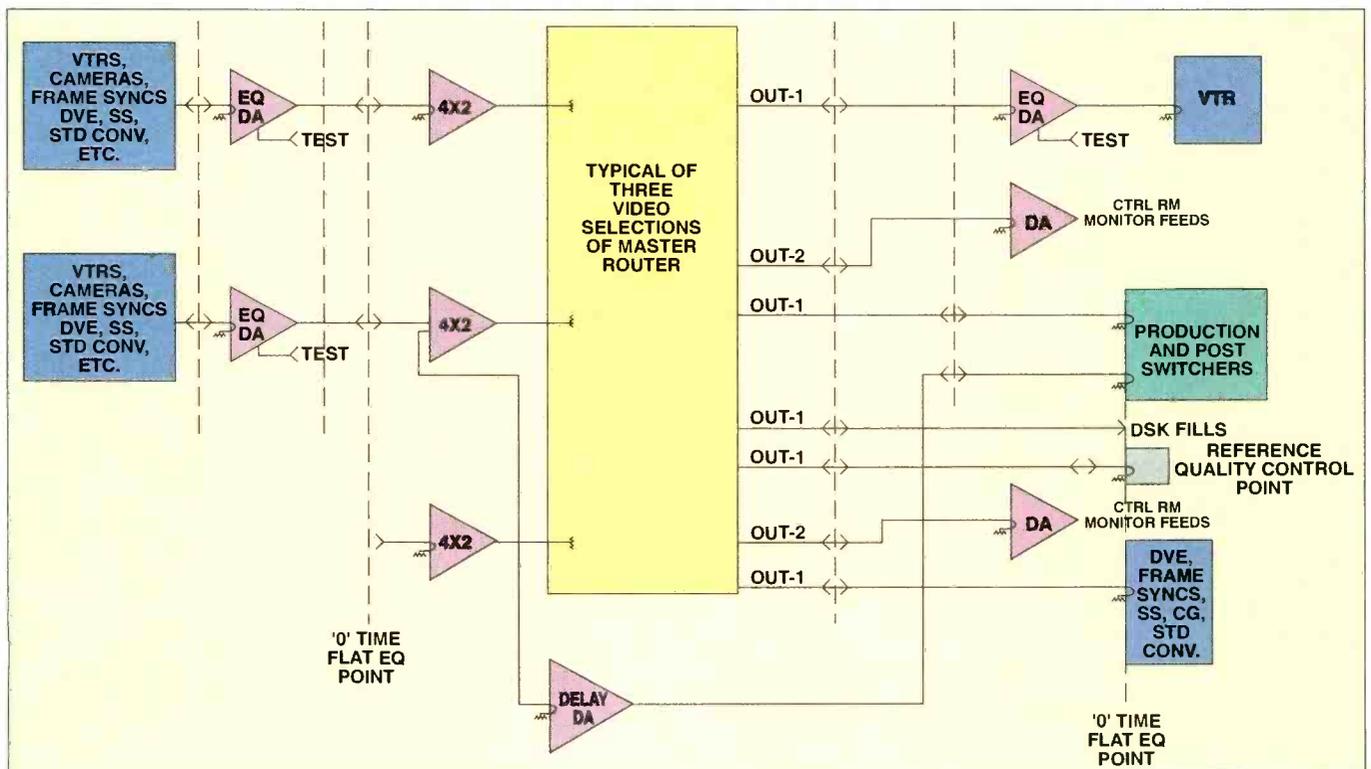


Figure 1. Block diagram of CBN router system.

single-stage crosspoint matrix switch. The system also had to fit the requirements of the renovated technical facility, as well as provide multiple options for future expansion and accommodate new standards. Regarding bandwidth, the system had to be capable of passing full-quality video of multiple standards, including proposed ATV signals.

The system chosen

The system selected was the AVS-2 master routing system from Dynatech Video Group (previously sold under the Utah Scientific name). It is configured in two separate switches, one in the satellite earth station and the other in the main technical facility at the SHB. The earth station switch is a 50 x 50 matrix with one level of video and two levels of audio, and a 20 x 20 matrix for audio/time code. The main switch is framed at 250 x 250 for video (crosspoint cards populated to 230 x 230), 210 x 210 for audio channels 1 and 2 (cards for 180 x 180), 210 x 180 for audio channels 3 and 4 (cards for 150 x 150) and 210 x 150 for time code (cards for 130 x 130). The main switching system also contains a frame for routing serial digital signals, but current facility requirements did not necessitate populating the frame with any crosspoint cards.

The frame layout for such a large video

input section makes the use of distribution amplifiers obligatory. The system was laid out with the ability for 250 inputs by 100 outputs to reside in a single equipment rack. This required three separate input sections to accomplish our full-framed capacity of 250 video outputs. (In other words, all 250 input signals must appear in each of the three racks containing the video section.) CBN selected Dynatech's 4 x 2 video DA for this purpose. One of the key criteria in this choice was its perfect match of specifications and bandwidth to the switch itself. The DA array is split into two separate racks to reduce the cable density in a single rack, thus allowing for more favorable cable routing and dressing, as well as more convenient accessibility for maintenance or system changes. The video portion of the switch, including the power supplies and the DA array, occupies most of four equipment racks.

The original facility had been planned to be a zero-timed facility, and although this concept worked well on paper, it had never been practical with the previous system design and routing switcher. The current upgrade included a plan to bring the facility into compliance with that original design theory of 17 years ago. The system was engineered with an array of new Dynatech delay DAs on the non-routable production switcher inputs to

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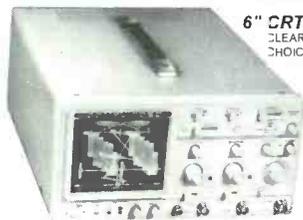
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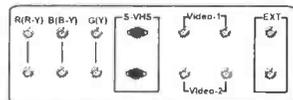
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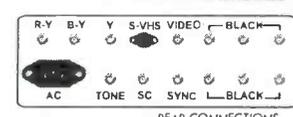
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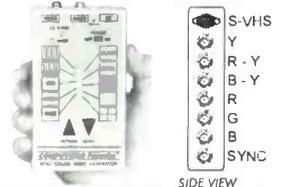
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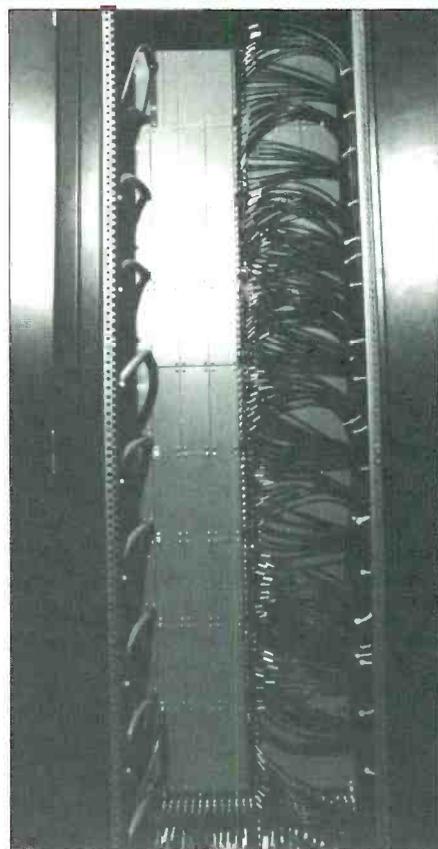
Circle (68) on Reply Card

accomplish a true zero-timed system, regardless of whether the signal path is routed or hard-wired. (See Figure 1.) When measurements were taken after the system's completion, we were able to expect accurate timing to $\pm 0.5^\circ$ of subcarrier phase, even when comparing a single source between its hard-wired and routed switcher inputs.

Each of the audio sections fits easily into two equipment racks. The wiring was straightforward with the inputs for each section located at the rear base of the rack and the outputs spread throughout frames in the rest of each section. Terminal connections are made easily with a small screwdriver, and the density of connectors is manageable.

Installation

CBN's in-house engineering staff handled all installation tasks, with testing and troubleshooting assistance provided by Dynatech's engineering staff. The system arrived at CBN in three stages: First came the crated control panels and other hardware, followed by two shipments (via electronic equipment-transport moving van) in which all frame components were rack-mounted for shipping. The system had few problems upon initial power-up, and even those were easily resolved. The system was wired for its full-framed capacity (audio and video) rather than just the current card population, allowing easier future expansion.



Rear panel on one of three video sections of the CBN router.

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The installation schedule was completed without delay or interruption. Programming broadcast on Feb. 28, 1995, ran through the new AVS-2, and the switch has been fully functional and performing up to or beyond expectations ever since.

The design and installation of the second AVS-2 for the satellite earth station was handled separately from the main system. It was installed over a weekend last fall.

Performance

The video section of the switch was put through several tests upon completion of the installation. The test signals were generated by a Tektronix TSG-2000 and measured by a Tektronix VM-700. The baseline measurements were taken by connecting the TSG-2000 directly to the VM-700. The second set of test results was obtained by completing the path from the patch panel through the equalizing DA string to input 49 of the switch, latched to output 192 through the DA string and back to the patch panel. The third test was a repeat of the second test, but

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using input 65 and output 65. Analysis of the VM-700 data showed the performance of the switch and the DA path to be nearly flawless. The audio performance of the router has not yet been objectively measured, but a marked subjective improvement in audio frequency response and stereo phase integrity has been noted by operators.

The control system for the AVS-2 is intuitive, user friendly and quickly mastered. The use of Dynatech's MRS 2 software makes configuring the router relatively simple. Modifying any control station can be done easily and without any interruption to the operation of the switch. MRS 2 allows the editing of each station's configuration, editing of source and destination tables, copying of setup parameters and the creation and editing of salvos. The software also allows crosspoints to be individually locked out on single stations, groups of stations or all stations. System status display and diagnostics are included, as well. The latter includes the ability to trace take commands down a party line. The MRS software runs on any standard IBM-compatible platform and provides true real-time monitoring of switch activity.

