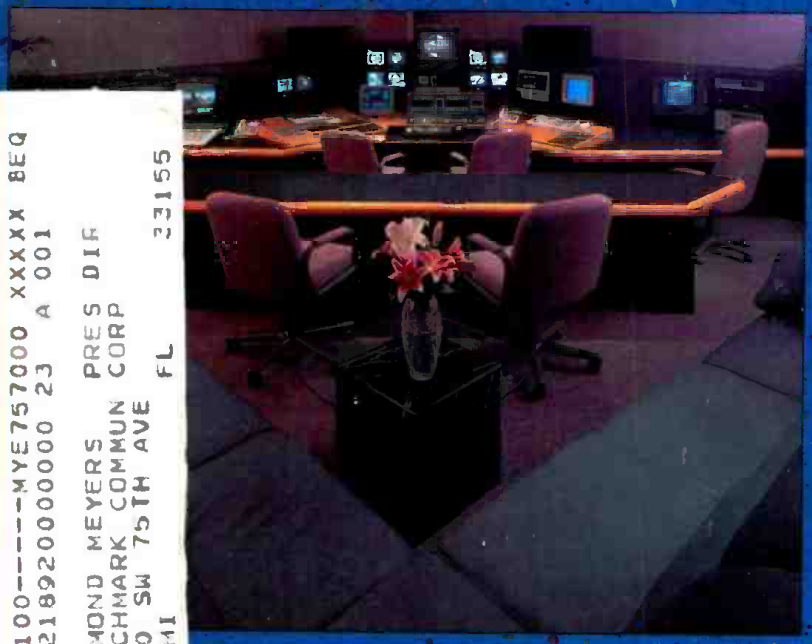
BROADCAST ENGINEERING

AN INTERTEC PUBLICATION

March 1992/$4.50

FACILITY DESIGN SPECIAL REPORT



1992 NAB Preview

R for radio profits p. 94

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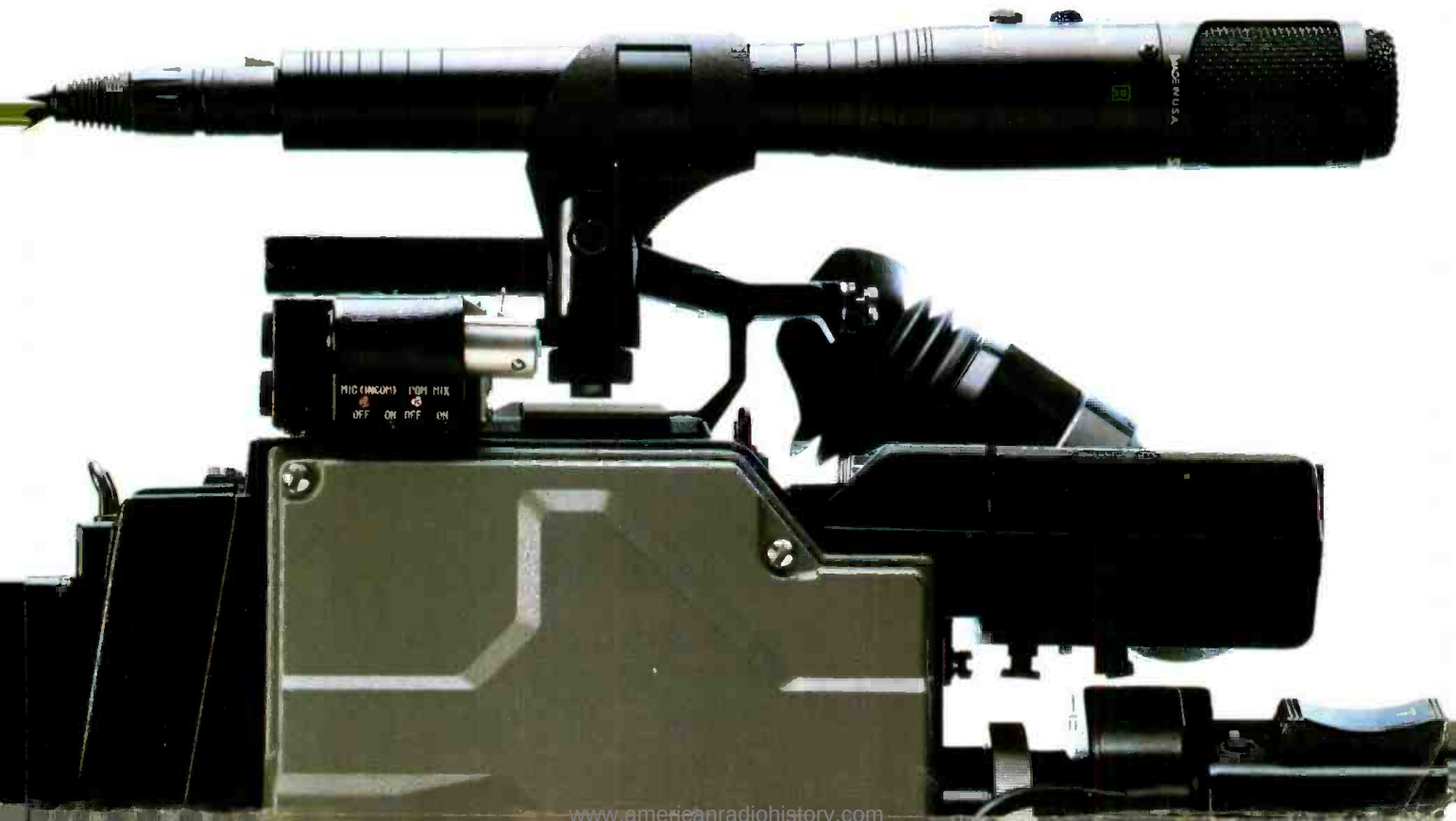

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FACILITY DESIGN SPECIAL REPORT:

Building new facilities for broadcast or production use requires careful planning. Because of the varied production requirements and equipment options available, the project manager must be able to properly balance needs and resources. Some of the toughest decisions lie with the construction of the physical environment — the studio. This month's issue highlights many new ways to solve facility construction issues, while saving you money — and giving you the competitive edge.

DEPARTMENTS

FEATURES:

OTHER FEATURE:

ON THE COVER

Facilities that stand the test of competition are carefully designed and planned with no room for error. This month's cover was designed by *BE* graphic designer, Stephanie Chiles.

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News

By Dawn Hightower, Sr. assoc. editor, and Leslie Smith, editorial asst.

FCC launches wireless interactive TV industry

The Federal Communications Commission (FCC) has launched America's wireless interactive TV industry by unanimously allocating a portion of the radio spectrum for interactive video and data services (IVDS) use. IVDS is commonly known as interactive television.

The FCC decision will create a new, wireless broadcast industry. Its action will allow companies to provide technology that turns consumers' televisions from 1-way information/entertainment vehicles to 2-way communication tools. Interactive television will allow consumers to perform services, such as shopping, polling, banking and bill paying directly through their television without using computers or telephones.

The FCC is allocating 1MHz in the 218-219MHz range of the spectrum for use by companies to provide IVDS to consumers. The FCC is expected to begin accepting applications for IVDS licenses within three to six months using an expedited lottery procedure. The agency should begin issuing the licenses before the end of this year, with the first service expected to reach customers soon thereafter.

Broadcasters tell FCC to reform new FM licenses policies

The National Association of Broadcasters (NAB) has urged the FCC to reassess its rules for awarding FM station licenses. NAB said existing FM policies have overcrowded the airwaves with new FM stations, diminished FM technical quality for radio listeners and weakened the economic lot of existing FM stations.

NAB's request for sweeping reforms would mirror actions regulators took to improve AM radio, including a freeze on all new applications for new AM stations. As part of its request, the NAB is also asking for an FM license freeze.

In addition, the NAB is asking the FCC to expand its FM ownership opportunities for minorities, including policies that would make it easier for minorities to purchase existing FM stations. NAB said this could be accomplished, in part, by expanding distressed sale and tax certificate policies.

In supporting an FCC freeze and regulatory review, NAB also wants the FCC to continue to allow broadcasters to upgrade their existing FM facilities.

SMPTE approves report on headers/descriptors

At a Feb. 6 meeting in San Francisco of the SMPTE Standards Committee, the report of the Task Force on headers/descriptors was unanimously approved. The report, in essence a feasibility study of possible methods to implement a header/descriptor mechanism, has been referred to the SMPTE Committee on Television Production Technology for further action. The final report will address the necessary work leading to a detailed SMPTE documentation of the format, construction and usage of the header and descriptor for the interchange of image, sound and related data between systems.

In essence, the proposed header is a digital label, identifying the encoding standard and the size of the data block contained in the associated envelope. It may also indicate the presence of a readable descriptor. The header is the enabling mechanism for the flexible exchange of picture, sound or other data between diverse systems, providing the necessary unambiguous information for the identification of the associated data.

The descriptor is a block of data that enhances the utility of the main data for the user. It may contain, in standardized format, data concerning production, ownership, access, previous processing or other information additional to the basic interpretation of the data. In simple processes, the descriptor may be skipped.

The header/descriptor is the key to the efficient and flexible use of the digital datastream for the communication, storage or display of digitally expressed pictures, sound, text or other items and makes possible scalable, extensible systems. It serves to identify the attributes of a data service between processes and enables the interoperability of systems using differing but predetermined standards.

The SMPTE is undertaking the documentation of the standard for a header/descriptor that will apply to television, multimedia, image transfer and a wide range of other related applications. It anticipates a close liaison with other groups involved in, or affected by, this work and is actively seeking maximum economy of application. The work represents a major and practical step toward the goal of fully flexible, interoperable, scalable and exten-

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Editorial

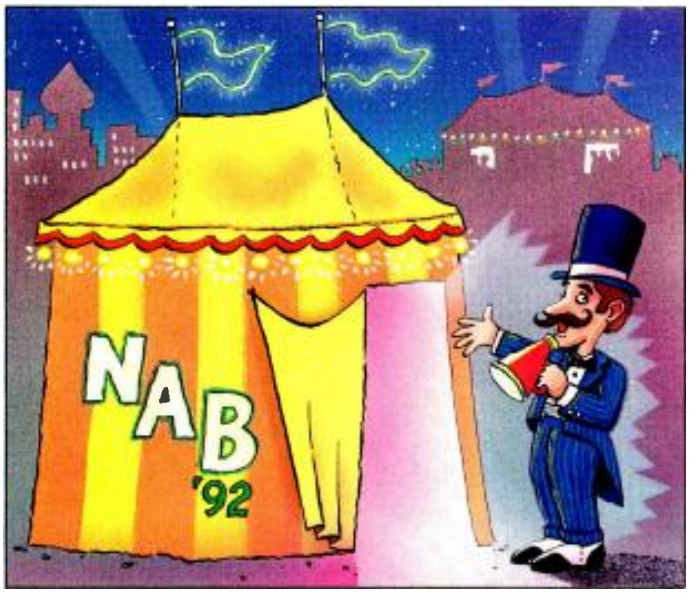
Hi ho, hi ho it's off to Vegas we go

Well here we go again. It's time to go back to the plastic and light desert oasis known as Las Vegas. It is the only place in the world where you can relieve yourself with too many beers while also playing the slot machine.

Our trek back to the desert will include approximately 50,000 professionals from broadcast, production and other entertainment fields. What will they find?

The early press releases for the NAB conference promise record numbers of new product introductions. Some of these may actually *be* new products.

As usual, there will be plenty of serious discussions about the industry's miserable state of affairs. Pundits will shake their heads sadly, reminiscing of days when the money practically fell off the table. Back then, broadcasting was fun *and* profitable. In some cases today, it's neither fun nor profitable.



Although these naysayers wring their hands in dismay, other, and much wiser, professionals will find new opportunities for success in advanced technology and services.

Amidst all of the hoopla that has little to do with the industry's future will be a few important meetings. Experts will outline their scenarios for stuffing 10 pounds of video into a 5-pound spectrum allocation so we can have terrestrial high-definition television. Others will offer solutions ranging from dealing with client bankruptcy to keeping the FCC off your doorstep. At last count there were more than 270 sessions scheduled over the 5-day event.

Broadcast Engineering magazine will have a full complement of editors and staff on site as usual. We will be at all the press conferences looking for the trends and issues that may affect you and the industry. We will also cover the major engineering sessions.

If you won't be attending this yearly extravaganza, don't despair. The June issue of *BE* will review the important points from the '92 show. Our coverage will not replace the glamour of the "strip" or winning chances at the tables, but then you were supposed to be there for business — right?

Brad Dick

Brad Dick, editor

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FCC Update

FCC reports on AM radiation exposure

By Harry C. Martin

The FCC has released a study on the exposure to radio frequency (RF) fields experienced by individuals who must climb AM broadcast towers to perform maintenance tasks, such as changing tower lightbulbs or painting. The data on such exposure is to help the FCC advise broadcasters of transmitting power levels that would allow maintenance tasks to be performed while preventing exposure of personnel to excessive RF radiation.

Significant absorption can result from currents induced in the body by RF fields. This is true at frequencies used for AM broadcast transmissions. In the study, measurements were made of currents induced in the body of an individual climbing each of two 1kW AM towers with electrical heights of 0.23 and 0.53, respectively. Copies of the study can be purchased through the National Technical Information Service at 703-487-4650.

An FCC OET Bulletin No. 56 issued in 1989 points out that high intensities of RF radiation can be harmful because of the ability of RF energy to rapidly heat biological tissue. Tissue damage can result because of the body's inability to cope with or dissipate the excessive heat. The extent of heating depends on several factors, including the frequency and intensity of the radiation, the duration of the exposure and how close the individual is to the RF source.

In 1985, the FCC began using the RF radiation protection guidelines established by the American National Standards Institute (ANSI) to determine safe levels of RF exposure for the public and for workers. Since 1985, applicants for new or changed facilities, or for renewal of a broadcast license, must submit detailed proof that the facility will comply with ANSI guidelines. The commission's regulations on evaluation of environmental RF radiation are found in Section 1.1307(b) of the agency's rules. Specific guidelines for compliance can be found in the FCC OST Bulletin No. 65.

Where the guidelines show that exposure levels may pose a problem, broadcast stations can take various steps to ensure compliance. Signs can be posted indicating danger from RF radiation, and access to sites can be restricted by fences. It also may be necessary to redesign an antenna, reduce power or relocate the station. Temporary measures to protect workers include lowering power levels while work is being performed, having work performed only when the station is not broadcasting and establishing procedures that specify the minimum distance that a worker must maintain from an RF source.

Martin is a partner with the legal firm of Reddy, Begley & Martin, Washington, DC.