The system's control panels are highly functional, intuitive, easy to operate and require minimal operator training. Several of our operators were trained on the various panels within 20 minutes, and in turn, trained the rest of the staff quickly. Within the first week of operation on the new system, questions regarding the operation of the panels virtually ceased. Control panel features and functionality are configured in software, and modification is relatively uneventful for the end user. Each panel contains a PROM that can be reprogrammed through many commercially available PROM burners, and the MRS 2

package contains all the necessary software.

Some of the most notable results of the project have been the virtual elimination of 60Hz hum and other audio/video artifacts and the elimination of crosstalk between levels. The increases in performance have allowed practical advances, such as using the switch during editing work. Previously, the editing suites could not perform match-frame or pre-read edits without patching around the switcher. The addition of two new audio levels and a time-code level have opened up new opportunities and flexibilities. Most notable, however, is the confidence the staff has developed in the new routing switcher.

Perhaps the biggest disappointment is that the transparency of the new switch has exposed problems in other equipment that had been previously undetected — although this is a balance we can live with. The Dynatech AVS-2 has solved our dilemma for today and has allowed us to keep the door open for tomorrow. ■

Laurence I. Einuis, Jr. is director of operations and engineering and John P. Parker is manager of engineering services at The Christian Broadcasting Network, Inc. (CBN), Virginia Beach, VA.

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

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

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



For more information on the
Dynatech AVS-2, circle (151) on
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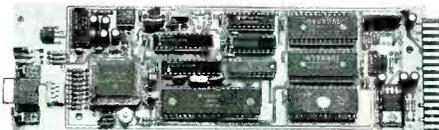


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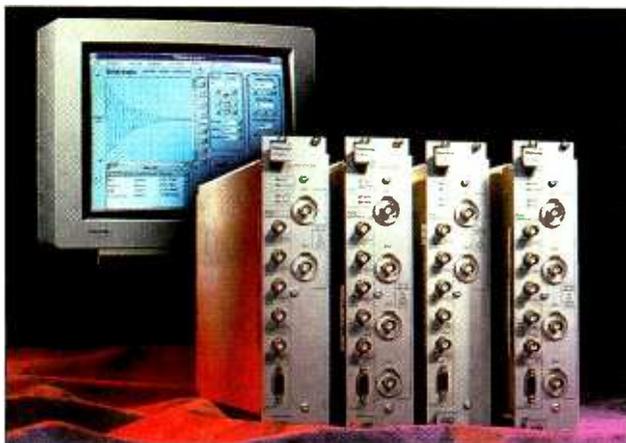
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VXI-based waveform analyzers

Tektronix

• **TVS600 series VXI waveform analyzers:** series of modules that are fully VXI plug-and-play compliant and offer 5GS/s on four channels simultaneously with a 1GHz bandwidth and eight bits of vertical resolution; the TVS621 and TVS641 analyzers are C-size VXI cards with two or four input channels respectively; both modules incorporate a digital real-time signal acquisition engine derived from the TDS 600 benchtop DSOs; both modules have a 250MHz bandwidth, simultaneous 1GS/s sample rate and 15K record length; a full range of signal processing and analysis functions reduce raw data to answers before leaving the card; the instruments' trigger system discriminates on both edge transitions and pulse width and responds to triggers on any of the 10 available backplane trigger lines; fast data channel protocol provides high-speed data transfer to the system controller.

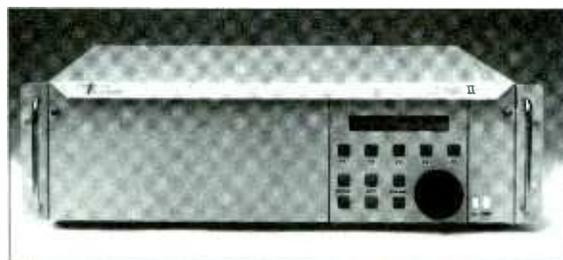
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Cassettes

Ampex Media Corporation

• **472 high-bias IEC Type II cassettes:** analog studio audio cassettes available in 10-, 20-, 30-, 45-, 60- and 90-minute configurations; the cassettes feature dual-coated pure chromium-dioxide IEC Type II tape formulation for improved high-frequency response while maintaining a full low-frequency response; the upgraded shell is made from polycarbonate material for added strength and temperature stability resisting warpage up to 200°; the 5-screw shell incorporates precision guide rollers that improve azimuth tracking and enhance playback fidelity by improving the integrity of the tape-to-head interface reducing intermodulation noise.

Circle (351) on Reply Card



Multiple processing unit

Prime Image

• **Multi-II:** the latest addition to the line of Prime Image digital video equipment that allows the user to mix and match as many as 10 processing capabilities in a single rack-mounted frame; the Multi-II accommodates any combination of time base correctors, frame synchronizers, audio delays, standards converters (including the Penta 5-field memory interpolation system) and logo insertion cards; users can specify the combination of equipment required.

Circle (352) on Reply Card

News production system

Quantel

• **Integrated news production system:** a system based on Quantel's random access disk and dedicated editing technologies that incorporates the Storybox journalist server; the system allows multiple Newsboxes to be networked with a Clipbox server, sharing up to 40 hours of centrally stored, true random-access video and audio; other news operations, such as the Lines Room, VTR resources, transmission suite and archive-tape facility, can be networked with the Clipbox; all users have instant access to all stored material at any time; the Quantel remote control protocol provides integration with news computers from all major news system suppliers.

Circle (354) on Reply Card

High-speed networking

Prisa Networks

• **NetFX family:** a product line of fiber channel adapter cards designed for high-speed movement of digital video data between computer workstations and computer to disk at rates up to 1,062.5Mb/s; NetFX adapters interface to Silicon Graphics' 64-bit GIO bus used by its Indigo2 and Indigo2 IMPACT workstations; both copper and fiber-optic media can be used with NetFX systems; either one or two independent fiber channel ports are available on each card.

Circle (355) on Reply Card

Windows interface for remote transmitter control

Gentner Communications

• **VRC-WIN:** a Windows interface for the Gentner VRC-2000 remote-control unit for broadcast transmitters; a VRC-1000 equipped



with VRC-2000 firmware can also be used with the new software; all VRC operations previously available in the DOS-based program SETUPVRC can be accomplished with VRC-WIN including logging, time of day, mute, clock, terminal mode and

setup functions; users can dial and connect to any of six sites by clicking on the desired SITE icon; users can obtain metering readings with both analog and numeric displays.

Circle (353) on Reply Card

Is COFDM dead *only* in the U.S.?

David Wood of the European Broadcasting Union (EBU) reports that Europe is rallying around COFDM. The European Digital Video Broadcasting (DVB) project will decide on the specific carrier rate (IFFT) for the European version of COFDM. DVB will likely choose a "dual-mode" standard.

There is now a COFDM project in Japan that is funded for \$30 million over four years, while employing 75 people to develop modems. The venture is called "Advanced Digital Television Broadcasting Laboratory." The group has decided to develop a COFDM modem in 6MHz. The group is funded by the Japanese administration (75%), as well as by a number of industry and broadcasting organizations, including NHK and Sony.

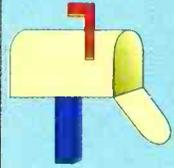
Scandinavia is pushing the "DIVINE" version of COFDM, while Australia and New Zealand are investigating COFDM within their channel assignment plan. China and South America are also considering COFDM.

In Ottawa, Canada, the Terrestrial Advanced Television transmission tests using the COFDM-6MHz modem were successfully demonstrated. The modem was used to demonstrate its performance under the conditions of an over-the-air channel, VHF Channel 11 (198-204MHz). The United States is the only country that is considering an 8-VSB system.

Was COFDM given a fair chance?

The CEG was successful in identifying the weaknesses of the prototype modem. The choice of a digital TV terrestrial broadcasting modulation standard requires broader evaluation. The positive factors of the COFDM technology were not emphasized in the CEG's report nor in its decision, especially the measurements that confirmed the capability of handling the α dB echoes within the guard interval. Because of this feature — the multipath handling capability — broadcasters the world over perceive that the COFDM technology has an advantage over other modulation technologies. Maybe broadcasters would like to see COFDM considered in totality — fully developed and tested — before a final decision is made for a TV broadcasting standard that can potentially affect so many for so long. ■

Louis Libin is a member of the COFDM-LLC Technical Committee and director of technology for NBC, New York, NY.



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BUSINESS

Hitachi, Woodbury, NY, has announced the sale of eight of its SK-2000PW digital cameras and its digital triax to **Maryland Public Television** to upgrade three of the production center's studios. The new equipment enables the studio to switch between 4x3 and 16x9 aspect ratios.

Panasonic Broadcast & Television Systems Company (PBTSC), Secaucus, NJ, announced the fall release of three new products during World Media Expo: the AJ-D700 DVCPRO camcorder, the AJ-D750 DVCPRO studio editing VTR and the AGEZ1 DVCam.

Sony, Park Ridge, NJ, has sold its 10,000th Digital Betacam videotape recorder. In commemoration of the sale, Sony has presented **Cable News Network International (CNNI)** with a Digital Betacam videotape recorder featuring a special "10,000th" logo and a 10,000-hour warranty.

Also, Sony Systems Integration has developed Starfleet, a truck-based product line that features state-of-the-art Sony technology, including a DVS-7000 digital switcher, Digital Betacam VTRs and up to 16 BVP-700 and BVP-750 cameras. **Fox Sports** launched its NFL season with an all-digital outdoor broadcast (OB) truck from the new line.

Sony has announced the purchase of more than two million dollars worth of its digital equipment by Post-Newsweek station **KPRC-TV**. The purchase includes 11 DVW-A500s, five DVW-A510s and one DVW-A501 Digital Betacam VTR, an LMS and a Flexicart system to go along with 13 BVW-300A portable Betacam SP camcorders.

Editing Technologies Corporation (ETC), Moorpark, CA, has sold three Ensemble Gold multilinear editing systems to **Tribune Interactive Network Services (TINS)**. The implementation of non-linear and multilinear editing will allow TINS the flexibility necessary to control the variety of machines and devices in its new local delivery systems.