Cable system fined for signal leakage

Late last year the FCC issued a notice of apparent liability and a fine of $23,750 to a cable system in Maryland after an inspection revealed excessive cable signal leakage. Section 76.611 of the commission's rules sets basic signal leakage performance criteria designed to prevent leakage that would cause interference to aeronautical radio receivers.

In the Maryland case, the FCC's Field Operations Bureau found serious system leakage on two successive days and issued a cease operations order to the cable system.

In assessing the fine, the commission used its standards, released last summer, to determine the dollar amount of the fine. Under the new standards, the base fine for unauthorized signal emissions is $12,500. However, because the commission found the leakage problem to be so severe and egregious as to be a serious threat to the public safety, the fine was adjusted to $23,750.

Wireless TV cameras and microphones

The commission has terminated a 1985 proceeding in which the agency proposed the use of UHF-TV spectrum by wireless cameras operated for electronic news gathering. The commission also terminated the freeze on the authorization of wireless microphones on UHF-TV spectrum above Channel 23.

Therefore, a reason no longer existed for continuing the freeze on the authorization of wireless microphones. This is especially true in view of the congestion problems caused by the intensive use of the UHF spectrum by VHF-TV stations and of the shared use of lower UHF-TV channels with private land mobile services in larger metropolitan areas.

FCC declines to require balanced treatment of ballot issues

In December, the FCC denied a complaint filed against an Arkansas TV station, alleging that the station failed to give adequate coverage to the position of those opposed to a November 1990 ballot issue involving Arkansas' usury limits.

In denying the complaint, the commission noted that any requirement that a licensee provides balanced coverage of ballot issues is derived from the fairness doctrine, which was repealed in 1987. At that time the agency concluded that the doctrine disserved "both the public's right to diverse sources of information and the broadcaster's interest in free expression" by chilling discussion of controversial issues. Therefore, the commission ruled that its decision to repeal the fairness doctrine, announced in "Syracuse Peace Council vs. WTVH" and upheld by the Supreme Court in 1990, applies to ballot issues as well.

Pioneer's preference awarded

The commission has granted a "pioneer's preference" related to a proposal it adopted last September to allocate spectrum for low-earth orbit (LEO) satellites.

Based upon demonstration of technological innovation and proposed service not currently provided, the commission tentatively decided to grant volunteers in technical assistance (VITA) a preference in licensing operation of a LEO satellite system. The commission decided to deny the related pioneer preference requests of two other entities. The FCC noted that VITA was the first to develop LEO technology, while its competitors' proposals involved no substantial innovations.

This action marks the commission's first tentative grant of a pioneer's preference, which is intended to foster the development and implementation of new technologies and services. ■

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Circle (7) on Reply Card

Part 3

Strictly TV

Camera video control

Operating CCD cameras

By Talmage Ball

Parts 1 and 2 of this column have described the use of camera control unit (CCU) controls for tube cameras in single and multiple camera productions. Today, *chip cameras* using charge-coupled devices (CCDs) are supplementing or replacing cameras using tubes. This column describes some of the differences between tube and CCD cameras.

No registration

In the tube camera, the pickups are mechanically suspended at the prism's outputs. In CCD cameras, they are glued to the prism's faces. This means that tube cameras can be adjusted for focus tracking, but the focus adjustment is permanently set in chip cameras from the moment the glue hardens.

The beam in a camera tube is controlled by signals in the yoke. Modifying these signals fine tunes the beam's sweep. The visual information clocks out of the CCD sensors strictly in bucket-brigade fashion. What the chip sees is what the viewer gets.

As the camera warms and cools, the mechanical properties of the tubes can change. This may affect registration and back focus. This is one reason for assigning a person to the video control position. The operator sometimes had to tweak functions back into tolerance during long productions.

On the other hand, once a CCD camera is set up, it should stay that way, with the exception of long-term component aging.

Colors

Once set, the color balance of a CCD camera generally requires no further adjustment. However, in multicamera operations there is still a chance that the cameras will appear different. This may be due to differences in the individual setup, or in the way the technician performing the setup interpreted the test instruments.

To color balance a properly operating CCD camera, first turn it on and allow it to stabilize. Examine the output of each camera encoder to make sure they are all set up the same. Next, check for timing and phasing errors between cameras.

The paint pots and controls for a good CCD camera resemble those described in Parts 1 and 2 of this column. Often, however, video operators use an 11-chip chip chart for CCDs instead of one with seven. This is because CCD cameras are precise enough to warrant the extra care.

The precision of a CCD camera is also sometimes its downfall. Without the mechanical and electrical adjustments, it is nearly impossible to compensate for certain lens errors. This has forced lens manufacturers to enhance the quality of their offerings. Some manufacturers even advertise certain lenses as being CCD compatible. (See "CCD Lenses: Shooting for Perfection," *BE* February 1992.)

The visual information clocks out of the CCD sensors strictly in bucket-brigade fashion. What the chip sees is what the viewer gets.

So which is better?

Choosing a tube or CCD camera involves maintenance and aesthetic judgments. The CCD camera will on average require fewer trips to the shop. Its digital circuitry will stay in tolerance longer. CCD cameras are also harder to damage. A tube camera can suffer *burn in* if left on too bright of an object for too long of a time. This may permanently damage the tubes. On the other hand, a CCD camera can photograph the filament of a glowing lightbulb, and then pan around and pull an image information from a scene lit by a flashlight.

Certainly this points to the CCD camera's advantages in ENG work. How about production in a controlled environment? Here, opinions differ. The debate is similar to the "tubes vs. transistors" arguments that circulated in the audio world a few years ago.

In the first place, CCDs are subject to some errors. There are roughly 400,000 pixel elements, each one a silicon device. The odds are high that all of them will not perform identically. This requires use of axis and modulation shading, as in tube cameras. Leakage current depends on temperature, so circuitry must have adequate thermal compensation.

On the other hand, these cameras set up with numbers, not potentiometers. This means changes in temperature or mechanical vibrations will not have as adverse an effect. Numerical control also lends the ability to copy setups from one camera to another, or to store multiple setups and download them as needed. Additionally, digital processing affords some image improvements that just are not possible with analog.

Artifacts

One reason for the debate is that CCDs create unique artifacts. Whether they are more or less harmful to the image than tube camera artifacts is subjective. Early CCD cameras suffered from vertical smearing in the highlights. This was because powerful light contaminated the chips' charge transfer systems. Modern techniques have greatly reduced this occurrence.

Another artifact is aliasing. This is due to the finite number of pixel elements. It is sometimes possible to see stuttering movement when playing back at slow speed an image from a CCD camera.

A most unusual artifact is the tilting effect that a CCD camera imparts to vertical lines. To demonstrate this, whip pan past a hard vertical transition, for example, a doorway. The door will seem to lean. Playing back each frame in slow motion will show the door to be vertical. Play it back at regular speed, and it will start to lean again.

Ball is vice president, engineering, Bonneville International, Salt Lake City.

Acknowledgment: The author wishes to thank Fred Himelfarb, a consultant with Panasonic Broadcast Systems, Secaucus, NJ, for help in the preparation of this article. ■

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Circle (8) on Reply Card

re: Radio

Digital radio — a process, not an event

By Skip Pizzi, technical editor

While reading history, you get the sense that events of the past all happened in a clean and well-defined way. A war began on this date and ended on that one; an invention was made on this date, a discovery on that one. Progress always seemed to occur overnight. Transitional periods across the thresholds of historical change are foreshortened and diminished as they recede into the past.

History's labels and landmarks fail to note the critical processes *within* these transitions. The forks in the road that are traversed and the heroic efforts made along the way are often glossed over. But for those who have lived through them, these periods are not a painless or transparent passage.

Broadcast radio now finds itself in the middle of such a transitory process, as if perched on the apex of a crossfade. The analog age of audio is ending, and its digital future is well under way.

The actual pace of this recent progress has been astounding. Not satisfied with annihilation of the LP, the CD juggernaut has now turned its forces upon the audiocassette. The amount of U.S. consumer dollars spent on CDs has surpassed those spent on cassettes in mid-1991, and CD units sold should outpace that of cassettes by mid-1992. (See Figure 1.) This crossover has taken place notwithstanding the convenience, low cost and near-ubiquity of the cassette medium. Consider also that this has occurred with CD-player penetration at only 25% of U.S. households. Potential for continued growth of digital audio is still in great supply.

Incremental digital conversion

Although broadcasters look for an eventual means of digital radio delivery as a possible savior in this environment, there is much to be done before DAB arrives. What some have forgotten in the rush toward a digital broadcast grail is an earlier, interim goal: by the time a digital broadcast system is implemented, a radio station's audio chain should already be largely, if not totally, digital. (See "The Digital Radio Station" in the March issue.)

Unlike the HDTV conversion faced by the TV industry, most radio stations have already taken the first steps toward their future. NAB data suggested that by 1990, more than two-thirds of U.S. radio stations already owned at least one CD player. (The majority of these owned two or more.) Our magazine's research confirms that trend's continuation, with more than 60% of stations reporting additional CD player purchases during 1990 and nearly another 40% that did so in 1991. Other digital audio equipment purchases rose substantially from 1990 to 1991, with DAT penetration at radio stations estimated at around 15%. A few stations are still using "pseudovideo" digital recording systems, but most of these plan to convert to DAT soon.

In addition to storage systems, other significant digital audio product areas are emerging. Radio stations can begin to implement the advantages of digital audio in their on-air processing, automation systems, production suites, remote backhauls, STLs and FM exciters. Look for them at NAB '92.

Gratification need not be all deferred in this process. Some benefit will be reaped immediately, such as when a component is upgraded. Remember that there may be a few exceptions to the rule that digital is necessarily better. State-of-the-art analog "islands" may exist for some time in certain areas of the digital broadcast chain, providing excellent quality and high cost effectiveness.

The approach should not be "if" but rather "when." Don't lament the apparently long road remaining to the digital broadcast era. In fact, there may not be *enough* time for stations to make the prerequisite conversions before digital transmission is possible. Broadcasters should work now toward making analog transmission the true limiting factor in their facilities' audio chains.

If all goes well, the effort expended in making a smooth transition to the digital future will disappear once we get there. But this implies good use of time, and a sensible distribution of resources, in the shift between analog and digital systems. As the Flying Kamarazovs say, "Time is what keeps everything from happening at once."

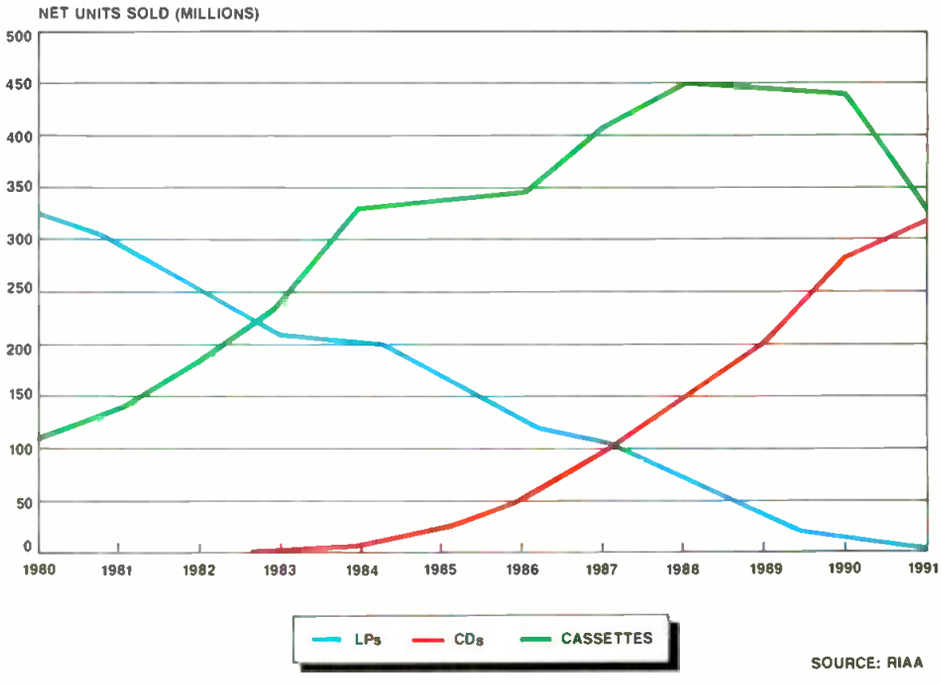

Figure 1. U.S. consumers' purchasing pattern of major recording formats. ■

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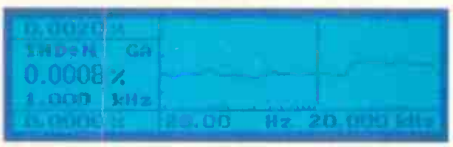

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Circle (9) on Reply Card

Part 1

Management for Engineers

The human network: a management tool

Things are changing

By Judith E.A. Perkinson

During this 4-part series on "networking" we will address the issues of network building, utilization and maintenance. There is no better time than now to begin to build or upgrade your professional network.

If you have been in broadcast engineering for more than a year, you are aware that the industry is changing. Budgets are tight, new technology abounds, stations are being sold, people are changing jobs, jobs are disappearing and new jobs are emerging.

The broadcast engineer is caught in the middle of this cycle. Managing this change is a challenge that may call for skills that have little to do with engineering.

In the communication industry the engineering department may be isolated from the other functions of a station. This isolation does not have to affect the smart engineer. Hundreds, maybe even thousands, of engineers just like you in stations across this country and beyond face many of the same problems, handle similar equipment, deal with the same personnel problems, develop capital budgets, and encounter the same rules and regulations. With all of these resources at your disposal, you don't have to face these industry changes alone.

Competitors or collaborators?

These other engineers may be your competitors when it comes to market share, trade secrets or proprietary information, and you should be cautious. For the sake of clarity, these three items will be called the "untouchables." But for the smart engineer, competitors mean other people in the same industry dealing with similar problems that do not include these untouchables. On this basis you can develop a link for communication and collaboration.

Fostering collaboration

Collaboration sounds like a good idea, but how does an isolated engineer tie into those hundreds and thousands of resources? The answer is *networking*. Networking is the fine art of linking up with individuals with whom you share a common concern, activity or function.

- *Formal networks.* Professional societies, such as SBE and SMPTE, are examples of more formal networks. Most of you have some contact with these societies. As valuable as these organizations are and as important as their function may be, they are not enough.
- *Personal networks.* Most of you also have a personal network. This is a group of friends and contacts that you have accumulated over the years and whom you contact from time to time. Most personal networks tend to be geographically limited and may also include non-engineering people. As valuable as these friends and contacts are and as important as their function may be, you still need more.
- *Professional networks.* Your professional network may include the members of your personal network, but it should go beyond that. Just think about your professional contacts. How many of them have changed jobs lately, retired or left the industry? How many of them have you talked to in the last six months?