Harris Corporation's Broadcast Division, Quincy, IL, has announced a 5-year warranty for its Platinum Series 10kW through 60kW and Platinum Series HT EL 500W through 10kW VHF transmitters.

Also, the company's DSE 1400/DSR 1400 digital satellite exciter/studio-grade receiver has been made DVB interoperable. This feature allows the unit to interoperate with a variety of DVB integrated receiver decoders (IRDs).

In addition, Harris has added a Hi Cam option to its line of mobile ENG systems. The Hi Cam feature includes a remotely controlled, single-chip CCD color camera attached to the vehicle's 42-, 52- or 58-foot antenna mast.

Pesa Switching Systems, Huntsville, AL, has moved to 330A Wynn Dr., Huntsville, AL 35805. The new telephone numbers are: main facility 205-726-9200; sales NY 800-328-1008; customer service 205-726-9222. New fax numbers are: main facility 205-726-9271 and customer service 205-726-9268.

Accu-Weather, State College, PA, has announced the sale of its UltraGraphix-32 Weather System to **WTOG-TV**, St. Petersburg, FL, and **WPTA-TV**, Fort Wayne, IN. Since its introduction at last April's NAB convention in Las Vegas, nine TV stations have bought Accu-Weather systems.

Thomson Broadcast Systems, France, and its parent company, **THOMSON Multimedia**, have been awarded two major contracts in succession, with **France Telecom** and **Galaxy**.

The contracts are to supply professional equipment and consumer decoders for digital broadcasting by satellite using the MPEG-2 standard.

Solid State Logic (SSL), UK, has sold an Axiom digital production system to TV network **ABC** for use at its New York production headquarters. ABC will install the specially configured Axiom with 24 mono and 24 stereo channels, together with a 48-track DiskTrack recorder/editor.

Also from SSL, the **BBC's** new Digital Sound Vehicle features Axiom. The mobile made its first public appearance at the ITS convention in Montreux, Switzerland.

The Axiom made its Hollywood debut when it was presented to Hollywood's film community at a series of 'one-on-one' demonstrations.

Dielectric Communications, Raymond, ME, has received an order for four antenna systems from **LIN Television Corporation**.

The company will design and supply antennas and transmission line components to VHF TV stations **WTNH** Channel 8, New Haven, CT, and **WAVY** Channel 10, Portsmouth, VA, as well as equipment for two other UHF stations.

Mobile Teleproductions International, Inc. (MTI), Orlando, FL, has taken delivery of a new 22-foot mobile production unit. The

truck is equipped with three **Ikegami** HL-43BT video cameras, a **Grass Valley** 300 switcher, a CMX 3600, a dual-channel **Chyron** 4200, a **Pinnacle** Prizm DVE, multiformat VTRs and a 24-channel audio console.

Euphonix Inc., Palo Alto, CA, has filed a registration statement with the Securities and Exchange Commission for a proposed initial public offering of 1,875,000 shares of its Common Stock. Of the offered shares, 1,250,000 will be newly issued Common Stock and 625,000 will be sold by existing shareholders of the company. The offering price is expected to be between \$8 and \$9 per share and is being made through **Unterberg Harris and Piper Jaffray, Inc.**

Zoran Corporation, Santa Clara, CA, and the **Goldtron Group**, Singapore, have formed **Oren Semiconductor Ltd.**, a joint venture company focused on the design, manufacture and marketing of ghost canceler integrated circuits (ICs) for the worldwide consumer TV market.

Oren Semiconductor will address the problem of multiple images on TV screens caused by the reflection of TV signals off large buildings or mountains. The company's ghost canceler ICs will be designed into consumer televisions, VCRs, cable decoders and TV set-top boxes.

PEOPLE

Mike Donovan has been named director of engineering for Home & Garden Television and Cinetel Studios, Knoxville, TN.

Glen Green has been named Southwest regional sales manager and general manager, Southwest operations for Quantel, Darien, CT.

William (Bill) W. Weston has been appointed as federal sales manager for PESA Switching Systems, Huntsville, AL. Also, **Elise Hudson Taylor** has been named marketing communications specialist.

Douglas Leighton has been appointed director of marketing for ASC Audio Video Corporation, Burbank, CA.

Chester A. Massari has been named vice president-general manager of the Quincy, IL, broadcast division of Harris Corporation, Melbourne, FL.

Gina Ward has been named an associate of the Benjamin Group Inc., Irvine, CA.

Steve Roach has been named product marketing manager of Sierra Design Labs, Incline Village, NV. ■



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- Quick start 1.5" viewfinder with 550 lines of resolution plus Zebra pattern video level indicator and color bar generator. Also, quick-start recording - takes only 0.5 seconds to go from REC PAUSE to REC MODE for immediate recording in the field.
- Built-in 8mm Time Code generator records absolute addresses. (Either non-drop frame or drop frame mode may be selected.) Furthermore the EVW-300 incorporates a variety of time code features such as Time Code PRESET/RESET, REC RUN/FREE RUN and User Bits.
- A variety of automatic adjustment functions for different lighting conditions are incorporated into the EVW-300.
 - ATW (Auto Trace White Balance) - when ATW is turned on optimum white balance is always ensured during recording, even for changes in color temperature. Conventional white balance adjustment is still provided with the Auto White Balance.
 - AGC (Automatic Gain Control) - in addition to manual Gain Up AGC provides linear gain up in the range of 0 dB to 18 dB.
 - Intelligent Auto Iris - for situations where the lighting between subject and background is different (subject is underexposed) the Intelligent Auto Iris automatically examines the scene and adjusts the lens iris for proper exposure
- Selectable Gain-up from 1 dB to 18 dB in 1 dB steps for Mid and High positions
- Clear Scan function - provides a variety of selection of shutter speeds ranging from 60-200 Hz allowing recording of almost any computer display without flicker.
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- LO-LUX mode allows shooting scenes that were previously impossible due to insufficient lighting. CCDs are maximized for low light sensitivity equivalent to an electronic gain of 24dB plus a JVC pixel readout system which provides an additional 6dB. Together they provide +30dB without the noise and picture degradation normally associated with this much gain. Excellent color balance is maintained even down to 1.5 lux illumination.
- Auto Shooting Mode where you only have to zoom, focus and record. All other parameters are controlled automatically.
- Enhanced ALC (Automatic Level Control) mode for continuous shooting in all light levels. This allows continuous automatic shooting from dark interiors to bright outdoors. Also features an aperture priority mode. Manually set iris for desired depth of focus, and ALC circuit automatically achieves correct video level.
- The Multi-Zone Iris Weighting system gives preference to objects in the center and lower portions of the picture. The Automatic Peak/Average Detection (APB) provides intelligence to ignore unusual objects such as bright lights.
- Auto knee circuitry extends a scene's light to dark dynamic range reproduction by up to five times without overexposure.
- Has large 1.5-inch viewfinder with 500 lines of resolution and EMPTC color bars. Status system provides audio levels, accumulated or remaining recording time and VTR operation. Also battery voltage and camera setup. Zebra pattern indication and safety zones with a center marker are also provided.
- Equipped with Variable Scan function. This allows flicker-free shooting of computer screens. Variable scan enables a precise shutter speed from 1/60.2 to 1/196.7 of a second in 256 increments to be set, matching a computer's scan rate. Almost any computer display can be clearly recorded.
- Star filter creates dramatic 4-point star effects. Users can also select from a wide range of optional filters.
- Advanced Memory System (AMS) stores customizable settings for various shooting conditions.
- Docks directly to the JVC BR-S422U, BR-S411UB and BR-S423CU professional S-VHS recorders. Optional adapters for docking to Hi-8 and Betacam SP are also available.



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 - Dual purpose rear pouch is an expandable battery chamber or all-purpose pocket.

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- **DIGITAL PRO PAC 13 LOGIC SERIES NICAD BATTERY** 13.2v 55 Watt Hours. 4 3/4 lbs. Run time: 2 hours @ 25 watts, 3 hours @ 17 watts

DIGITAL COMPAC MAGNUM

Extremely small and light weight (almost half the size and weight of a Pro Pac), the powerful Digital Compac Magnum still has more effective energy than two NP style slide-in batteries. The high voltage design and Logic Series technology eliminate all the problems that cripple conventional 12 volt slide-in type batteries. The Digital Compac Magnum is the professional choice for applications drawing less than 24 watts. Not recommended when using an Ultralight.

- **DIGITAL COMPAC MAGNUM 14 LOGIC SERIES NICAD BATTERY** 14.4 v 43 Watt Hours. 2 3/4 lbs. Run time: 2 hours @ 20 watts, 3 hours @ 13 watts.
- **DIGITAL COMPAC MAGNUM 13 LOGIC SERIES NICAD BATTERY** 13.2v 40 Watt Hours. 2 1/2 lbs. Run time: 2 hours @ 18 watts, 3 hours @ 12 watts.

GOLD MOUNT BATTERIES

The Logic Series Gold Mount batteries are virtually identical to their respective DIGITAL versions (above) with respect to size, weight, capacity, IMPAC case construction, and application. They are similarly equipped with micro-code logic circuits and comprehensive ACS sensors that communicate directly with all Logic Series chargers, providing the essential data critical for optimum performance, reliability and long life. They do not, however, include DIGITAL microprocessor features such as the integral diagnostic program "Fuel Computer", LCD/LED display and InterActive viewfinder fuel gauge circuit.

- **PRO PAC 14 NICAD BATTERY** (14.4v 60 Watt Hours)
- **PRO PAC 13 NICAD BATTERY** (13.2 v 55 Watt Hours)
- **MAGNUM 14 NICAD BATTERY** (14.4v 72 Watt Hours)
- **MAGNUM 13 NICAD BATTERY** (13.2 v 66 Watt Hours)
- **COMPAC MAGNUM 14 NICAD BATTERY** (14.4v 43 Wh)
- **COMPAC MAGNUM 13 NICAD BATTERY** (13.2v 40 Wh)

MP-4D DIGITAL FAST CHARGER w/LCD and DIAGNOSTIC PORT

The most advanced and versatile Anton/Bauer charge in addition to features such as four-position one-hour sequencing fast charge, five fast charge termination systems, it also has:

- SSP (Selective Sequence Programming) which automatically arranges the charging order among the 4 batteries to assure fully charged batteries in the shortest time possible.
- Multifunction LCD checks each of the four battery positions and indicates charge status, available capacity, battery type/rating, percent of maximum charge, battery serial number, date of manufacture, accumulated charge/discharge cycles and other data.

Vinten



Vision SD 12 and SD 22

Pan and Tilt Heads with Serial Drag

The Vision SD 12 and SD 22 are the first heads with the "Serial Drag" pan and tilt system. The system consists of a unique, permanently-sealed fluid drag and an advanced lubricated friction drag. So for the first time, one head gives you all the advantages of both fluid (viscous) and lubricated (LF) drag systems - and none of their disadvantages. Achieve the smoothest pans and tilts regardless of speed, drag setting and ambient temperature. The Serial Drag system provides the widest range of infinitely variable precise settings with repeatable, consistent drag in each pan and tilt direction.

- Features:**
- Simple, easy-to-use external control for perfect balance.
 - Patented spring-assisted counter-balance system permits perfect "hands-off" camera balance over full 180° of tilt.
 - Instant drag system breakaway and recovery overcome inertia and friction for excellent "whip pans".
 - Consistent drag levels in both pan and tilt axis.
 - Redesigned flick on, flick off pan and tilt caliper disc brakes
 - Greater control, precision, flexibility and "touch" than any other head on the market.
 - Touch activated, time delayed illuminated level bubble.
 - Environmental working conditions from as low as -40° to as high as +60°C.
 - SD 12 weighs 6.6 lbs and supports up to 35 lbs.
 - SD 22 weighs 12.7 lbs and supports up to 55 lbs.

Vision Two Stage ENG and LT Carbon Fibre ENG Tripods

The ultimate in lightweight and innovative tripods, they are available with durable tubular alloy (Model #3513) or the stronger and lighter, axially and spirally wound carbon fiber construction (Model #3523). They each incorporate the new torque safe clamps to provide fast, safe and self-adjusting leg clamps that never let you down. Two stage operation gives them more flexibility when in use as well as greater operating range.

- "Torque Safe" requires no adjustment. Its unique design adjusts itself as and when required, eliminating the need for manual adjustment and maintenance and making for a much more reliable clamping system.
- New hip joint eliminates play and adds rigidity.
- They both feature 100mm levelling bowl, fold down to a compact 28", and support 45 lbs.
- The #3513 weighs 6.5 lbs and the #3523 CF (Carbon Fibre) weighs 5.2 lbs.

Vision 12 Systems

All Vision 12 systems include #33643 SD 12 dual fluid and lubricated friction drag pan/tilt head, single telescoping pan bar and clamp with 100mm ball base.

SD-12A System

- 3364-3 SD-12 Pan and tilt head
- 3518-3 Single stage ENG tripod with 100mm bowl
- 3363-3 Lightweight calibrated floor spreader

SD-12D System

- 3364-3 SD-12 Pan and tilt head
- 3513-3 Two-stage ENG tripod with 100mm bowl
- 3314-3 Heavy-duty calibrated floor spreader

SD-12LT System

- 3364-3 SD-12 Pan and tilt head
- 3523-3 Two-stage carbon fibre ENG tripod w/100mm bowl
- 3363-3 Lightweight calibrated floor spreader
- 3425-3 Carry strap
- 3340-3 Soft case

Vision 22 Systems

All Vision 22 systems include #3386-3 SD-22 dual fluid and lubricated friction drag pan and tilt head, single telescoping pan bar and clamp with dual 100mm/150mm ball base.

SD-22E System

- 3386-3 SD-22 Pan and tilt head
- 3219-52 Second telescoping pan bar and clamp
- 3516-3 Two-stage EFP tripod with 150mm bowl
- 3314-3 Heavy-duty calibrated floor spreader

SD-22 LT System

- 3386-3 SD-22 Pan and tilt head
- 3219-52 Second telescoping pan bar and clamp
- 3523-3 Two-stage carbon fibre EFP tripod w/100mm bowl
- 3314-3 Heavy-duty calibrated floor spreader
- 3425-3 Carry strap
- 3341-3 Soft case

SD-22 ELT System

- 3386-3 SD-22 Pan and tilt head
- 3219-52 Second telescoping pan bar and clamp
- 3383-3 Two-stage carbon fibre EFP tripod w/150mm bowl
- 3314-3 Heavy-duty calibrated floor spreader

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TASCAM DA-88 Multi-Track Recorder



The first thing you notice about the eight channel DA-88 is the size of the cassette - it's a small Hi-8mm video cassette. You'll also notice the recording time - up to 120 minutes. These are just two of the advantages of the DA-88's innovative use of 8mm technology.

- Intrinsic to the 8mm video format is the Automatic Track Finding (ATF) control system. This approach records the tracking control information, along with the program material, using the helical scan (video) head. Competing S-VHS based system record the tracking data with a linear recording head, independent of the program data. The S-VHS tape must be run at a higher speed (thereby delivering shorter recording time) to deliver control track reliability, and requires some form of automatic or manual tracking adjustment. Synchronization and tracking must be adjusted, either automatically or manually (just like on your home VCR) as the machine ages, or if the tape is played back on another machine.
- On the other hand, the ATF system ensures that there will be no tracking errors or loss of synchronization. The DA-88 doesn't even have (or need) a tracking adjustment. All eight tracks of audio are perfectly synchronized. What's more, this system guarantees perfect tracking and synchronization between all audio tracks on all cascaded decks - whether you have one deck or sixteen (up to 128 tracks).
- Incoming audio is digitized by the on-board 16-bit D/A at either 44.1 or 48KHz (user selectable). The frequency response is flat from 20Hz to 20KHz while the dynamic range exceeds 92dB. As you would expect from a CD-quality recorder, the wow and flutter is immeasurable.
- One of the best features of the DA-88 is the ability to execute seamless Punch-ins and Punch-outs. This feature offers programmable digital crossfades, as well as the ability to insert new material accurately into tight spots. You can even delay individual tracks, whether you want to generate special effects or compensate for poor timing. All of this can be performed easily on a deck that is simple and intuitive to use.

OPTIONS

- RC-808 - Single Unit Remote Control
- RC-809 - System Remote Control
- MU-8824 - 24-Channel Meter Unit
- SY-88 - Complete SMPTE/EBU Chase Synchronizing and MIDI Machine Control interface



RD-8 Multi-Track Recorder



This digital multitrack recorder is designed specifically for the audio professional. Fostex has long been a leader in synchronization, and the RD-8 is no exception. With its built-in SMPTE/EBU reader/generator, the RD-8 can strip, read and jam sync time code - even convert to MIDI time code. In a sync environment the RD-8 can be either Master or Slave. In a MIDI environment it will integrate seamlessly into the most complex project studio, allowing you complete transport control from within your MMC (MIDI Machine Control) compatible sequencer.

- Full transport control is available via the unit's industry-standard RS-422 port, providing full control from your video bay. The RD-8 records at either 44.1 or 48KHz and will perform Pull-Up and Pull-Down functions for film/video transfers. The Track Slip feature helps maintain perfect sound-to-picture sync and the 8-Channel Optical Digital Interface keeps you in the digital domain.
- All of this contributes to the superb sound quality of the RD-8. The audio itself is processed by 16-bit digital-to-analog (D/A) converters at either 44.1 or 48KHz (user selectable) sampling rates, with 64x oversampling. Playback is accomplished with 18 bit digital-to-analog (D/A) and 64x oversampling, thus delivering CD-quality audio.
- The S-VHS transport on the RD-8 was selected because of its proven reliability, rugged construction and superb tape handling capabilities. Eight tracks on S-VHS tape allow much wider track widths than is possible on other digital tape recording formats.
- With its LCD and 10-digit display panel, the RD-8 is remarkably easy to control. You can readily access 100 locate points, and cross-tape time is fully controllable in machine to machine editing. Table of Contents data can be recorded on tape. When the next session begins, whether on your RD-8 or another, you just load the set up information from your tape and begin working. Since the RD-8 is fully ADAT compliant, your machine can play tapes made on other compatible machines, and can be controlled by other manufacturers ADAT controllers. Your tapes will also be playable on any other ADAT deck.
- In addition to familiar transport controls, there are a number of logical, user friendly features. This is the only unit in its class with an on-board, back-lit variable contrast LCD display. It provides all of the information you'll need to keep track of offsets, punch points, generator functions and other pertinent data. Three function keys, combined with HOME, NEXT and UP/DOWN buttons, enable you to navigate the edit menu effortlessly. If you need to have access to the front panel controls, the optional model 8312 remote control gives you remote command of the most common functions.



RF SERIES CONDENSER MICROPHONES

Unlike traditional condenser microphones, the capacitive transducer in Sennheiser condenser microphones is part of a tuned RF-discriminator circuit. Its output is a relatively low impedance audio signal which allows further processing by conventional bi-polar low noise solid state circuits. Sennheiser microphones achieve a balanced floating output without the need for audio transformers, and insures a fast, distortion-free response to audio transients over an extended frequency range. The RF-design yields exceptionally low noise levels and is virtually immune to humidity and moisture. The comparatively low RF-voltage across the elements of the transducer also eliminates arcing and DC-bias creeping currents. Sennheiser employs RF-technology to control residual microphone noise. Optimizing the transducer's acoustic impedance results in a further improvement in low noise performance. Sennheiser studio condenser microphones operating according to this RF-principle have proven their superior ruggedness and reliability in the past decades under every conceivable environmental condition.