A professional network is something you establish when you begin work and continue to build upon. Just like a piece of equipment this management tool needs its own kind of maintenance. There is no time like the present to upgrade your professional network. If you have never built a professional network then now is the time to begin.

Homework assignment

The NAB convention presents the opportunity to meet a wide variety of individuals in the industry. Building a network allows you to make those meetings a valuable addition to your professional resources.

Step No. 1. Be prepared. Copies of this magazine are available to everyone who attends the NAB convention. Pick up an extra copy and have it available while you attend the sessions and see the exhibitions. Not only will you have your network building material, but you will also have a good map of the exhibition hall.

Step No. 2. Talk to people you do not know. People who are looking at the same equipment or attending the same sessions are likely to share your interests.

Step No. 3. Recruit potential network members. Try to locate at least five people who operate in a work environment similar to yours. This could be the same type of station, staff size, kind of equipment, style of operation or geographic area. The idea is to find people who may face similar problems. This kind of "homogeneous network member" is more likely to be a resource for you. You may also be that person's resource.

Also, ask if your potential network member has read this column. If not, pull out the copy you have been carrying and share it. Let this contact know you are interested in following the series.

Step No. 4. Recruit potential network members. This activity is similar to step No. 3 except that instead of finding people like you and in similar situations, find people in different stations, locations or groups that you are interested in learning more about. Try to recruit three network members in this category.

Step No. 5. Exchange contact information. There is no reason to recruit network members unless you can contact them after the convention is over. Exchange business cards and agree to send each other information about your respective stations and your resume or a short biographical sketch.

Step No. 6. Follow up. When you get back to your station send the material you promised within two weeks.

Step No. 7. Continue learning. Be sure to read the rest of the 4-part series in *BE* magazine.

During the next three months you will learn how to turn those contacts into a combination of new friendships and valuable professional resources. If you do, you will be one giant step on your way to working smarter. ■

Perkinson is a senior member, the Calumet Group, Inc., Hammond, IN.

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Part 1

Circuits

Computer-based video editing

NTSC and PAL to CCIR 601 conversion

By Gerry Kaufhold II

This is the first in a 2-part series that will provide details about a new, low-cost series of silicon chip sets for television. These chips convert analog video signals into digital data that can be manipulated in the memory of a personal computer. They are inexpensive but still offer D-1 quality. Several manufacturers are planning new products around these chips. Examining the chips will also provide a quick introduction to digital signal processing (DSP) techniques for video.

Analog method

The color video signal consists of two parts: luminance (Y) and chrominance (C). The luminance portion occupies the lower 3MHz of the video signal's bandwidth. The luminance signal swings approximately one volt, peak-to-peak. Within this range are three distinct sections. The horizontal and vertical sync signals appear from zero to approximately 0.4V. Black level setup is positioned between 0.40V and 0.47V. Actual picture luminance information resides between the top of the setup and 1V.

The color subcarrier signal, centered at 3.58MHz, contains two color-difference signals. These are separated in phase by 90°. The colorburst signal that rides on the backporch of horizontal sync provides a phase lock reference that is used in decoding the color signal.

In an analog demodulator, the luminance signal provides sync, setup and the Y signal. The color subcarrier is demodulated to produce the U and V signals. A color-space conversion matrix combines the Y, U and V signals to produce red, blue and green.

Converting analog into digital

The digital video circuit must do the same things as the analog systems: sense sync, find setup, control peak-to-peak voltage level, and decode color from YUV to RGB. The difference is that the output is designed for computer consumption.

There are two chips, and an A-to-D converter digitizes the input video. The digital multistandard demodulator (DMSD) uses digital signal processing (DSP) techniques to pick chroma information off the subcarrier to develop color. (See Figure 1.)

The analog-to-digital flash converter has to sample at least 13.5 million samples per second to produce CCIR 601 D-1 component (RGB) video. At this sampling rate, NTSC and PAL video will produce horizontal lines with 720 picture elements (pixels).

Making it square

Now it gets tricky. Remember that a TV pixel is rectangular, but a computer screen pixel is square. To minimize distortion, designers have adopted certain tricks to put a rectangular pixel in a square hole. By sampling these NTSC signals at 12.2727272MHz, designers obtained images with 640 active pixels per horizontal line. This matches the 640×480 resolution of a standard VGA monitor. Using this oddball sampling frequency automatically adapts the digital signal to the computer monitor. (For PAL, the sampling frequency is adjusted to 14.75MHz.)

The A-to-D converter can resolve 256 voltage levels. The 192 highest values track the baseband luminance signal. The 64 lower digital states, between 0V and 0.47V, are permanently assigned to sync and setup. Using this much resolution on these timing signals makes it possible to detect extremely small changes in the slopes of their leading edges.

Instead of trying to lock onto the colorburst signal, the A-to-D syncs to the horizontal line rate by catching the leading edge of each horizontal sync pulse. A circuit called the *discrete time oscillator* integrates any errors due to variation in the horizontal line period. This highly accurate line timing signal is passed, along with the digitized byte stream from the luminance circuit, to the DMSD for processing.

Next month we'll see how the DMSD uses these signals to pick the color subcarrier and its two chroma signals out of the digitized bytes coming from the A-to-D converter.

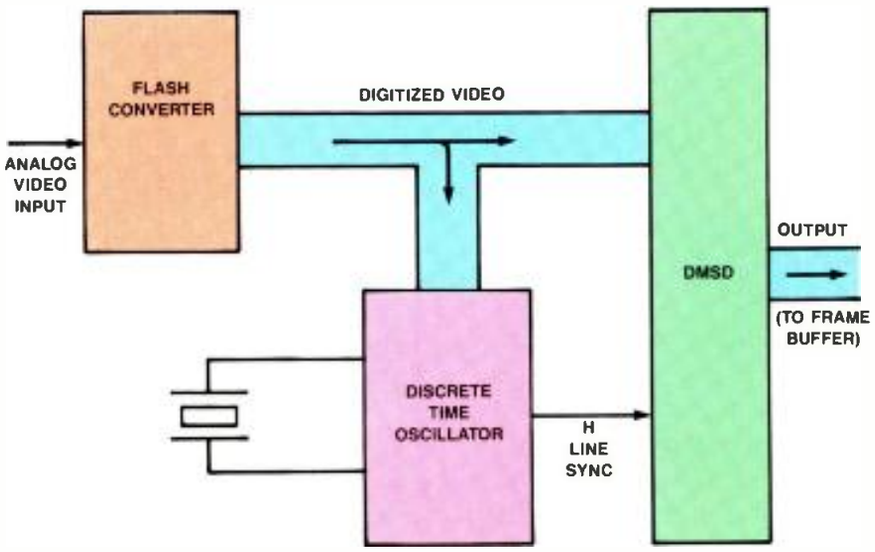

Figure 1. *The new digital video chip sets inexpensively replicate the functions of analog circuitry using DSP techniques. The discrete time oscillator creates an H-line timing reference used by the digital multistandard demodulator to decode color information.* ■

Kaufhold is an electronics industry analyst based in Tempe, AZ.

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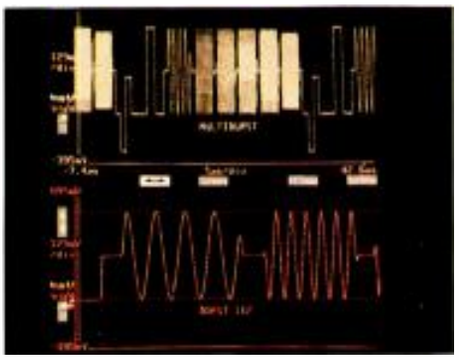
A Hit.

Part 1

Troubleshooting



Maintaining STLs

RF link overview

By Chris Durso

This month, we start a 6-part series on studio-to-transmitter link (STL) maintenance. The series will examine the elements of microwave STLs, concentrating on ways to engineer and maintain them to ensure reliable operation.

The primary job of an STL system is to deliver programming to a remote transmitter site for broadcast. Because the STL is such a critical link in the broadcast chain, it must be engineered to the highest possible standards.

In addition to the STL path, broadcast systems may also include a transmitter-to-studio link (TSL), a telemetry return link (TRL) and one or more intercity relay (ICR) stations. TSLs typically route video, audio and data signals back to the studio. TRL systems are used by radio stations for the meter-display signals of their transmitter remote-control systems. The ICR is similar to the STL but does not deliver its signal to the transmitter. ICR systems are often used to transmit programming between broadcast studio facilities.

The FCC classifies STL systems as *auxiliary broadcast stations*. The rules and regulations that deal specifically with aural STLs are found in Part 74, Subpart E. TV STL rules are found under Part 74, Subpart F.

Durso is chief engineer at KPBS-FM, San Diego.

System configuration

The typical analog aural STL system can be configured in two ways. In one method, FM stations may opt to deliver programming to the transmitter as two discrete audio channels or in the form of the composite FM baseband signal. Discrete systems have built-in redundancy and can deliver better signal-to-noise figures at greater distances than their composite counterparts. With RF combining, a discrete STL requires only one feedline and antenna at each end.

On the other hand, the composite system allows the convenience of keeping all audio-processing equipment at the *studio* location. Where STL path lengths are not excessive, a composite system can deliver excellent performance. Because of their greater transmission bandwidth, composite systems require higher RF levels than discrete systems for equivalent noise performance.

TV systems also use discrete and composite audio transmission via subcarriers. In addition to the main-channel audio subcarriers, most TV STL systems incorporate additional subcarriers for SAP, transmitter-facility remote control and steering of tower-mounted ENG receive antennas. (See Figure 1.)

Frequencies

Aural STLs operate between 944-952MHz as prescribed in 74.502(a). TV stations may also use this band, but only on a secondary, non-interference basis.

Aural STLs can each use up to 500kHz of bandwidth. The STL includes additional subcarriers that are not part of the program channel, thus the need for additional spectrum above what is typically broadcast.

Aural stations may also operate in the 2GHz, 7GHz, 13GHz and 23GHz bands, where engineering considerations differ from systems operating in the 944-952MHz region.

TV STL systems typically operate in the 7GHz and 18GHz bands. Channel allocations can be found under 74.602 of the rules. Unlike aural STLs, TV systems often include a TSL to facilitate the return of video and audio signals along with metering data from the transmitter site. Technically, the STL and TSL systems are almost identical and may even share a common feedline and antenna system.

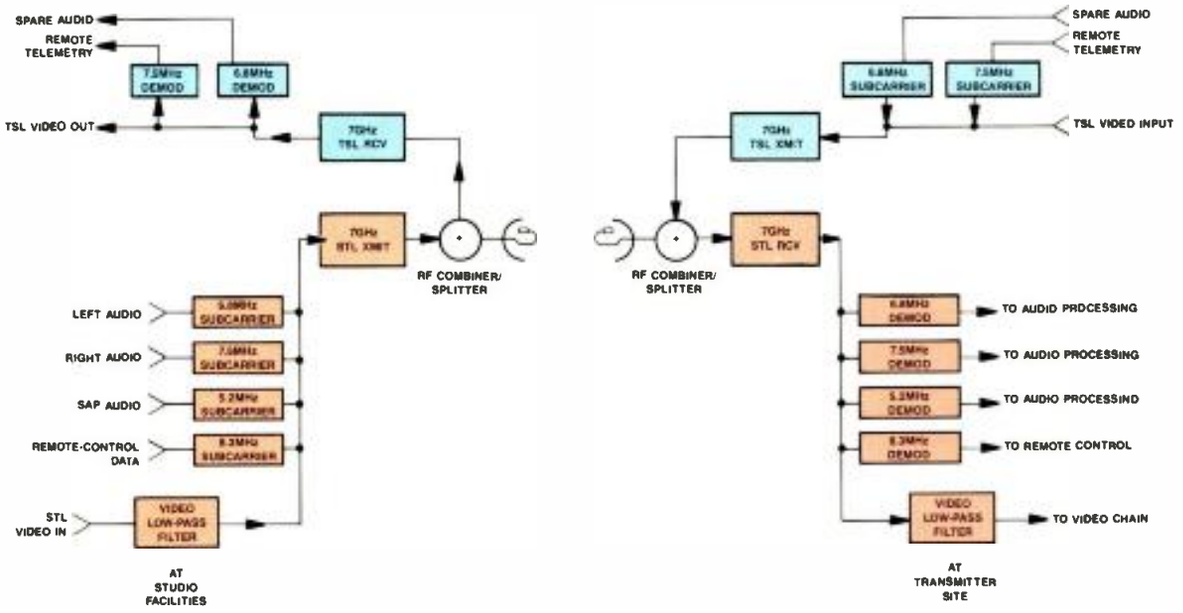


Figure 1. *Typical TV STL system configuration.* ■

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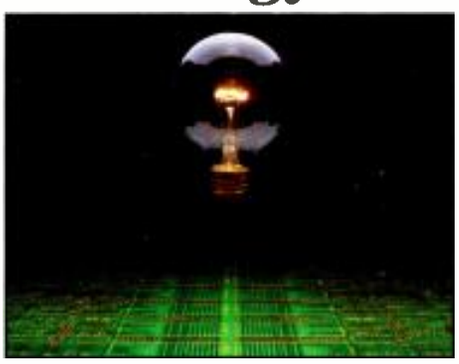
Technology News

Mini-routers for maxi-facilities



By Dave Quebbeman

If you were to name significant changes that have occurred in the production and broadcast facilities over the last 10 years, the list would be lengthy. Today, CCD-based camera sales outpace tube-based units, and probably the current population of CCD cameras now outnumbers the tube types. Digital video and audio are alive and operating nicely in concert in many facilities.

Component video systems, both analog and digital, have created a need for much more complex signal networks and wider bandwidth signal paths. With attending audio, time code and control data paths information, the problem of getting the right signals to the right place at the right time can be like an intricate spider web, with an attentive spider standing ready to strike.

Distribution problems are like being at the center of an intricate spider web with an attentive spider ready to attack.

Routers solve problems

Solutions for distribution problems are the realm of routing switchers, and better routing solutions are constantly being developed. Quite often you find routers configured with separate cards for audio, video and data or even a separate chassis for each type of signal. Many of the routing systems in facilities demand a large amount of space to accomplish their purpose. To answer that situation, distribution switcher manufacturers are now developing a new generation of routers with component densities several times greater than those previously offered — up to 2,048 audio crosspoints and 1,024 video crosspoints per rack unit.

Quebbeman is a technical writer for BTS, Salt Lake City.

Such a density would allow a 64-input by 64-output video switcher, combined with a complete 64-by-64 stereo audio switcher to fit into a single 19.25-inch-high chassis. Larger systems, like a 160×128 video/stereo audio router would be contained in 44 rack units, which is the space typically provided by a standard equipment rack. Such switchers could range from 32×32 to 160×256 (or even a 352×128 matrix) and could be assembled and installed without the use of input distribution amplifiers.

Manufacturers are also looking for a family of switchers that can share a single chassis. Such families could include an HDTV-compatible analog video version; an analog audio version, designed specifically for stereo; a 400Mbit/s serial digital video version; and an AES digital audio switcher.

Using this concept, each switcher could be partitioned to support a different signal standard or sync reference, allowing, for example, NTSC video, PAL video, digital video and AES audio to share the same chassis. The signal standards could be changed by the user in the field.

Previous analog audio switcher designs often had stereo pairs routed through completely separate hardware "levels." The new approach will allow for special switching combinations, such as output summing, where a stereo signal must be mixed into a monaural output.

Designs for efficiency

Following concepts originally developed for telephone switching, newly developed routers include computer facilities to determine the most efficient path for a signal to use. This makes sense in that typically, not all inputs or outputs are in use simultaneously. The end result is that fewer crosspoints become capable of doing the job more efficiently than a massive array. Not everyone is willing to take the decisions of computers on faith, however. In fact, a request heard more and more often is for a monitoring function for new router designs. Such a monitor will report the current configuration status of the system. In essence, such a system becomes a router within a router, allowing engineering personnel to verify the switcher's performance without interrupting any normal operations.

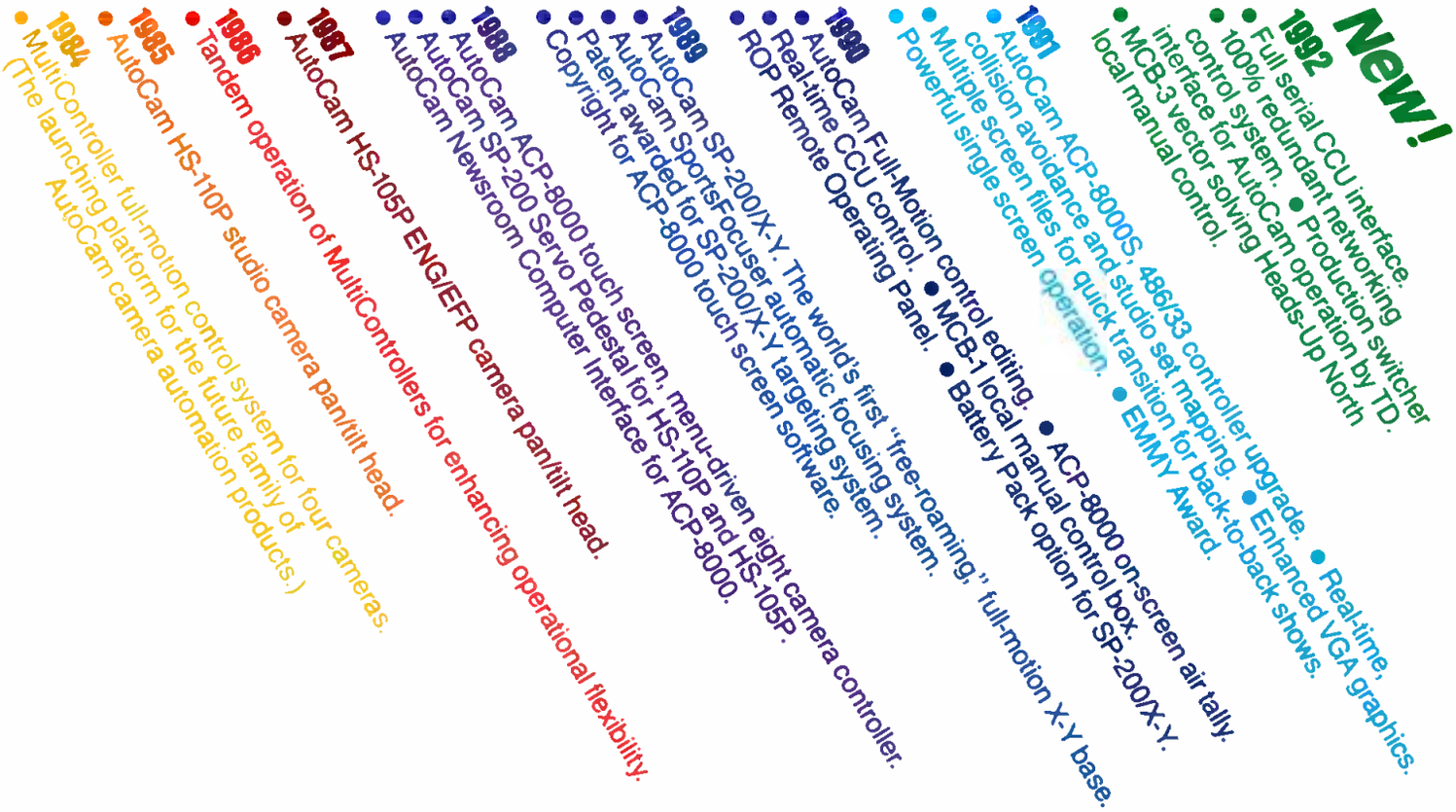
High density, flexibility and cost-effective distribution drive router designs.

Switchers must be reliable. Paramount to reliability of all electronic equipment is the source of operating power. Newer switchers will often be supplied with one automatic line-sensing power supply, or two supplies, if redundancy is desired. The supplies will automatically compensate for power-line variations, typically covering a range of 86V-130V or from 206V-250V for facilities outside the United States.

Control systems must also follow the growing demands of production and broadcast facilities. Automated operations will expect rapid development of routers capable of operation by computer-driven controllers that combine machine and switcher control on a LAN as well as by lower cost and less complex control panels.

As many other areas of technology are finding, you could say that distribution switchers for video, audio, data and other signals have become moving targets. Solutions to the problems of crosspoint density demand the examination a number of parameters, which include switching speed, signal response, path bandwidths, signal crosstalk, spatial volume and component cooling. Designs that exhibit appropriate answers to these parameters will continue to be much sought after.

Editor's note: The goal of increased crosspoint density is part of the Venus router design project. ■



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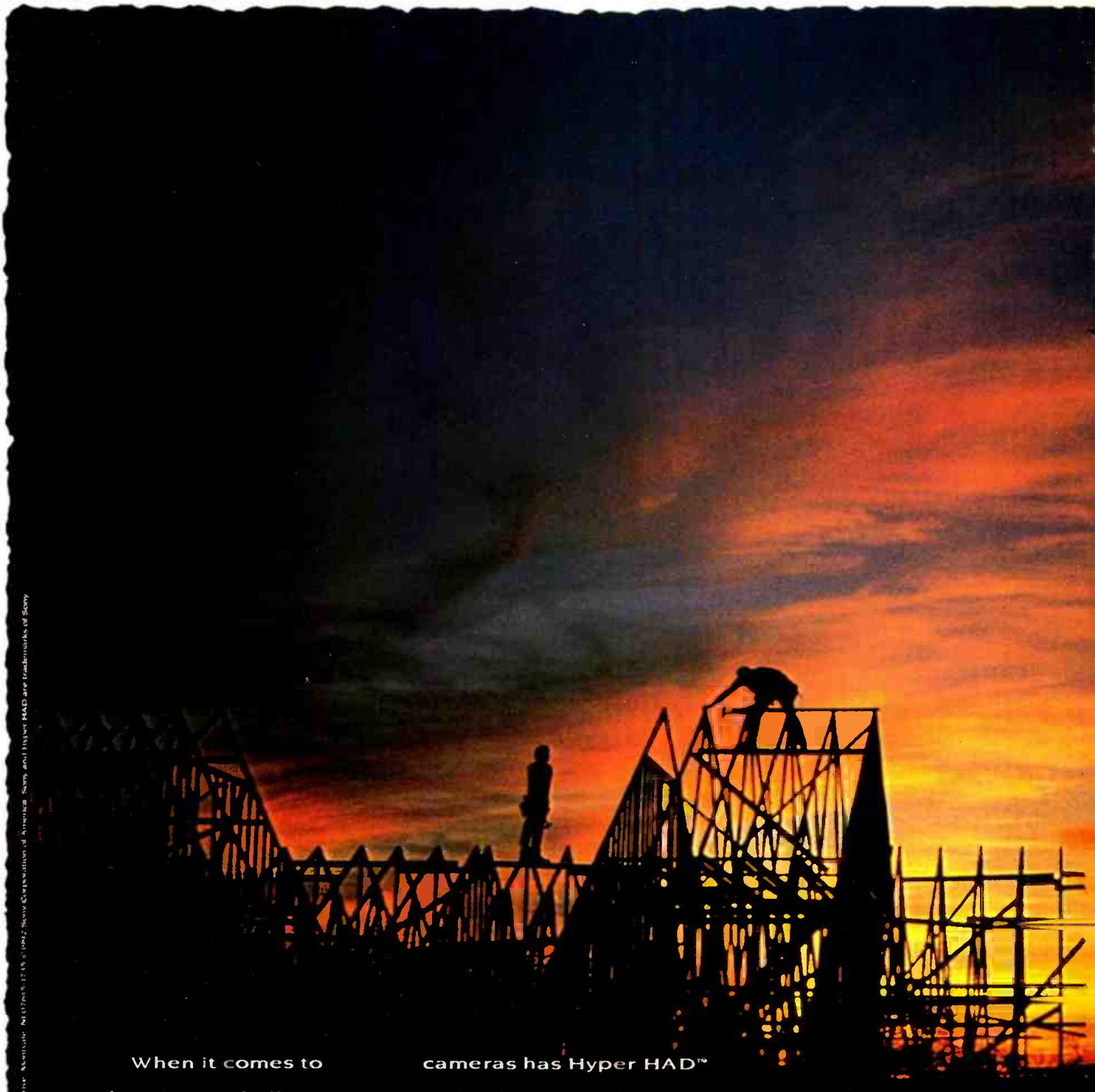

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SBE Update

SBE day at NAB

By Jerry Whitaker

The SBE has agreed to develop three technical sessions at the annual National Association of Broadcasters Convention. This is the first time SBE sessions will be included at an NAB convention as a part of the NAB *Broadcast Engineering* conference.

Whitaker, a technical writer based in Beaverton, OR, is vice president of SBE.

SBE/NAB BROADCAST ENGINEERING CONFERENCE

Schedule of Engineering Sessions

Tuesday, April 14: Morning Radio Session

Coping with New Technology

Session coordinator: John Battison, consultant
Session assistant coordinator: Paul Montoya, Broadcast Services

8:45 a.m. ***Opening presentation***

8:55 a.m. ***Session chair's remarks and welcome***

9:00 a.m. ***Radio in the 1990s: Challenges and Opportunities***
- Brad Dick, *Broadcast Engineering* magazine
An overview of the technical and regulatory issues currently before the radio industry.

9:30 a.m. ***Digital Cable Audio: When and Where***
- Don Lockett, National Public Radio
A technical overview of cable radio and its place in your market.

10:00 a.m. ***The Expanding Role of DSP in Audio Technology***
- Michael Collins, Motorola
An overview of digital signal processing technology and how it is reshaping the professional audio industry.

10:30 a.m. ***Improving Transmitter Performance Through Class E Operation***
- David Cripe, Broadcast Electronics
Theory of operation of Class E power amplifiers and how they compare with conventional Class D systems.

11:00 a.m. ***The Dependence of AM Stereo Separation on Transmitter Load Phase***
- Jerry Westberg, consultant
Detailed analysis of load phase adjustment for optimum AM stereo performance.

11:30 a.m. ***Close of session***

Tuesday, April 14: Morning TV Session

Television: Coping with New Technology

Session coordinator: Richard Farquhar, SBE president
Session assistant coordinator: Robert Goza, KMOV-TV

8:45 a.m. ***Opening presentation***

8:55 a.m. ***Session chair's remarks and welcome***

9:00 a.m. ***Television: Where has all the Money Gone?***
- Jerry Whitaker, technical writer
An examination of key trends in the TV market and what we can do about them.

9:30 a.m. ***Enterprise-Wide Automation***
- Bob Paulson, AVP Communications
Report on a new way of viewing TV station automation and how it can apply to your station.

10:00 a.m. ***A Case History: Master Control Automation***
- Marvin Born, WBNS-TV, Columbus
The paybacks and problems of TV station automation.

10:30 a.m. ***Basics of Digital Video Compression***
- Carl Ostrom, Systems Resources
A summary of the major video compression schemes under development today and what they hold for the future.

11:30 a.m. ***NASA: Applying New Technology Today***
- Tom Bentson, NASA
How NASA is using new technology to solve old problems.

11:30 a.m. ***Close of session*** **(Lunch break)**

Tuesday, April 14: Afternoon Regulatory Session

Broadcaster's Rules of the Road

Session coordinator: Dane Ericksen, Hammet & Edison
Session assistant coordinator: William Hineman, WTHR-TV

12:45 p.m. ***Opening presentation***

12:55 p.m. ***Session chair's remarks and welcome***

1:00 p.m. ***FCC Enforcement Efforts: Not Business as Usual Anymore***
- Richard Smith, FCC FOB
Report on the enforcement activities of the commission and on the effects that increased fines are having on stations.

1:30 p.m. ***Beta Testing: a Self-Inspection Program***
- Jim Zoulek, FCC Los Angeles office
Report on the track record of a unique self-inspection program organized by one of the FCC field offices.

2:00 p.m. ***Changes in Structural Standards for Communications Towers***
- John Windle, Stainless
An outline of the significant changes contained in new ANSI/TIA/EIA standards and how they will affect a typical broadcast station.

2:30 p.m. ***New Issues Facing Frequency Coordination***
- Richard Rudman, chair, SBE Frequency Coordination Task Force
The upcoming political conventions, proposed spectrum reassignments and the looming issue of HDTV augmentation channels have made frequency coordination more critical than ever.

3:00 p.m. ***The SAGE I System for EBS***
- Jerry LeBow, SAGE Alerting Systems
An inside look at one alternative to the current EBS system.

3:30 p.m. ***The Future for EBS***
- Bill Ruck, KFOG/KNBR Radio
With the perspective to two recent San Francisco Bay Area disasters (Oakland fire and earthquake), where should EBS go from here?

4:00 p.m. ***WARC-92: What is it and Why Should I Care?***
- John Reiser, FCC
Report on the upcoming WARC meeting and other international activities and on effects they could have on broadcasters.