MKH 20 P48U3 Omnidirectional

Low distortion push-pull element, transformerless RF condenser, flat frequency response, diffuse/near-field response switch (6 dB boost at 10 KHz), switchable 10 dB pad to prevent over-modulation. Handles 142 dB SPL. High output level. Ideal for concert, Mid-Side (M-S), acoustic strings, brass and wind instrument recording.

MKH 40 P48U3 Cardioid

Highly versatile, low distortion push-pull element, transformerless RF condenser, high output level, transparent response, switchable proximity equalization (-4 dB at 50 Hz) and pre-attenuation of 10 dB to prevent over-modulation. In vocal applications excellent results have been achieved with the use of a pop screen. Recommended for most situations, including digital recording, overdubbing vocals, percussive sound, acoustic guitars, piano, brass and string instruments, Mid-Side (M-S) stereo, and conventional X-Y stereo.

MKH 60 P48U3 (Short Shotgun)

Short interference tube RF condenser, lightweight metal alloy, transformerless, low noise, symmetrical capsule design, smooth off-axis frequency response, switchable low cut filter (-5 dB at 100 Hz), high frequency boost (+5 dB at 10 KHz) and 10 dB attenuation. Handles extremely high SPL (135 dB). Ideal for broadcasting, film, video, sports recording, interviewing in crowded or noisy environments. Excellent for studio voiceovers.



MKH 70 P48U3 (Shotgun)

Extremely lightweight RF condenser, rugged, long shotgun, low distortion push-pull element, transformerless, low noise, switchable presence (+5 dB at 10 KHz), low cut filter (-5 dB at 50 Hz), and 10 dB preattenuation. Handles 133 dB SPL with excellent sensitivity and high output level. Ideal for video/film studios, theater, sporting events, and nature recordings.

MKH 416 P48U3 Supercardioid/Lobe (Shotgun)

Transformerless, RF condenser designed as a combination of pressure gradient and interference tube microphones. Very good feedback rejection, low proximity effect, 128 dB SPL rugged and resistant to changing climate conditions. Ideal for boom, lishpole, and camera mountings. A long-distance microphone for video, film, and studio recording. Excellent for interviewing for reporters, podium or lecture microphone.

MKH 816 P48U3 Ultra-directional Lobe (Shotgun)

Narrow-beam pattern, transformerless RF condenser microphone. Handles 124 dB SPL and has high output voltage. Perfect for crowded news conference, movie sets, TV stages, sporting events and nature recording.



FP32A PORTABLE STEREO MIXER

This small and rugged portable mixer is well equipped to handle the demands of EFP, ENG, live music recording or any other situation that requires a low noise high performance mixer.

- High quality-low noise electronics, perfect for digital recording and transmission
- Three balanced inputs, two balanced outputs plus tape out and monitor
- Supports all types of condenser mics with internal phantom supply
- Inputs can be switched between mic and line level
- Each channel has own pan pot
- Each channel has illuminated meter and peak indicator
- Two units can be cascaded to provide six input channels
- Internal 1KHz oscillator for record and send level calibration
- Internal (2x9V alkaline batteries) or external power
- Switchable low cut filters



MicroSeries 1202 12-Channel Ultra-Compact Mic/Line Mixer

Usually the performance and durability of smaller mixers drops in direct proportion to their price, making lower cost models unacceptable for serious recording and sound reinforcement. Fortunately, Mackie's fanatical approach to pro sound engineering has resulted in the MicroSeries 1202, an affordable small mixer with studio specifications and rugged construction. The MicroSeries 1202 is a no-compromise, professional quality ultra-compact mixer designed for non-stop 24-hour-a-day professional duty in broadcast studios, permanent PA applications and editing suites where nothing must ever go wrong. No matter what your application, the MicroSeries 1202 is ideal. If price is the prime consideration or you simply want the best possible mixer in the least amount of space, there is only one choice.

CR-1604

16-Channel Audio Mixer

In less than three years, the Mackie CR-1604 has become the industry standard for compact 16-channel mixers. It is the hands-down choice for major touring groups and studio session players, as well as for broadcast, sound contracting and recording studio users. For them the CR-1604 offers features, specs, and day-in/day-out reliability that rival far larger boards. Its remarkable features include 24 usable line inputs with special headroom/ultra-low noise UniTulipus circuitry, seven AUx send/returns, 3-band equalization, constant power pan controls, 10-segment LED output metering, discrete front end phantom-powered mic inputs and much more.



M-2600 Series 16/24/32 Channel Eight Channel Mixers



LOW NOISE CIRCUITRY

- Combining completely redesigned, low noise circuitry with Absolute Sound Transparency™ the M-2600 delivers high-quality extremely clean sound. No matter how many times your signal goes through the M-2600, it won't be colored or altered. The signal remains as close to the original as possible. The only coloring you hear is what you add with creative EQ and your outboard signal processing gear.
- Double reinforced grounding system eliminates any hum.
- World-class power supply provides higher voltage output for better headroom and higher S/N ratio.

THE BEST AUX SECTION IN THE BUSINESS

The most versatile AUX section in its class: routing expensive high-end consoles 8 sends total, 2 in stereo. Send signal in stereo or mono, pre- or post-fader. Available all at once. Return signal through any of 6 stereo paths.



PC-CODI TEXT and GRAPHICS GENERATOR

A PC-compatible (ISA bus) board, the PC-CODI incorporates a broadcast quality encoder and wide bandwidth linear keyer to provide highest quality realtime, video character generation and graphics display. Used individually or configured with multiple boards, it is a complete and affordable solution for information displays, broadcast, video production or multi-media applications.

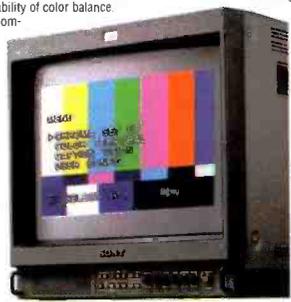
- Standard PC/AT ISA bus interface, 2/3 length form factor
- Fully-antialiased displays
- Less than 10msec. effective pixel resolution
- 16.7 million color selections
- Fast, realtime operations
- Character, Logo and FX (Image transparency)
- Display and not-display buffers
- Bitstream typeface library selection
- Variable edges: border, drop shadow and offset
- Variable flush
- Full position and justify control of character & row
- User definable intercharacter spacing (squeeze & expand)
- Multiple roll/crawl speeds
- Automatic character kerning
- User definable tab/template fields
- Shaded backgrounds of variable sizes and transparency
- User definable read effects playback, wipes, pushes, fades
- High quality composite & S-video (Y/C) encoder
- Integral composite and S-video line keyer
- NTSC or PAL sync generator with genlock
- Module switchable NTSC or PAL operation
- Software controlled video timing
- Board addressability for multi-channel applications
- Auto display sequencing
- Local message/page memory
- Preview output with safe-title/cursor/menu overlay
- Composite & S-video input with auto-genlock select

SONY COLOR MONITORS

PVM-1350

13" Presentation Monitor

- Employs a P-22 phosphor fine pitch CRT to deliver stunning horizontal resolution of 450 horizontal lines.
- Equipped with beam current feedback circuit which eliminates white balance drift for long term stability of color balance.
- Has analog RGB, S-video and two composite video (BNC) inputs as well as 4 audio inputs.
- Automatic Chroma/Phase setup mode facilitates the complex, delicate procedure of monitor adjustment. Using broadcast standard color bars as a reference, this function automatically calibrates chroma and phase.
- Chroma/Phase adjustments can also be easily performed with the monochrome Blue Only display. In Blue Only mode video noise can be precisely evaluated.
- Factory set to broadcast standard 6500K color temperature.
- Provides an on-screen menu to facilitate adjustment/operation on the monitor. The on-screen menu display can be selected in English, French, German, Spanish or Italian.
- On power up, automatic degaussing is performed.
- There is also a manual degauss switch to demagnetize the screen.
- Sub control mode allows fine adjustments to be made on the knob control for contrast, brightness, chroma and phase. The desired level can be set to the click position at the center allowing for multiple monitors to all be controlled at the same reference level.



PVM-1351Q

13" Production Monitor

- Has all the features of the PVM-1350 PLUS - is also a multistandard monitor. It accepts NTSC, PAL and NTSC video signals. NTSC 4.43 can also be reproduced.
- Equipped with a SMPTE 259M Serial Digital Interface. By inserting the optional serial digital interface kit BKM-101C for video and the BKM-102 for audio the PVM-1351Q can accept SMPTE 259M component serial digital signals.
- Equipped with RS-422 serial interface. With optional BKM-103 serial remote control kit all of the monitor's functions can be remotely controlled with greater confidence and precision.
- Equipped with input terminals such as component (Y/R-Y/B-Y), analog RGB, S-video, 2 composite video (BNC) and 4 audio terminals for complete flexibility.
- Aspect ratio is switchable between 4:3 and 16:9 simply by pressing a button.
- Underscan and HV delay capability. With underscan, entire active picture area is displayed. Allows you to view entire image and check the picture edges. HV delay allows viewing of the blanking area and sync/burst timing by displaying the horizontal and vertical intervals in the center of the screen.
- Color temperature switchable between 6500K/9300K/User preset. 6500K is factory preset. 9300K is for a more pleasing picture. User preset is 3200K to 10,000K.

PVM-1354Q/PVM-1954Q 13" and 19" Production Monitors

All the features of the PVM-1351Q PLUS.

- SMPTE C standard phosphor CRT is incorporated in the PVM-1354Q/1954Q. SMPTE C phosphors permit the most critical evaluation of any color subject. Provides over 600 lines of horizontal resolution.
- The PVM-1354Q mounts into a 19-inch EIA standard rack with the optional MB-502B rack mount bracket and SLR-102 slide rail kit same as PVM-1351Q. The PVM-1954Q mounts into a 19-inch EIA rack with the optional SLR-103 slide rail kit.

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HORITA

WG-50 Window Dub Inserter

- Makes burned-in SMPTE TC window dub copies
- Indicates drop-frame or non-drop-frame time code
- Also functions as horizontal and vertical size and position
- Adjustments for "see-thru" mode surrounds display
- Provides real-time code outputs for copying TC
- Displays time code or user bits • Display on/off
- Field 1/field 2 indicator • Sharp characters
- Always frame accurate (on time)

\$269

TG-50 Generator / Inserter

Combination time code generator and window dub inserter. It includes all features of WG-50 PLUS-

- Generates SMPTE time code in drop/non-drop-frame format
- Jamsync mode jams to time code input and outputs new TC
- Simple "on screen" preset of time code and user bits
- Run/stop operation using front panel momentary switch
- Selectable 30/60/90/120-second automatic generator back-time
- Make a window dub copy while recording TC on source tape

\$349

BSG-50 Blackburst/Sync/Tone Generator

- The BSG-50 provides an economical means for generating the most common RS-170A video timing signals used to operate various video switchers, effects generators, TBCs, VCRs, cameras and video edit controllers.
- 6 BNC video/pulse outputs
- Now available: 6 blackburst, 4 sync, 2 subcarrier
- Each sync output individually settable for composite sync, composite blanking, H-drive, or V-drive
- Separate buffer for each output—maximum signal isolation
- 1KHz, 0dB sinewave audio tone output, locked to video
- Outputs can easily be configured to meet specific user and equipment needs

\$269



CSG-50 Color Bar/Sync/Tone Generator

- Generates full/SMPTE color bars, blackburst and composite sync signals
- Built-in timer can automatically switch video output from color bars to color black after 30 or 60 seconds. Easy and convenient for producing tape leaders and stripping tapes with color bars and black.
- Front panel selection of full-field or SMPTE color bar patterns or colorblack (blackburst) video output.
- Includes crystal-controlled, 1KHz, 0dB audio tone output.
- Outputs: video, sync, ref frame, 1KHz, 0dB
- Audio tone switches to silence and color bars change to black when using 30/60 second timer
- Fully RS-170A SC/H phased and always correct. No adjustment required

\$349

TSG-50 NTSC Test Signal Generator

- The TSG-50 generates 12 video test signals suitable for setting up, aligning, and evaluating the performance of various video equipment found in a typical video editing system, such as video monitors, distribution amplifiers, VCRs, switchers, effects generators, TBCs, etc. In addition to the video signals, the TSG-50 also generates composite sync and, with a video DA such as the Horita VDA-50, a time code generator.
- Fully RS-170A SC/H phased and always correct. No adjustments ever required
- Built-in timer automatically switches video output from color bar pattern to black after 30 or 60 seconds. Makes it easy to produce tape leaders of color bars followed by black.
- Video signals generated are in accordance with industry standard EIA RS-170A video timing specification.
- Audio tone switches to silence and color bars change to black when using 30/60 second timer
- Convenient pattern selection - 12 position front panel switch
- Includes crystal controlled, 1KHz, 0dB audio tone output
- Generates precise oscilloscope trigger output signal one H line before start of color field 1.
- Outputs: video, sync, ref frame, 1KHz, 0dB

\$439

WE STOCK THE FULL LINE OF HORITA PRODUCTS INCLUDING:

- WG-50 - Window Dub Inserter
- TG-50 - Generator/Inserter
- TRQ-50 - Generator/Inserter/Search Speed Reader
- TRQ-50PC - Has all of the above plus RS-232 control
- VG-50 - VITC Generator, LTC-VITC Translator
- VLT-50 - VITC-To-LTC Translator
- VLT-50PC - VITC-To-LTC Translator / RS-232 Control
- RLT-50 - Hi8 (EVO-9800/9850) TC to LTC translator
- TSG-50 - NTSC Test Signal Generator
- BCS-50 - Serial Control Tiller "Industrial" CG, Time-Data Stamp, Time Code Captioning
- SAQ-50 - Sale Area, Convergence Pattern and Oscilloscope Line Trigger and Generator

SONY

SVP-5600 and SVO-5800 S-VHS Player / S-VHS Editing Recorder

SVP-5600 and SVO-5800 features:

- By combining the high resolution (400 horizontal lines) of S-VHS with high quality signal processing techniques like DNR, Digital Field DDC and Chroma Process improvement, they deliver the consistent picture quality so essential to editing. They also incorporate a wide video head gap and track width (58mm) for stable and faithful picture reproduction.
- Each has a built-in TBC plus an advanced Digital Noise Reducer (DNR) for both the chrominance and luminance signals to eliminate noise during playback. At the same time, a field memory incorporated in the noise reducer removes jitter to provide sharp, stable pictures. The field memory, also includes a Digital Field DDC (Dropout Compensator), which replaces signal dropout with information from the previous field.
- They also incorporate Chroma Process Improvement circuitry for excellent color picture quality in the playback mode. This advanced circuitry greatly improves the chroma bandwidth, thus enabling sharper and clearer color picture reproduction.



ADVANCED EDITING FUNCTIONS

- For frame accurate editing, both machines employ a sophisticated servo system, an improved quick response mechanism and built-in LTC/VITC time code capability. This makes them ideal for animation and computer graphic recording, where a frame-by-frame editing function is indispensable.
- They are equipped with industry standard RS-422 9-pin serial interface. The 9-pin connector carries edit commands and time code data between the VCR and the edit controller.
- When connected to an RS-422 equipped edit controller, the SVO-5800 functions as an editing recorder. It performs assemble and insert functions and also provided audio split editing capability of normal audio tracks 1 and 2. In the insert mode, video, audio and time code can be inserted independently, or in any combination.

- They each incorporate four-channels of high quality video. There are two channels with Hi-Fi (AFM) tracks and two with longitudinal (normal) tracks. The Hi-Fi tracks provide a wide frequency response from 20Hz to 20kHz and a superb dynamic range of 90db. The normal tracks incorporate Dolby B noise reduction for high quality sound reproduction. XLR connectors are used for the inputs and outputs for all four channels.

MULTIPLE INPUTS & OUTPUTS

- Both machines employ composite and S-Video connectors. With optional SVBK-170 Component Output Board, they provide component signal output through BNC connectors. With the board, the VCRs can be integrated into Betacam SP editing systems.

USER FRIENDLY OPERATION

- Built-in character generator which superimposes characters on the "video monitor output" signal. This allows time code data, control track, menu setup and VCR function status to be shown on a monitor.
- For more efficient operation they have an on-screen setup menu which allows a variety of customized VCR mode operations. Programmed in the form of a layer structure, you simply go through the menu and initialize VCR operation.
- All parameters of the TBC, such as luminance level, chroma level, setup, hue, Y/C delay, sync phase and SC phase are easily controlled from the front panel, and can be remotely controlled from the optional UVR-60 TBC Remote Control. The UVR-60 also accesses field freeze function in the still mode and allows on/off control of the chroma and luminance noise reducer.
- Quick and smooth picture search can be performed by either using an RS-422 equipped edit controller or the optional SVRM-100 Remote Control Unit. Recognizable color pictures are provided at up to 10x normal speed in forward or reverse.

FXE-100 ALL-IN-ONE VIDEO EDITING SYSTEM

The new FXE-100 is an A/B roll editing system designed for quicker, easier video editing, and is well-suited for today's professional audio/visual communications. It is at once an edit controller which controls basic VCR functions, a special effects generator which cuts, mixes, wipes and composites the video sources with stunning effects; and an audio mixer with various fading and switching abilities. There is no longer a need to configure multiple devices for video editing. With either Hi-8 or S-VHS VCRs and the FXE-100, an ideal professional editing system can be easily configured.



- Switchable machine control of three RS-422 equipped VCRs or three RS-232 equipped VCRs. Basic VCR functions, such as play, stop, still, fast forward, rewind and record, are controlled through these interfaces. Variable speed control is also possible for VCRs equipped with Dynamic Tracking.
- Accepts time code, control track (CTL), and 8mm time code as editing references. These can be set separately for each VCR.
- Performs assemble and insert editing (Video, Audio 1, Audio 2). The first EDIT mode, which allows you to record sufficient timecode for synchronization to a new tape is also featured.
- Features a split edit function which allows setting of audio and video in-points separately. This permits you to bring in the audio source before a visual transition.
- Store up to 99 scenes, including effects settings, in memory.
- Edit list data can be saved and downloaded to an IBM-compatible PC, allowing you to review or modify edit data at any time.

- The FXE-100 has two program buses, the A- and B-bus. Each bus provides Player 1, Player 2, Aux inputs and Background Color. Both composite and S-Video signals can be input.
- Taking advantage of the freeze function, two machine editing with effect transitions is realized by freezing the recorder OUT point picture. Also, by selecting the same video source in both A and B bus, wipe or mix in/out of the digital effects is possible without picture transition. This "Self A Roll" function is another feature which allows effective two machine video editing.

SWITCHER AND SPECIAL EFFECTS GENERATOR

- Multiple wipe patterns, including picture scroll and slides, are programmed in. Wipe patterns are easily accessed, and transition rates can be set. Soft edges or a choice of 15 color borders can be added to most wipes and effects.
- Variety of mix effects, such as mosaic mix, black and white mix, postzation mix and picture-in-picture (PIP). Also fade to black and fade to white effects.
- Digital effects, such as mosaic, paint, pixel trail, multi-picture, monochrome, and zoom. Picture freeze function is also featured in frame or field mode.
- Because all the special effects can be set separately to the video sources of each bus, wipes or dissolves of the sources with the digital effects can be executed. It is also possible to combine multiple effects to create stunning images, such as wiping the multi-picture effect with the paint effect and dissolving color corrected picture with mosaic effects.

ADJUSTABLE TRANSITIONS

- Transitions are done using the fade lever, or they can be automatically set. Transition time can be set from 0 to 999 frames. Transition can also be paused and reversed. Other parameters such as GPI timing, pulse selection and pre-roll time can be set.

CHROMA KEYS

- The FXE-100 features chroma and luminance keys to superimpose characters, figures, or video sources onto a background. Clip and gain levels can be adjusted to give clean and sharp key edges. Color correction is done via the joystick for both buses with memory to hold a favorite setting for storage and recall.