4:30 p.m. ***Roundtable Discussion: Dealing with a Changing World***
- Richard Smith
- Jim Zulik
- Don Windle
- John Reiser
- Richard Rudman
- Bill Ruck
- Jerry LeBow
- Dane Ericksen

5:00 p.m. ***SBE Membership Meeting***

5:30 p.m. ***Close of Session***

Tuesday, April 14: Afternoon Concurrent Event

2-5:00 p.m. ***Certification exams***

3:00 p.m. ***SBE Chapter Chairmen's Meeting***

■

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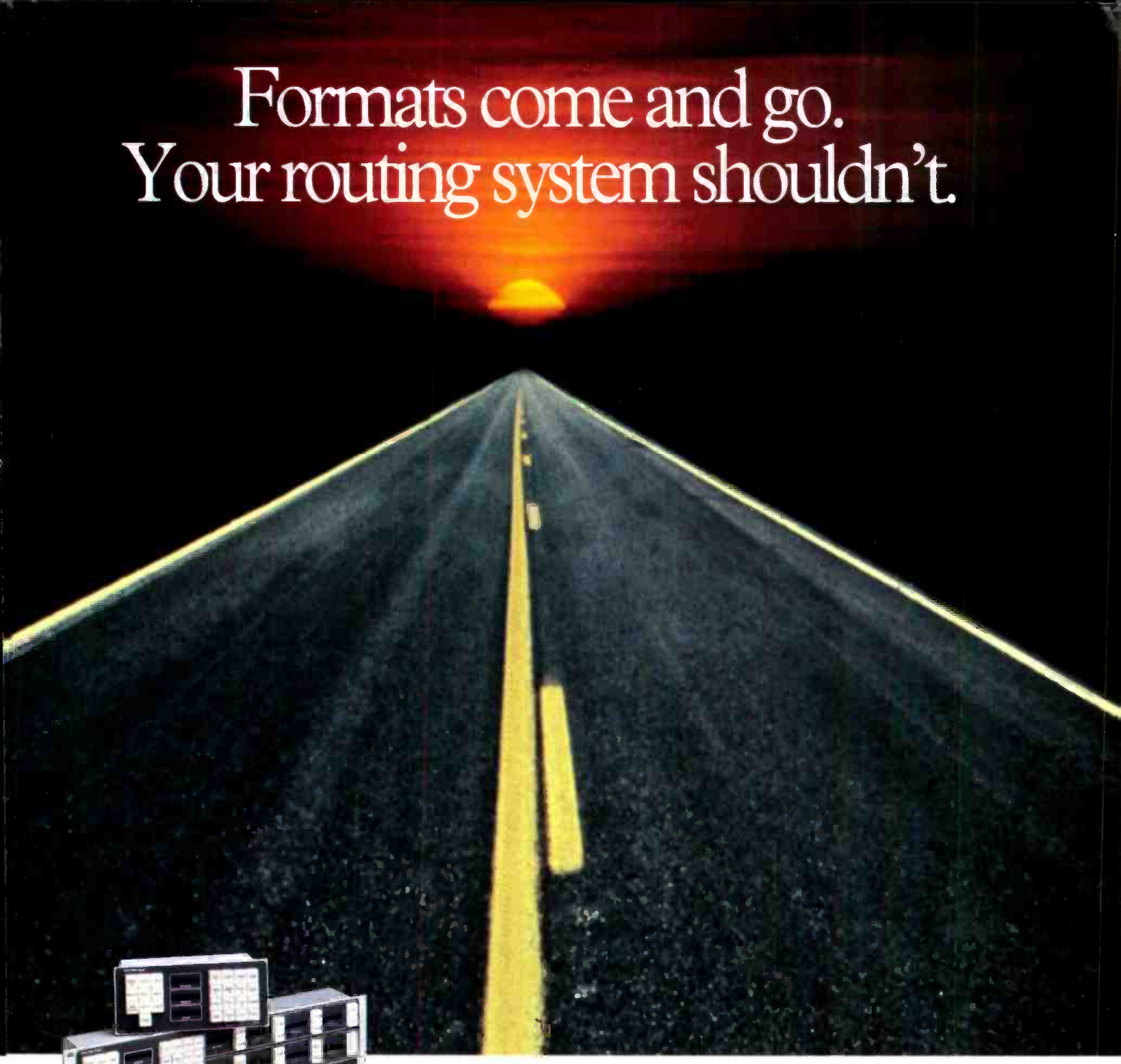

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Continued from page 4

sible systems that so many are seeking. Television, HDTV, HRI, graphics and image communications will at last be able to overcome many of the barriers to the free flow of material.

Tutorials supplement 134th SMPTE Technical Conference

The Society of Motion Picture and Television Engineers' (SMPTE) 134th Technical Conference, which will be held from Nov. 10-13 at the Metro Toronto Convention Center, is called "Images in Motion — The Second Century" and will be preceded by two concurrent and all-day tutorials.

"The Post Experience" will focus on the creative and technical aspects of post-production, such as electronic post-production and sound editing.

"Multimedia World" will give an overview of the multimedia business, including display, processing control and communications.

Through the conference itself, the program will feature approximately 90 technical papers that will explore methods of imaging and examine the future of technologies. The equipment exhibit will run concurrently.

Proceedings available for Advanced TV Conference

The Society of Motion Picture and Television Engineers (SMPTE) is offering a collection of Proceedings from the 26th annual Advanced Television and Electronic Imaging Conference, which was held on Feb. 7-8 in San Francisco. The book will contain 20 selected, unedited papers on the convergence of computers and video-audio technology, including topics such as motion imaging, networked mixed media computing, the role of the microcomputer in editing and graphics and digital HDTV.

McKinney, Hammett and Edison win engineering awards

James C. McKinney, chairman of the Advanced Television Systems Committee, has been named the recipient of the 1992 NAB TV Engineering Achievement Award. Robert Hammett and Edward Edison, of the San Francisco consulting firm, Hammett and Edison, have received the 1992 NAB Radio Engineering Achievement Award for developing several technical systems and techniques in radio broadcasting.

NAB releases report on TV ghost-canceling systems

The National Association of Broadcasters (NAB) field-tested the effectiveness of five different ghost-canceling systems and found that each one effectively reduced or eliminated the fuzzy, multiple images that can sometimes degrade TV reception. Philips Laboratories' system appeared to be the best performer, but field-test performances varied significantly among the systems and depended somewhat on the transmitting frequency, the type and complexity of the ghosting condition, and the received signal level. The other four systems that NAB measured were developed by AT&T/Zenith, the Broadcast Technology Association of Japan, the David Sarnoff Research Center/Thomson Consumer Electronics and Samsung Electronics. A technical subgroup of NAB's Advanced Television Task Force developed the field-test procedures.

The NAB conducted the field tests in the fall of 1991, using UHF and VHF TV stations in Washington, DC.

The goal is to develop a voluntary transmission standard that, in turn, would enable manufacturers to produce ghost-canceling equipment, allowing TV stations to provide ghost-free pictures to their local communities. ■

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NAB engineering conference preview

By Skip Pizzi, technical editor

Las Vegas once again prepares for the premier industry conclave.

The Bottom Line

There's no better place to do your 1-stop shopping for broadcast technology than the annual NAB show. Between the exhibit floor and the technical sessions, it's hard to avoid finding something new and useful for your facility. With the Las Vegas locale keeping expenses reasonable, the NAB convention provides a great overall value to the professional broadcaster. You don't have to get lucky on this trip to Vegas to come home a winner.

$

With its new face completed, the Las Vegas Convention Center (LVCC) will host the NAB 1992 Convention, April 12-16 (Sunday through Thursday). NAB's Broadcast Engineering, Radio Management and TV Management conferences will fill those five days, in addition to the NAB '92 Exhibition and the NAB HDTV World Conference and Exhibition both running April 13-16. Other related events include the Broadcast Education Association Convention, April 10-13, and the Broadcasters' Law and Regulation Conference, April 14-15.

Unlike last year's show, the entire NAB '92 exhibition will be held under one roof in the remodeled and expanded LVCC. More than 750 exhibitors will show their wares in 500,000 square feet of space. Radio/audio exhibits will occupy a self-contained exhibit in the new section of the hall. (See *Broadcast Engineering* magazine's exclusive exhibition floor map, included in this issue.) The HDTV conference and exhibits will be held in the Hilton Center, as in the past, with 16 exhibitors filling 16,000 square feet.

Conference highlights

Although no over-the-air digital radio demonstrations are planned for this year's show, some in-band format proponents plan demonstrations at their exhibition booths. Several important papers will also be presented on the subject at the Engineering Conference, including reports on NAB in-band interference tests, Canadian digital radio tests and the Japanese "St. GIGA" DBS service, along with updates from each of the digital radio format proponents.

Among the conference's TV sessions, highlights include ghost-canceling system test results, digital video, automation and interactivity. Other general-interest sessions will focus on broadcast regulation, maximizing coverage, reducing operational costs and international activities.

A full list of Engineering Conference papers as they stood at press time begins below. (See also the schedule for the HDTV World Conference on pg. 35.) To complete your NAB '92 pre-briefing, consult the exhibitor and new products listings that follow in this issue.

Engineering conference schedule

Sunday, April 12

Radio sessions

Digital Audio Systems
8:45 a.m. - 12:15 p.m.

- *Introduction to Digital Audio*, Larry Hinderks, Corporate Computer Systems.
- *Low-Cost Digital Audio Storage Using 3.5" Floppy Disks*, William Franklin, Fidelipac.
- *Digital Compact Cassette: The Audio Coding Technique*, Paul De Wit, Philips Consumer Electronics.
- *RF Design Considerations in the Development of a High-Spectral Efficient, Multichannel All-Digital STL*, R. Richard Bell, Dolby Laboratories.

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- *Digital Audio Interface*, Robert Weirather, Harris Broadcast Division.
- *Digital Audio Production in the CBC: Past, Present and Future*, Steve Lyman, Canadian Broadcasting Corporation.

Digital Audio Processing
1:15 - 5:00 p.m.

- *Developments, Standards and Implementation of Audio Test Standards for Compression*, John P. Stautner, AWARE.
- *Digital Audio Processing — Knee-Deep in the Hoopla!*, Frank Foti, Cutting Edge Technologies.
- *Digital Audio Processing for FM: System Considerations*, Robert Orban, Orban, a division of AKG Acoustics.
- *Broadcasting on the ISDN*, Steve Smythe, Hamish Eassie and Michael Smythe, Audio Processing Technology.
- *AC-2: High-Quality Audio Coding for Broadcasting and Storage*, Grant Davidson and Marina Bosi, Dolby Laboratories.
- *The Road from MASCAM via MUSICAM to ISO/MPEG Audio Layer II: Audio Coding for the '90s and Beyond*, Gerhard Stoll, Institut für Rundfunktechnik.

Television sessions

Television and New Technology
8:45 a.m. - 12:00 p.m.

- *Television Data System for Program Identification*, David K. Broberg, Mitsubishi Electronics America.
- *DBS for Local Broadcasters*, Norman D. Weinhouse, Space Systems/Loral.
- *ISDB (Integrated Services Digital Broadcasting), Transmission System in the 12GHz Digital Satellite Band*, Naoki Kawai, Toshiro Yoshimura and Eisuke Nakasu, NHK.
- *Results of Field Tests of Ghost-Canceling Systems for NTSC Television Broadcasting*, Lynn Claudy, NAB.
- *Ghost-Canceling Laboratory Tests and Computer Simulation Results*, Bernard Caron, Communications Research Centre.
- *An Overview of Ghost-Cancellation Reference Signals*, Stephen Herman, Philips Laboratories.

Interactive Video
1:15 - 4:05 p.m.

- *TV Answer*, Tom Friel, TV Answer.
- *The InTOUCH TV System, a Technology Description*, Thad A. Young, William C. Laumeister, Interactive Systems.
- *Interactive Network Production Processes for Interactive Television*, Thomas Kanady, Interactive Network.
- *Pay Per View — Video on Demand*, Jeff Roman, Jerrold Communications.
- *New Interactive Television Applications of T-Net*, Louis Martinez, Radio Telecom and Technology.

Other session

International Broadcasting
1:15 - 4:05 p.m.

- *WARC Report*, Ben Fisher, Fisher, Wayland, Cooper & Leader.
- *The European Broadcasting Union: Studies of Advanced Systems*, George Waters, EBU Technical Center.
- *The Asian-Pacific Broadcast Union Status Report*, ABU Technical Center representative.
- *Eurocrypt, A Successful Conditional Access System*, Vincent Lenoir, CCETT/SRL/ACS.
- *Digital Television Broadcasting Developments in Europe*, Terry Long, Independent Television Commission.

Monday, April 13

Radio sessions

Digital Audio Broadcast I
8:45 - 11:50 a.m.

- *Interference Tests for DAB in the FM Band*, Kenneth Springer, NAB.
- *The Current Context for Digital Radio: Climate, Opinion and Activities in the Industry*, Skip Pizzi & Robert Culver, Committee for Digital Radio Broadcasting.
- *Automotive Impact on DAB System Needs*, Mark Kady, Delco Electronics.
- *Canadian Eureka Test Results*, Stephen Edwards, Canadian Association of Broadcasters.
- *American Digital Report*, Edward A. Schober, P.E., Radiotechniques Engineering.
- *EMCEE Report*, Perry Spooner, EMCEE Broadcast Products.
- *Eureka Report*, Dr. George Plenge, Institut für Rundfunktechnik.

Digital Audio Broadcast II
1:15 - 4:35 p.m.

- *Digital Sound Broadcasting*, G. Chouinard & R. Voyer, Communications Research Centre.
- *SCI/LinCom Report*, Steve Kuh, LinCom.
- *Terrestrial Delivery of DAB*, Lloyd Englebrecht.
- *USA Digital Report*, Paul Donahue, Gannett Broadcasting.
- *Synetcom Report*, Etienne Resweber.
- Panel discussion. Judith Gross, moderator.

Television sessions

Video Production and Post-Production
8:45 - 11:55 a.m.

- *Building Technical Facilities for a New Generation of Graphics Production for "Entertainment Tonight,"* Robert B. Kisor, Paramount Pictures.
- *Moving Pictures on Air*, John Woodhouse & Bob Pank, Quantel.
- *Driving Toward PC-Based Post-Production*, Jon Sergneri, Autodesk.
- *Bridging Computer Graphics and High-Quality Video*, Danielle Forsyth, Tektronix Video Products Operation.
- *Fold It or Fix It: The Changing Face of Special Effects*, Martin Stein, Ampex.
- *Mobile Unit One...First Stop: 1992 Winter Olympics*, James Herschel, CBS.
- *A Producer's Guide to Digital Compositing — The Making of the Gloria Estefan Video*, Ron Fenster, Limelite Video.

UHF Transmission
8:45 - 11:55 a.m.

- *MSDC Klystron Field Performance*, Earl McCune, Varian Microwave Tube Products.
- *A Technical Description of the IOT-Equipped Transmitter and First-Year Operating Results*, Nat S. Ostroff, Comark.
- *Some Exciting Adventures in the IOT Business*, Geoff Clayworth, H.P. Bolen & R. Heppinstall, EEV.
- *Using Tetrode Power Amplifiers in High-Power UHF TV Transmitters*, Joseph Wozniak, Acrodyne Industries.
- *Upgrading UHF Transmission Lines and Antennas — Two Case Studies*, Kerry Cozad, Andrew Corporation.
- *Broadband UHF TV Combiners for the Australian Equalization Program*, Jim Stenberg, Passive Power Products.
- *UHF All-Band Antennas and Components for the 21st Century*, Dennis Heymans, Micro Communications.

Television Automation
1:15 - 4:35 p.m.

- *What is Broadcast Automation?*, George L. Fullerton, Louth Automation.
- *Robotic Camera Pedestals for News at CBS-New York*, Darcy Antonellis, CBS.
- *Camera Automation at WJZ-TV*, Richard

Seaby, WJZ-TV.
- *The ATTC Laboratory Automation System*, Scott E. Hamilton, Advanced Television Test Center.
- Panel discussion: *Implementing Automation — Practical Hints for Planning the Project*, Gerald Robinson, Hearst Broadcasting, moderator.

Other session

Maximizing Broadcast Signal Coverage
1:15 - 5:15 p.m.
- *Communications Engineering Tutorial*, Richard L. Biby, P.E., Communications Engineering Services.
- *Mounting Your Television Broadcast Antenna for Optimum Reception and Costs*, Kerry Cozad, Andrew Corporation.
- *Analysis of FM Booster System Considerations*, Stanley Salek, Hammett & Edison.
- *The Mount Diablo Booster System*, Bill Ruck, KFOG/KNBR.
- *Increasing FM Coverage While Reducing Rooftop EMI Exposure*, Tom Silliman, ERI.
- *Optimization of VHF Power and Antenna Combinations*, Karl Lahm, Lahm, Suffa & Cavell.
- *A New Multichannel Community Antenna for FM Broadcast*, Ali R. Mahnad, Ph.D.E.E., Jampro Antennas.
- *A New High-Powered Solid-State Transmitter*, Hilmer Swanson, Harris Broadcast Division.

Tuesday, April 14 (SBE Day)

Radio session

Coping with New Technology
8:45 - 11:30 a.m.
- *Radio in the 1990s: Challenges and Opportunities*, Brad Dick, *Broadcast Engineering* magazine.
- *Digital Cable Audio: When and Where*, Don Lockett, National Public Radio.
- *The Expanding Role of DSP in Audio Technology*, Michael Collins, Motorola.
- *Improving Transmitter Performance Through Class E Operation*, David Cripe, Broadcast Electronics.
- *The Dependence of AM Stereo Separation on Transmitter Load Phase*, Jerry Westberg, consultant.

Television session

Coping with New Technology
8:45 - 11:30 a.m.
- *Television: Where has all the Money Gone?*, Jerry Whitaker, technical writer.
- *Enterprise-Wide Automation*, Bob Paulson, AVP Communications.
- *A Case History: Master Control Automation*, Marvin Born, WBNS-TV.
- *Basics of Digital Video Compression*, Carl Ostrom, Systems Resources.
- *NASA: Applying New Technology Today*, Thomas J. Bentson, NASA.

Other session

Broadcasters' Rules of the Road
12:45 - 5:00 p.m.
- *FCC Enforcement Efforts: Not Business as Usual Anymore*, Richard Smith, FCC Field Operations Bureau.
- *Beta Testing: a Self-Inspection Program*, Jim Zoulek, FCC Los Angeles Field Office.
- *Changes in Structural Standards for Communications Towers*, John Windle, Stainless.
- *New Issues Facing Frequency Coordination*, Richard Rudman, chair, SBE Frequency Coordination Task Force.
- *The SAGE I System for EBS*, Jerry LeBow, SAGE Alerting Systems.
- *The Future for EBS*, Bill Ruck, KFOG/KNBR.
- *WARC-'92: What is it and Why Should I Care?*, John Reiser, FCC.
- Panel discussion: *Dealing with a Changing World*, Dane Ericksen, Hammett & Edison, moderator.

SBE Certification Exams
2:00 - 5:00 p.m.

SBE Chapter Chairs Meeting
3:00 p.m.

SBE Membership Meeting
5:00 - 5:30 p.m.

Wednesday, April 15

Radio session

AM and FM Improvement
8:45 - 11:30 a.m.
- *The Denon/NAB SuperRadio*, Robert Heiblim, Denon USA.
- *FM Technical Study*, Karl Lahm, Lahm, Suffa & Cavell.
- *RDS Technical Update*, Dietmar Kopitz, EBU.
- *Improving the IM Distortion Characteristic of Your Present AM Transmitter*, Tim Cutforth, P.E., Vir James Broadcast Engineering Consultants.
- *Optimization of FM Performance by Tuning for Symmetrical Group Delay*, Geoffrey N. Mendenhall, P.E., Broadcast Electronics.
- *The Towers Industrial Park Project at KTNQ*, Ogden Prestholdt, P.E., consulting engineer.

Television session

Digital Television
8:45 - 11:30 a.m.
- *Signal Distribution and Processing in a Serial Digital World*, Marc Walker, BTS Broadcast Television Systems.
- *A Totally Digitized In-House NTSC Routing Switcher System*, Takeo Tsutsui & Masatoshi Yorozu, NHK.
- *Digital Noise-Reduction Techniques*, David E. Acker, FOR A Corporation of America.
- *Compressed Digital Video: A Technology Overview*, Tom Lookabaugh, Compression Laboratories.
- *A Networking Solution for Still-Stores and Graphics*, Bob Pank, Quantel.
- *A Still-Animation File System Employing a Video Solid Recorder*, Takayuki Tanaka, Toshiyuki Sakamoto & Hisashi

Other session

Reducing Station Operating Costs
1:15 - 5:00 p.m.
- *How to Bargain with the Power Company and Other Methods to Reduce Power Costs*, Patrick J. O'Hare, Cost Analysis.
- *How to Get the Most Out of Telephone and Data Services*, Steve Pilling, Telecom Consultants.
- *How to Obtain the Greatest Number of Tube Life Hours*, John Sullivan, Econco.
- *Demand-Side Energy Management*, John Jensen, Kinetech.
- Panel discussion. Dennis Ciapura, Noble Broadcasting, moderator.

Thursday, April 16

Workshops

Fiber-Optic Workshop
8:45 - 11:55 a.m.
- *Fiber Optics and its Application to Broadcasting*, J. Repi, AT&T Network Cable Systems Services.

Camera Workshop
8:45 - 10:30 a.m.
- *How to Obtain the Best Performance from Your Camera*, Fred Himmelfarb, Panasonic.

FAA/FCC Workshop
8:45 - 10:30 a.m.
- Participants: David Morse, FAA; Richard Smith, FCC; Edward W. Hummers, Jr., Fletcher, Herald & Hildrith.

Satellite Uplink Workshop
10:35 a.m. - 12:00 p.m.
- Presenter: Norman Weinhouse, Norman Weinhouse & Associates.

Contract Engineers Workshop
10:35 a.m. - 12:00 p.m.
- Participants: John Bisset, Multiphase Consulting; Mark Persons, M.W. Persons Associates; Mike Patton, Mike Patton & Associates; Grady Moates, Loud and Clean.

Continued on page 35

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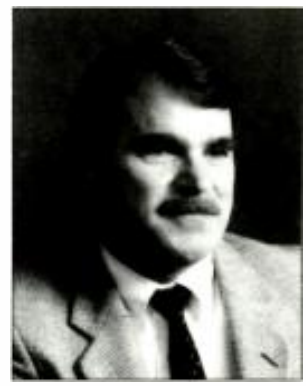

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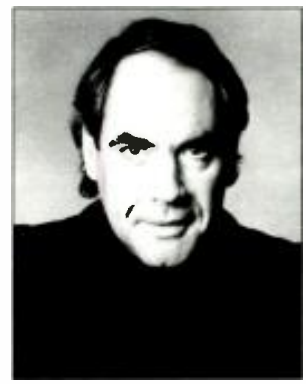

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Continued from page 32

1992 NAB HDTV World Conference Schedule

Monday, April 13

Opening Ceremonies
9:00 - 10:00 a.m.

HDTV Production Techniques
10:00 a.m. - 12:00 p.m.
- Experienced producers and experts discuss film and video techniques for HDTV program production.

HDTV Audio and Ancillary Services
10:00 a.m. - 12:15 p.m.
- Sound and data transmission and presentation techniques for HDTV systems are suggested.

HDTV: Getting It On the Air
2:00 - 5:00 p.m.
- Both technical and economic facts of HDTV life are considered, including smaller market realities. A panel discussion concludes the session.

HDTV Programming I
2:00 - 5:00 p.m.
- A screening of eight European HDTV productions.

Tuesday, April 14

HDTV Programming II
9:00 a.m. - 12:00 p.m.
- Six HDTV productions from around the world are shown, including Japanese coverage of the Winter Olympics and a solar eclipse.

Digital HDTV Tutorial
9:00 - 9:30 a.m.
- This presentation familiarizes a primarily technical audience with digital techniques used in the ATV proponent systems.

HDTV Proponent Systems (Technical)
9:30 a.m. - 12:00 p.m.
- HDTV format proponents present technical descriptions and updates on their systems.

1991 Montreaux Electronic Cinema Festival: HDTV Winners
2:00 - 5:00 p.m.
- Screening of the award-winning entries from this international competition.

Advanced Television Equipment
2:00 - 5:00 p.m.
- Consideration of a variety of HDTV and EDTV production. transmission and conversion hardware.

1992 HDTV Assessment
2:00 - 3:15 p.m.
- A panel of leaders in ATV R&D and regulation discuss technical and regulatory developments and assess their potential impact.

HDTV Proponent Summary
3:15 - 3:45 p.m.
- A non-technical summary of the concepts and approaches taken by each ATV broadcast format proponent.

Continued on page 186

Facility design special report

You don't have to reinvent the wheel when it comes to redesigning or renovating your facility. Just ask the experts.

Today's broadcast and production facilities are more sophisticated than ever. For the past 20 years, technical managers have dedicated their efforts to improving the electronic hardware. However, it's only been in recent years that the acoustic environment of these rooms has received similar attention.

Part of the reason for today's attention to room acoustics lies in the improved signal-processing equipment that is available. Listeners can now hear room noise, air-conditioning rumble or noisy equipment every time a microphone is open.

Video producers aren't off the hook either. Large screen televisions and high-quality 27-inch monitors provide the viewer with more opportunity to critically judge your product. Inferior video images can be quickly identified. This means if your video isn't as good as the station's across town, you could be costing your company money.

This special report addresses the important issues of studio design. We will begin by looking at how serial digital video can be effectively implemented to give your facility that competitive edge. In "Building a Serial Component Facility" you'll see how one post-production company used serial technology to gain the technological advantage for its clients.

Broadcast facilities today seldom build new spaces from the ground up. Instead, existing buildings have to be modified to accommodate the new high-tech users. This often is indicative of trying to fit square pegs into round holes. "Adaptive Reuse: Fitting a Square Peg Into a Round Hole" outlines how two stations were able to effectively surmount the limitations of an existing structure when rebuilding their facilities.

Time is money, and that applies to studio construction. A broadcaster or production house cannot afford to be off the air or out of service while the new spaces are constructed. This means that the new studios must be built quickly and cost effectively. "Building With Modular Studios" illustrates the use of a construction technique that can reduce construction time and may even save you money.

Engineering myths are like rumors, difficult to trace and impossible to eliminate. Fortunately, the article, "Exposing Acoustical Myths," does just that. Before you undertake that new studio project, see just how many of your "facts" are really myths that could cost you money and jeopardize the quality from your facility.

"Planning for Serial Digital Video" details a design scenario for moving into the digital video domain. If you're not planning now for serial digital video, you're already behind the learning curve. Catch up fast with this tutorial feature.

Finally, the article, "The Transition Process: Getting From A to D," outlines the evolution from the analog to digital domain within the video production environment. This move is no longer an option. It will happen. The only question is will you be ready?

Brad Dick

Brad Dick, editor

Building a serial component facility

By Philip Mendelson

Designing a component digital facility requires a new set of rules and presents some interesting, sometimes costly, challenges.

The Bottom Line

It is now the age of serial digital. Facility-wide digital interconnection is now feasible. However, rushing pell-mell into massive serial digitization is hardly the answer. If nothing else, the cost is prohibitive. What is needed is a methodical approach to serial digital. This article details the approach whereby one facility has obtained the benefits of serial while avoiding many of the pitfalls.

The D-1 format component digital tape machine was introduced five years ago. At the time, it was difficult to consider it as much more than an island in a predominantly analog facility. As 4:2:2 signal processors and switchers became available, such treatment was still inevitable. Bit parallel interface was still the norm, and cable length restrictions limited the scope of such a plant.

The Digital Magic facility in Santa Monica, CA, is a component digital (4:2:2) video studio. The facility was designed for visual effects and compositing work for television and film, as well as for more traditional styles of editing, graphics and film transfer. Construction of a successful 4:2:2 facility requires special attention to several areas. This article highlights some of the difficulties that must be overcome.

Mendelson is vice president of engineering, Digital Magic, Santa Monica, CA.

New Bushido

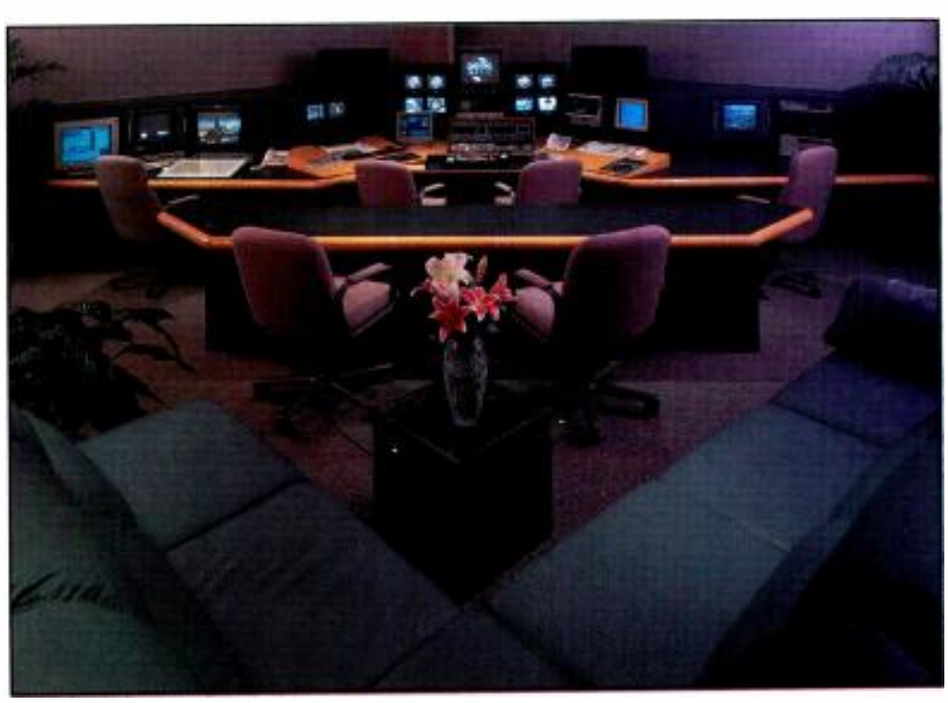
Compared to the design of conventional video facilities, digital interface and processing requires a new set of rules. In a 4:2:2 facility the signals are not composite; they are component.