WIPE CONTROL

- By moving the location stick, you can move the closed wipe patterns such as square, circle and heart, around the screen. This function also enables you to start the wipe transition from any desired position on the screen.

AUDIO MIXING

- Audio follow-video editing can be performed with the FXE-100. Two channels are assigned to each player VCR's input and one channel for the recorder VCR's input. Two channels of AUX inputs and a MIC input are available for mixing background music with voice-over. All audio input levels can be adjusted separately. Two Program output channels and one monitor channel are provided. A switch for -7.5dB and +4.0 dB is provided for flexibility in choosing input levels for VCRs with either RCA or XLR connectors.

USER FRIENDLY OPERATION

- All keys and buttons are logically grouped by function, and are color coded for quick identification and economy of keystrokes.
- Permits one monitor operation. No need for multiple monitors. Various editing data, such as edit mode and time code address of each VCR, can be monitored on the same screen.

VERSATILE SYSTEM INTEGRATION

- No need to configure multiple devices. By simply connecting three VCRs, a professional video editing system is formed.
- Two frame synchronizers allow perfectly synchronized wipes and dissolves without time base correctors.
- Equipped with two GPIs for control of external devices, such as character generators and audio mixers. Also has a GPI input, allowing it to be controlled from an external edit controller.
- Has four black burst outputs to distribute internally generated sync signal, synchronizing connected devices. There is no need for an external sync generator.

MAGNI

MM-400

- The MM-400 is a combination waveform and vector monitor especially conceived for the cost-conscious producer. A low-cost alternative to CRT-based waveform monitoring the MM-400 produces a video picture of the input signal's waveform and displays it on any video monitor. It provides a simple, affordable and accurate way to set camera levels before a shoot, or to check time base correctors and color fidelity in editing. Problems like hue shift, smearing, muddy contrast and loss of detail are easily identified for correction.

FEATURES:

- Converts waveform or vector display information into a standard video signal which can be displayed on a video monitor or routed around a video facility, no need for additional expensive monitors. Switch between pictures and waveforms at the push of a button.
- Incorporates an advanced SC/H phase and color frame indicator that is a must for editing and post production. At a glance it tells you if a signal's subcarrier-to-horizontal phase is properly adjusted and if the signal's color frame matches the house black burst connected to the MM-400 external reference input.
- Works anywhere and with any analog video format—NTSC, PAL, Component or S-Video. It has automatic detection between NTSC and PAL formats.
- Three loop-through inputs can accept three composite signals or one component, or RGB signal.
- No complex displays or special test signals are required for component video monitoring.
- Interchannel timing and amplitude display make component analog monitoring easy. Has color bar limit markings for Betacam, M-II and SMPTE formats.
- Waveform and vectorscope controls, including channel, sweep speed, position control, phase rotation are on easy-to-see dedicated pushbuttons.
- Besides instant toggling between picture and waveform, a mix mode combines waveform and picture displays for simultaneous viewing.
- The MM-400 can be readily used by even novice operators. It has easy-to-understand set-up menus for display color, interchannel timing, SC/H phase alarm.
- Usable in any video facility of any size for displaying signals, its low cost makes it affordable by the smallest studio, while its features and performance make it ideal for monitoring in high-end facilities as well.

LEADER Model 5850C

Vectorscope

- An 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.

Model 5860C Waveform Monitor

- A two-input waveform monitor, the 5860C features 1H, 1V, 2H, 2V, 1µs/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.

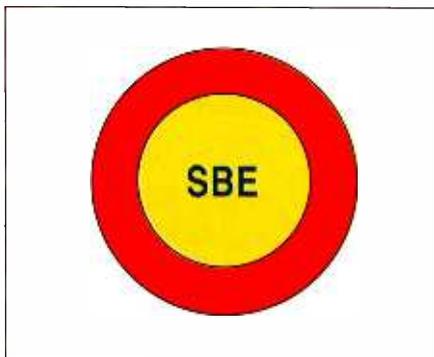
Model 5864A Waveform Monitor

- A fully portable waveform monitor for field use, the Model 5864A is a two-channel unit that provides 2H and 2V sweeps with MAG, FLAT and IRE response, and normal and X4 gain.

Model 5854 Vectorscope

- 2-channel portable vectorscope is ideal for field use and features A and B phase reference, fixed and variable gain. Both units shown with optional battery holder and NP-1 type battery.

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Around 1988 the Federal Aviation Administration (FAA) retained Ohio State University to develop an Airspace Analysis Model (AAM). This model was to predict whether interference from FM broadcast stations would be caused to VHF communications (COM) and instrument landing systems (ILS) receivers used in commercial and private aircraft.

Given the lack of a guardband between the top of the FM broadcast band (88MHz-108MHz) and the VHF aeronautical band (108MHz-137MHz), and the disparities in power (up to 100kW effective radiated power [ERP] for Class C FM stations compared to 50W-200W ERP for VHF avionics stations), this was and is a valid concern.

Unfortunately, the AAM that was developed often overpredicts the amount of interference to COM and ILS stations. As a result, the owners or permittees of even lower-power 6kW Class A FM broadcast stations have had to spend thousands of dollars fighting unreasonable "hazard" determinations by the FAA.

For instance, the AAM might predict interference to virtually all of the 3,300 points used to model an ILS volume (3-D airspace). However, checks with FAA staff at the airport in question would reveal no interference complaints and no actual interference. Experience has shown that the major culprit is the FAA's insistence on programming its AAM to accommodate the worst-performing aircraft radios (insofar as susceptibility to brute-force overload is concerned). This is in spite of the fact that commercial aircraft and the vast majority of private aircraft have avionics packages that are far superior to the "worst-case" radio.

A monkey on broadcasters' backs

The AAM is, in effect, a "monkey" on the backs of FM broadcasters. Although the FAA also applies the AAM to applications filed by TV broadcasters, FAA objections to those applications, when they occur, can generally be solved by the applicant agreeing to provide an additional 10dB-15dB of spurious signal suppression beyond the -60dBc required by the FCC rules.

The FAA apparently doesn't understand that high-powered UHF TV transmitters don't

A new monkey on broadcasters' backs?

generate spurious signals at 108MHz-137MHz. Even if they did, the signal would never propagate up a waveguide transmission line with a cutoff frequency several hundred megahertz above the VHF COM/ILS band. Even if such a spurious signal did reach the transmitting antenna, it would not receive the power gain the antenna imparts to signals within its designated 6MHz frequency range.

It has, therefore, been easy for TV broadcasters to "humor" the FAA and agree to provide additional suppression for a purported interference threat from an alleged spurious signal 300MHz to 600MHz below the station's fundamental frequency.

A similar problem with GPS

It now appears that a similar problem may be developing between TV stations and Global Positioning System (GPS) receivers. The FAA has proposed to replace its existing system of VHF ILS with GPS. This is a change from the prior FAA plan, which was to replace VHF ILS with a microwave landing system

casters should also be given the opportunity to comment on the proposed AAM and its algorithms, and minimum performance standards for GPS receivers to be installed in aircraft should be developed.



It now appears that a similar problem may be developing between TV stations and GPS receivers.

(MLS) using precision approach radars, the method currently favored in Europe.

If aircraft replace their VHF ILS radios with 1,570MHz-1,580MHz GPS receivers, and if the early reports of TV station "interference" to GPS receivers turn out to be chronic, the FAA probably would have no qualms about developing a "GPS AAM," and start issuing hundreds of "hazard" determinations to TV stations wishing to modify their facilities.

Given the present "use it or lose it" FCC policy regarding construction of a second advanced TV (ATV) channel, the number of potential FCC applications that could be "reviewed" by the FAA, even when the applicant proposes to use an existing tower and does not have to directly notify the FAA, is enormous.

Thus, the "ILS monkey," now on the back of any FM station that applies to the FCC for a new or modified FM facility, may land with all the force of King Kong on the backs of TV broadcasters. The time is ripe for the broadcast industry and the FCC to make sure that any "GPS AAM" used by the FAA is (this time) developed in compliance with the Administrative Procedures Act (APA). Broad-

There have been at least three recent articles addressing the issue of TV broadcast station interference to GPS receivers. It is unclear whether the problem is one of an obsolete and too lenient FCC specification for spurious signal suppression by TV transmitters or a problem of brute-force overload to GPS receivers, which may result in TV station harmonics being generated in the GPS receiver's front end. (Under the current FCC rules, TV stations only have to suppress harmonics and out-of-band spurious signals by 60dBc, as opposed to an 80dBc suppression requirement for AM and FM broadcast transmitters.)

However, what is clear is that any GPS avionics package designed for use by aircraft, which may well fly through the main beam of a 5,000kW UHF TV station during a landing approach, needs to have a "brick wall" high-pass filter. This is to ensure that front-end overload by the *authorized fundamental* of a TV broadcast station will never occur. Unlike the FM broadcast/VHF avionics problem, there is almost an octave of separation between even the highest channel UHF TV station and GPS receivers.

Therefore, there should be no excuse for not designing a GPS receiver immune to brute-force overload from the fundamentals of UHF (and VHF and FM) broadcast stations. ■

Dane E. Ericksen is a P.E., CSRE, CSTE and chairman of the SBE FCC Liaison Committee.



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DIRECTOR OF ENGINEERING The Educational Communications Board, partners in the Wisconsin Public Television and Radio Networks, has an opening for a senior management position to administer the Delivery Division. Responsible for the planning, development, and ongoing management of all delivery functions for statewide radio, television, and distance education networks. Successful applicants will have a degree in Electrical Engineering and 5-10 years of professional or managerial experience in broadcast engineering or equivalent. Preference will be given to those with SBE, FCC and related certifications. Salary commensurate with experience. Excellent benefit package. Location: Madison, WI. For application materials contact ECB Personnel at (608) 264-9669. Applications must be returned by Nov. 30.

RF MAINTENANCE ENGINEER Oklahoma PBS affiliate has an opening for a Network Maintenance Engineer. Component level trouble shooting skills required. Ideal candidate will have UHF and VHF translator and transmitter, and a good working knowledge of microwave systems. In state travel required. Comprehensive benefit package. Please send resume with salary history to Personnel, OETA, P.O. Box 14190, Oklahoma City, Oklahoma 73113. EEO.