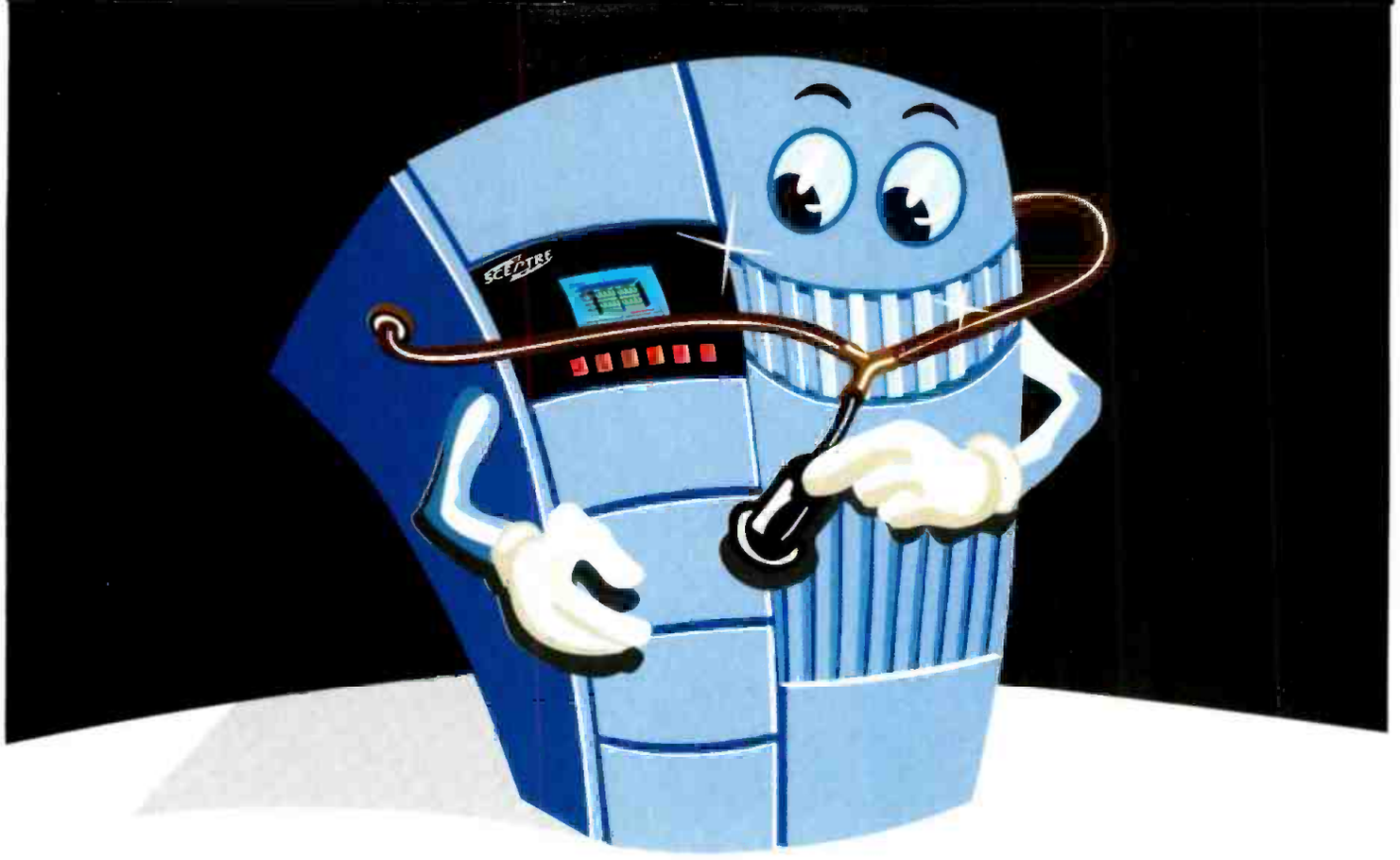
Special issues include:

- The cost for parallel-to-serial conversion equipment.
- The need for greater care in wiring and cabling.
- The special timing constraints of a digital facility.
- The unique monitoring difficulties faced in a digital facility.

Digital signal processing is largely a bit parallel operation. The *native* I/O format of 4:2:2 equipment is thus parallel. Serial I/O is still an option but often a costly one.

Continued on page 42





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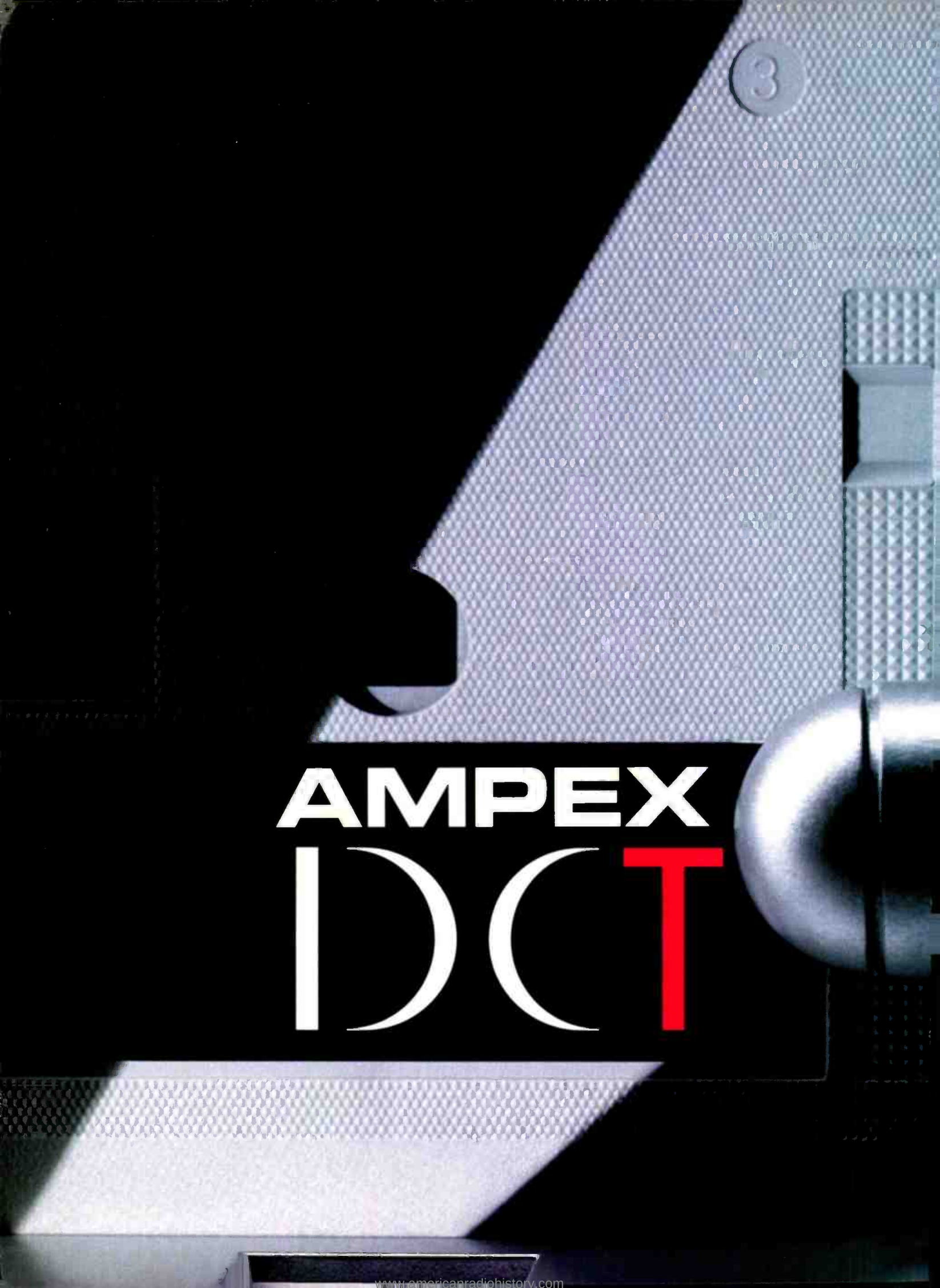

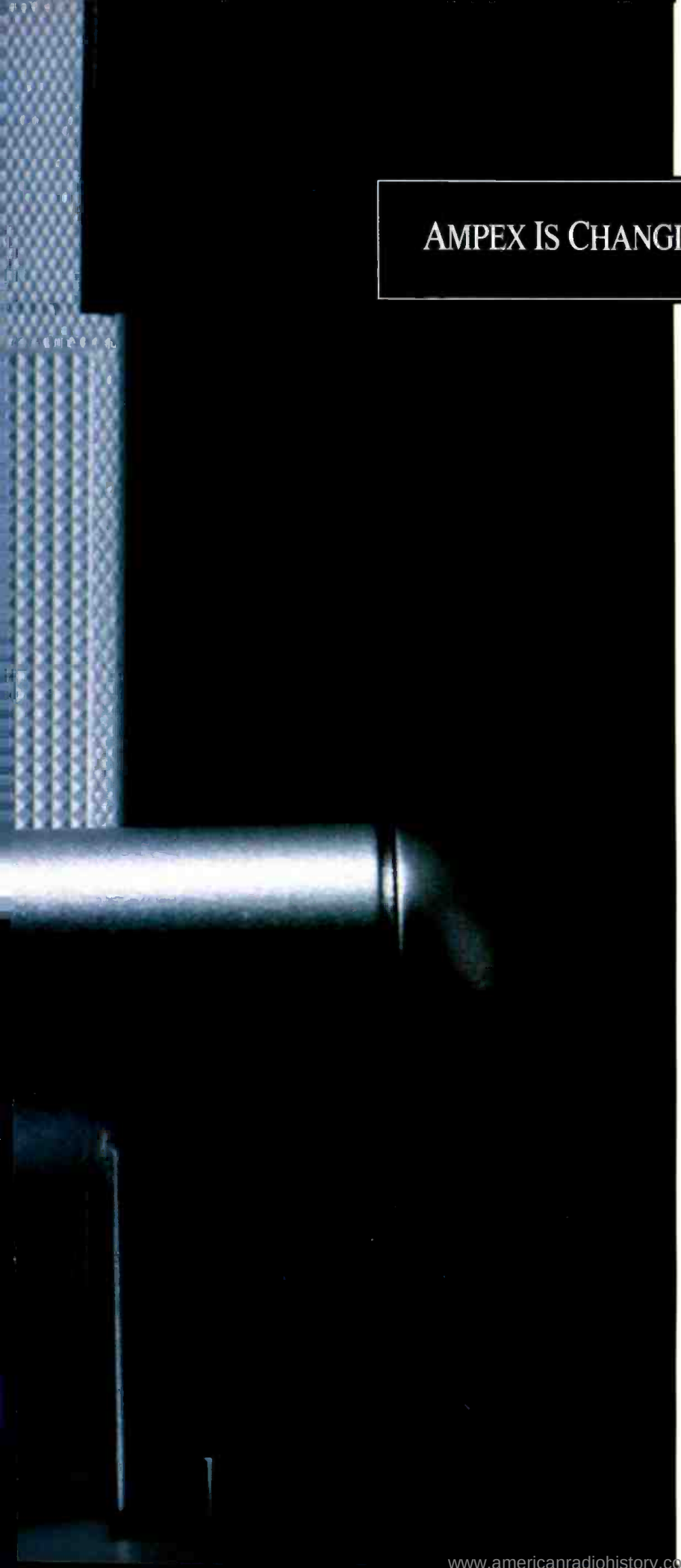

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Continued from page 38

New equipment, such as serial codecs and new digital/analog transcoders, have finally made it viable to integrate 4:2:2 building blocks into a cohesive plant design.

The serial/parallel cost trade-off

To start, the cheapest way to hook together two 4:2:2 devices is with a piece of 25 conductor cable fitted with DB-25 connectors. This costs approximately $50. Unfortunately, cable length is restricted. This is because individual conductors in the cable may have unequal lengths or characteristics. This may lead to data corruption due to cable-induced data and clock skew.

An average price for a single-ended codec, which converts parallel 4:2:2 information to a serial datastream, is about $750. It's double that for a complete conversion. Looking at the figures makes it obvious that serial conversion for its own sake is absurd. Nevertheless, in most situations serial makes sense. The secret may be to build a hybrid system that uses serial when it's necessary but captures the cost advantages of parallel.

In the case of the Digital Magic facility, the main routing and distribution hub is at the center of an 'L'-shaped machine room that is 225 feet long. It was clear that serial distribution would be required for the system to operate reliably. It was also clear that some sources did not require and would not benefit from global distribution. This equipment was located close together and connected with parallel cables of 25 feet or less.

This also comes perilously close to dedicating a piece of equipment to a given suite or function. Dedicated equipment implies a lack of flexibility. A middle ground was reached by mounting core equipment that requires little operator access (DVE, switcher frames and disc recorders) in a physically confined area. This keeps most of the fan noise and heat-generating equipment away from the mainstream.

Until all digital equipment is supplied with serial I/O without extra cost, it remains prudent to consider the aforementioned compromise. Hopefully even then, parallel I/O will at least remain an option. This will prevent existing parallel facilities from being forced to undergo costly revisions prematurely.

So what is the right mix? In this facility, the balance is heavily serial. Half of the 12 video inputs per switcher employ deserializers. All of the switcher outputs are simultaneously serial and parallel. All DVE and disc recorder feeds are serial. All tape, disc recorder, and suite outputs, as well as switcher aux sends, are serial.

Only those sources that will likely remain local and dedicated, such as still-stores and DVE outputs, are parallel. To preserve flexibility, custom patch panels were built with DB-25 shielded connectors. All the normals consist of 4-inch lengths of ribbon cable terminated with high-quality crimp connectors.

Routing and distribution

With the arrival of serial digital routing switchers has come a debate about what these switchers should do. Should these devices provide reclocking? Cable equalization? Waveshaping?