TV - SATELLITE TECHNICIAN WHYY-TV seeks experienced mobile satellite operator to provide primary, hands-on field supervision and operating support for uplink trucks. Requires valid commercial driver's license. Must be familiar with technology, have outgoing personality, & the ability to travel. Full-time position; excellent benefits. Send resume w/salary requirements to: HR Dept., 150 N. 6th, Phila., PA 19106. EOE M/F.

DIRECTOR OF ENGINEERING Orban, a Harman International company, is a 25 year old San Leandro based company involved with the design, manufacture and marketing of electronic equipment for professional broadcast applications. Orban currently has a director position open in its Engineering Department. The ideal candidate will be responsible for planning, directing and coordinating the research and development of new broadcast, post-production, etc. equipment and systems as well as the improvement of existing equipment and systems from concept through completion. This position will also be responsible for creating and maintaining a system of and environment for open and timely communication between Engineering and other departments and assisting in the formulation of new product and sustaining a product development, technology goals and plan. BSEE or Computer Science degree minimum, Masters preferred with management education. Previous experience with management in research and development activities in design, engineering and personnel is required. Prefer experience in professional broadcast or post-production equipment or systems which utilize digital signal processing, aware of analog audio design, high speed digital systems, ASIC, CAD/CAM and CASE among others. This individual must have demonstrated ability to successfully interface with staff at all levels. Orban offers a competitive benefits package. Send resume and salary requirements to: J. Murray, Orban, 1525 Alvarado Street, San Leandro, CA 94577. EOE.

BROADCAST ENGINEER. NBC affiliate seeking right person for engineer position. Requires a minimum of 5 years experience in television studio and VHF transmitter maintenance, associate degree in electronics or technical school graduate and FCC General Class license. PC and computer related experience a plus. Send resume and salary requirements to: Mike Caruso, Chief Engineer, KTVE-TV, 2909 Kilpatrick Blvd., Monroe, La. 71201. No calls. E.O.E.

BROADCAST ENGINEER: WTXL-TV has an opening for an Assistant Chief Engineer. We are looking for a highly motivated individual with extensive broadcasting and electronics background. Extensive component level troubleshooting skills required as well as the ability to be on call. Send resume to Brad Strommen C.E., 8927 Thomasville Road, Tallahassee, Florida 32312. No calls please. EOE.

KTCA, DIRECTOR OF OPERATIONS Twin Cities Public Television seeks a Director of Operations. Responsible for overall operations and support of all technical facilities including all production, post-production, broadcast and satellite communications, staff and online services, building operations and maintenance and support of all technical services. Primary responsibility is in the overall management of the production processes including resource scheduling. The director has a working relationship with 2 unions and is a facilitator for established teams in the department. Some experience with collective bargaining units and an ability to smile in the face of frustration preferred. Minimum requirements include 10 years experience in a television production environment and 5 years in management. BA/BS or equivalent degree, excellent communications and problem solving skills required. Please send resume and cover letter by October 20, 1995, to KTCA-TV, Box 177-BE, 172 East 4th Street, St. Paul, MN 55101. Equal Opportunity Employer.

MAINTENANCE TECHNICIAN Major market TV station has immediate opening for a VCR maintenance technician. Experience with Sony Betacam equipment is essential. Please send resume to: Classified Ad Coordinator, Broadcast Engineering, Dept. 768, 9800 Metcalf, Overland Park, KS 66212-2215. Equal Opportunity Employer.

ASST. CHIEF ENGINEER/MAINTENANCE SUPERVISOR Audio-Video and VCR repair to component level w/EE or equiv. Seeking good Broadcast electronic and mechanical skills to maintain studio, automated MC, and transmission systems at our new Irvine plant. Send resume to Personnel, KDOC-TV, 18021 Cowan, Irvine, California 92714. EOE.

TELEVISION CHIEF ENGINEER for UHF station needed to help make a difference. Transmitter maintenance, etc. Must have UHF experience, KDOR TV 17, 2120 N. Yellowwood, Broken Arrow, (Tulsa) OK 74012. KDOR TV 17 is an Equal Opportunity Employer.

TV/RADIO/TELEPORT ENGINEERING SUPERVISOR University licensed TV/Radio/Teleport facility is seeking an individual with at least five years of maintenance experience and excellent interpersonal skills to supervise personnel, daily operations, corrective maintenance, and new facility construction. FCC license and/or SBE certification with two or four year related degree preferred. Salary range is \$29,800-\$49,400 with excellent benefit package. Send letter of application, resume, and three letters of reference to: Director of Engineering, WGUV AM/FM/TV, 301 W. Fulton St., Grand Rapids, MI 49504-6492. Review of applications will begin immediately and position will remain open until filled. EEO/AA/ADA.

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Interested candidates should forward their resume with salary history to: **ITS CORPORATION, HR Department, 375 Valley Brook Road, McMurray, PA 15317, FAX: (412) 941-4603** EOE

VIDEO ENGINEERS

Rank Video Services America, the leader in home video duplication is looking for video engineers to staff our new state of the art duplication facility. Applicants should have 5 to 10 years experience in a broadcasting and/or production environment. Strong emphasis on D-2 and D-3 VTR format, Autocad, and Windows application desirable. SBE certification a plus. Minimum 2 year electronics degree. Please send resumes to: Rank Video Services America, 9201 Faulkner Lake Road, North Little Rock, AR 72117. Attn: Human Resources. EOE.

TECHNICAL COORDINATOR

Rank Video Services America, the leader in home video duplication, is seeking a Coordinator with 4 to 5 years experience in supervising the day-to-day activities of the technical team which performs maintenance on all electronic equipment in the head-end, production and quality control areas of a multi-process manufacturing plant. BSEE and technical video broadcast experience required. Salary range is 35-50k+ depending on experience. Benefits include health plans, paid vacation, paid holidays, and a 401-K plan. Please send resumes to: Rank Video Services America, 9201 Faulkner Lake Road, North Little Rock, AR 72117. Attn: Human Resources. EOE.

THE SYSTEMS GROUP

Systems Design/ Project Manager

We are currently seeking experienced individuals with a technical background in A/V systems design and project management. Responsibilities will include generation of rack layouts, floor plans, overall systems design and integration. Projects include analog and broadcast systems, as well as performance venue facilities. Experience with AutoCAD and Microsoft Word/Excel preferred. Some travel may be required. TSG is conveniently situated within the greater NYC metropolitan area.

Please send resumes to:

The Systems Group
66 Willow Avenue
Hoboken, NJ 07030
Fax: 201-798-3033

(Equal Opportunity Employer)

MASTER CONTROL OPERATORS

SportsChannel New England, a leading regional cable sports network, is seeking experienced Master Control Operators for on-air switching, satellite-dish operations and videotape recording. An understanding of audio, video, signal routing and commercial insertion systems is required; the ability to work in a fast-paced, live sports environment is a must. SBE certification preferred. Hours include early mornings, evenings and weekends.

For confidential consideration, please send resume to: Master Control Manager, SportsChannel New England, 10 Tower Office Park, Woburn, MA 01801. We are an equal opportunity employer.

SportsChannel New England

STATION MANAGER

with television engineering background needed immediately for KSKN-TV in Spokane, Washington. Individual responsible to operating full power, 24-hour, UHF home shopping network station. Must be experienced in transmitter, studio, and microwave maintenance. Knowledge of FCC regulations and compliance mandatory. Management experience a plus but not required. Good people and community relations skills necessary. FCC license required. Send resume to KSKN-TV, Inc., Corporate Office, 408 Paseo Companeros, Chico, CA 95928. KSKN-TV is an equal opportunity employer.

Video Service/Maintenance Technician

Swiderski Electronics, Inc. a leader in the Audio/Video/Telecommunications field, has an immediate opening for a qualified Audio/Video Service/Maintenance Technician. 2 yrs. exp. Position works with Broadcast/Industrial 1/2', 3/4' and 1' VTR's & related equip.

Send resume & salary history to:
H/R Dept., 1200 Greenleaf Ave.
Elk Grove Village, IL 60007
Fax resume (708) 364-5019

Projects Department Manager

Within the Systems Integration Division, you will orchestrate the management of resources to execute complex, fully integrated broadcast systems. The ideal candidate will bring thorough project management experience and will be expected to further enhance project management techniques and new quality assurance programs. Your major responsibility will be to ensure project completion, both within schedule and budget. You will work in concert with our marketing and sales groups for future project budgeting. You will also prepare and update budgets and capital expenditures.

Requires 10+ years' experience in broadcast or production systems, as well as project management with 6 years' supervisory experience. Job Code: CCY-PDM

Proposal Manager

Utilize your sales and marketing expertise to oversee the development, coordination and preparation of sales proposals. This will include specifying strategy formulation and plan generation, as well as designing proposal formats and ensuring that guidelines meet customer and company needs. Requires 4+ years' broadcast or television production experience emphasizing operations. Excellent writing skills a must; familiarity with value-added sales processes desirable. Job Code: CCY-PM

Sr. Video Systems Design Engineers

Regular Full-time and Contract/Temporary

We're looking for very seasoned Engineers to work on designing large scale digital audio and video facilities. Candidates must be strong in system level engineering design, technical problem solving, team building and communications. Responsibilities will include the design of floor plans, equipment rack elevation layouts, and detailed signal flow construction diagrams. Fluency in Microsoft Excel for Windows is required; AutoCAD, MS Word and MS Access software knowledge a plus.

Requires 5+ years' experience in the design, operation, maintenance and testing of large scale state-of-the-art analog and serial digital audio and video production, as well as broadcast facilities. Job Code: CCY-VSD

Send responses to: **Sony Electronics Inc., 3300 Zanker Road, MS: SJ-2C2, San Jose, CA 95134; FAX (408) 955-5166. Or email youngc@ccmail.nhq.sony.com. EOE.**

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