Cable equalization is a given. It must be possible to employ several hundred meters of cable without worrying about transmission errors occurring.

The need for data reclocking is not so apparent. The primary argument for reclocking is that it prevents the build-up of jitter-based errors, especially in multiple passes of an unconditioned signal through a switch.

In this facility, cable lengths reach a maximum of 150 feet. In serial video terms, this is a comparatively short run. In addition, examination of source and destination equipment showed that the

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data is invariably reconstructed. Multiple unconditioned passes through the routing switcher will not occur. For this reason, the facility took a more basic approach. We purchased a 400MHz equalizing switch *with no data reclocking*. When fully configured, this switch will be 96×96 in size. So far, there have been no problems with jitter or data recovery.

As future needs change, localized parallel distribution can be upgraded on a piecemeal basis to serial, and the existing serial system will be transparent to embedded digital audio.

Serial precautions

One potential danger in approaching the use of serial I/O is the temptation to treat it as you would treat analog video. True, it is possible to use standard 8281 type coax (even though this is a 270m/bits/s bitstream). Users must be careful, however, to treat the serial signal as the RF signal that it is. Although some tests have shown serial to be robust, use good impedance-matching and bandwidth practices when wiring a facility.

For instance, many video facilities have for years gotten away with using 50Ω patching and cable termination hardware. A typical source will travel through six or more connection points (from the patch panel normal through the router, through another normal and to the destination). A little RF theory tells us to avoid this many impedance mismatches. For a slightly additional cost a facility can use 600MHz bandwidth-rated patch panels and true 75Ω BNC connectors.

Timing considerations

The 4:2:2 environment simplifies facility timing. *Zero timing* is no longer necessary or even meaningful. Most digital devices use full-frame window input synchronization. As long as there are no analog switcher crosspoints, timing is not a consideration.

A further timing advantage of the 4:2:2 environment is that all outputs from the digital switchers are synchronized, including aux sends. These switcher aux sends can be used as the source selectors to peripheral equipment. This ensures that inputs to devices with narrow input locking windows (some DVEs and disc recorders) will always be in time relative to each other and to system reference.

The 4:2:2 environment also eliminates the need for color framing. Component video requires no colorburst reference or subcarrier. Edits can be made without concern for these relationships. This is one reason that this facility will usually edit to D-1, even if output to a composite digital or analog format will eventually be required.

Devices, such as analog VTRs, Ultimattes, monitoring equipment and bridge transcoders for interformat conversion still require a great deal of analog component and composite signal distribution. However, timing is simplified, because most analog destinations do not require timed sources. (An analog VTR, for instance, will lock itself to the incoming video.)

The input frame buffering that allows most 4:2:2 equipment to be self-timing may also cause an undesirable side effect. A typical path from source, through the switcher and to the record device, can have a 1- or 2-frame delay. Interformat converters, such as a transcoder from a 1-inch machine, and switcher inputs can add another two frames of delay. This can wreak havoc on the timing integrity of audio and time code.

Fortunately, in effects work, this is not an every day problem because not much audio work is done. In an edit session, sophisticated EDL management software can remedy the problem by trimming the edit. Because audio mixing and editing is in the digital domain, audio delay units can easily be inserted into the path. If time code must be compensated for, say in dub-

Continued on page 48

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Continued from page 44
bing, then audio delay units can be routed in as well.

Conversion factors

It is worth noting that it is component analog video (CAV) that ties some of this together. For now, the telecine and color corrector are CAV devices. The advantage of the Y, R-Y, B-Y component system over the more traditional RGB is that it offers 3-wire operation (sync is on luminance). This means there is less susceptibility to gain errors. In addition, a composite luminance signal can be used as a monitor feed or in a digital conversion where only a monochrome signal is required. The facility has standardized on the SMPTE format because it accommodates greater chroma excursions and uses a luminance signal with no setup.

Do not overlook the importance of the transcoder. Be aware of the device's limitations. The process of digital transcoding between NTSC/PAL and component formats involves, among other things, filtering, sample-rate conversion and scaling.

Analog and digital encoders/decoders use similar filtering. Filtering modes are usually selectable. Selection of trap, comb or time domain depends on the program material.

Sample-rate conversion is similar to standards conversion. The signal is mathematically reconstructed from the samples on hand, and new samples at the new rate are created.

An example of scaling is the conversion of 4:2:2 to 4fs (D-1 to D-2 or D-3). (See Figure 1.) A luminance signal represented by codes spanning between 16 and 235 must be scaled to fit a signal spanning codes between 60 and 200. This translation is no trivial matter. A look at a shallow ramp passed through the transcoder will tell you a lot about how well it is doing its job.

The scaling process is complicated by the fact that the transcoder will also usually add setup to the signal. In a compositing environment, it is crucial that the device be capable of providing variable setup levels, including negative black. This is often needed to provide enough keying range. The 4:2:2 format places base line at digital code 16, thus allowing negative excursions of almost eight IRE units.

Clearly the choice of transcoder must be made with a keen eye. Filtering and scaling techniques vary. Currently, the price of various transcoders can vary over a 3:1 range, depending on the desired functions. In this facility, original 4:2:2 elements are used whenever possible. When it is not, there is a pool of transcoders that can be selected from to find one that best meets the project's needs.

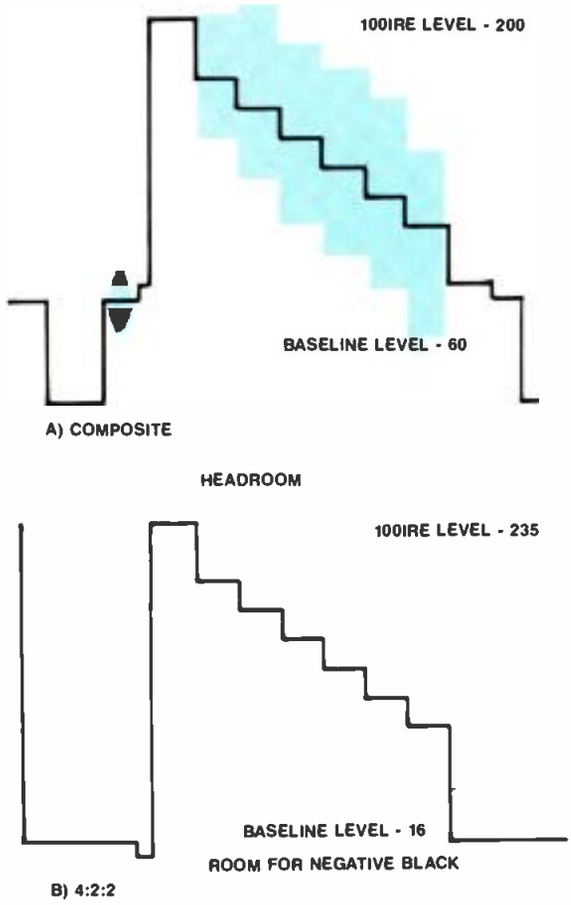

Figure 1. *Quantization systems for composite video signals (a) must reserve a range of values to represent active video. Component video (b) uses two reserved codes for sync. This leaves more values free to represent active video.*

Recording format limitations

Today's digital tape machines and disc recorders have limited word length. Although the signal format and data path can use a 10-bit word, the D-1 format records only eight bits of data in each chrominance and luminance channel. This can sometimes cause picture degradation in graduated backgrounds where the luminance or chrominance gently ramps. Small words (i.e., eight bits or less) will tend to produce banding because the bit transitions are too coarse. It is important to select the appropriate rounding or truncation process in upstream processing to minimize the degradation. (See Figure 2.)

Keep in mind, however, that the D-2 and D-3 formats may have objectionable artifacts of their own. These composite formats must reserve some of their dynamic range for the sync interval and negative subcarrier excursions. This results in reduced quantization levels available for active video. Furthermore, the encoding and decoding process by which luminance and chrominance are added prior to digitization must be extremely clean. It is still possible to find video equipment that performs luminance and chrominance separations using a simple notch filter. Digitizing a signal that has already been contaminated with encoding artifacts, such as dot crawl, accomplishes little.

It is likely that as the technology matures and costs continue to lower, new disc and tape formats will appear that will use the full capabilities of the digital signal.

The compositing process

Much has been written about the D-1 tape format. Over the years since its introduction, its idiosyncrasies have become well understood. The format is likely as error-prone as any other digital tape format. Errors, even if they are covered by concealment systems, can accumulate over many successive generations, causing subtle artifacts, such as texturing. Image degradations can build over multiple generations. This is, of course, dependent on media quality and the condition of the machine's heads.

Some multilayer compositing work may require numbers of passes that exceed the acceptable margin of the D-1 format. This makes the disc recorder an important medium. Using a disc recorder with a digital interface allows nearly unlimited data passes, with no accumulation of errors. Typically, source material from D-1 or any other format is *cached* to two or more disc recorders for editing.

In recent months, the dollar/megabyte cost of disc storage has been tumbling. Although this has made it possible to handle larger segments, this process is most often used for short segments (two

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minutes or less).

Monitoring and quality control

All technical quality control (QC) stations in this facility have a digital router destination and digital monitoring. This allows operators to check the signal at any point, without concern for NTSC conversion artifacts that might occur if an analog monitor was used.

Today's digital monitors are not always truly digital. Instead, they are often analog monitors containing encapsulated D-to-A converters. This may increase the cost, but it prevents analog cable losses between decoder (D to A) and monitor.

In addition, the technical QC stations provide component and composite analog monitoring. This allows all analog sources to be monitored in their native format.

It must also be possible to look at these decoded signals with scopes. For this reason, the facility selected digital monitors that provide decoded component analog outputs. A properly adjusted monitor will provide a reliable and accurate component waveform and vector display feed.

Waveform monitoring to check bitstream integrity, such as eye pattern measurements, is considered an engineering function, and it is performed with a lab scope.

Component monitoring instruments present some new challenges to operators and engineers familiar only with composite analog video. They also cost more. The operator learning curve is quite fast, however, and there seems to be no substitute for the ability to monitor a signal in its purest form. Doing so eliminates confusion as to where a given artifact or glitch originates. This can minimize troubleshooting and downtime.

All suites use digital monitoring as well, with scopes fed in a similar manner. The monitors are fed digital preview data and encoded composite inputs. This meets the dual monitoring needs of the operator. It is essential, in compositing work, to be able to see an artifact-free image. It is also essential to see how the image will fare in its eventual NTSC state. Nothing can demoralize a client more than to have spent several days working with a pristine composite image only to see it fall apart at the final stage. Frequent real world comparisons help avoid this occurrence.

In recent years the power of digital video processing has increased substantially. Early attempts at digital keyers produced sharp, razor-like keys that looked quite unnatural. Current-generation equipment is capable of producing natural and artifact-free video compositions. As this format has evolved, it has supplied us with the tools we need to seize the advantages of working exclusively in the digital domain. And as its evolution continues, it will offer us new tools that will likely surpass even the best of what is available today.

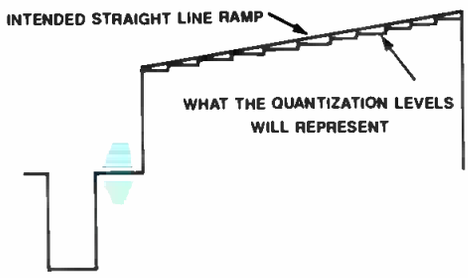

Figure 2. *An example of one effect of insufficient quantization levels. Shallow ramping signals may show contouring under certain conditions.*

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Building with modular studios

Alfred W. D'Alessio

In today's studio construction, "prefab" is no longer a dirty word.

The Bottom Line

The special requirements of acoustical spaces make studio design and construction into time-consuming and expensive processes. Yet this may not always be necessary. In many cases, "off-the-shelf" prefabricated room modules can provide equivalent and more predictable acoustical results, at lower cost and with quicker installation than conventional construction. These methods may make the difference that puts state-of-the-art facilities within a station's reach.

Does your station need the acoustics to match today's audio standards? The answer depends on your station's programming and operations. True, a leather-lunged DJ blasting into a quivering microphone a quarter-inch from his lips at a 50kW rocker could do just fine from a typewriter stand in the traffic department. But how long would the president of the stock brokerage firm upstairs stand the pulsating bass from the monitor speakers which, acoustically speaking, are hanging from the feet of his desk?

Does the same control room that sounds fine during afternoon drive become the sonic equivalent of a 55-gallon drum when you open four mics for the morning zoo? And what about all that pumping and breathing you get every time the PD asks for another decibel of processing? Is it the gear or the control room acoustics sucking the lint out of the carpet pads between every word?

Or perhaps you can't realize a full return on the equipment investment your station has made in the production room because the sound from its monitors leaks into the air control room (or vice versa) and limits its operation. A few minutes spent listening to your station on a "walkman"-style receiver may reveal scores of other acoustical problems that aren't obvious on a table radio.

Continued on page 56

D'Alessio is president of Northeastern Communications Concepts, New York.

The modular installation of a control room and studio at WQXR, New York, shows that asymmetrical geometry and aesthetic interior acoustic finishes can both be accommodated.

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Continued from page 52

Tuning vs. isolation

Regardless of your format, you'll need to pay some attention to acoustical detail if you're planning a new facility or an addition to an existing one. At some point you'll have to establish a ratio between the money you'll spend on *noise control and isolation* vs. that which you'll allocate for *room tuning and sound absorption*. The sum total will depend on how close you want your studio productions to rival CD technology, with the amount you put toward noise control being final. If noise control isn't done correctly the first time, there's no "fixing it in the mix" as there might be with additional tuning and absorbing materials. So think seriously about getting noise control under control right from the start.

It is important to recognize the distinction between acoustical tuning and noise control. The materials commonly associated with an acoustical property, such as mineral tile ceilings or urethane and fiber glass wall panels have virtually no sound *isolating* properties. They are used almost exclusively to control the sound decay rate or reverberation time within a given space, hence their designation as *acoustical treatment* or *tuning* materials.

On the other hand, the construction methods and products used to keep sound from traveling from your production control room to your on-air studio or the office suite upstairs are defined as *noise control* or *isolation*. These are the same principles that are employed to keep street traffic, office and air-conditioning noise or flushing toilets from getting on the air. Concrete, brick, block, gypsum board, glass, lead, neoprene, springs and caulking compounds dominate the shopping list for minimizing the propagation of noise between spaces.

Most of the published information on noise control subliminally suggests that you write a blank check for the construction budget to cover the costs of designing, documenting and building overly complicated structures. The basis for these designs is sometimes more anecdotal than scientific, and the effectiveness of the final product often relies more on the work of a contractor than on the intended design.

Where the money goes

The challenge facing today's acousticians goes beyond creating studio and control rooms that rival the accuracy and dynamic range of the common CD. In broadcasting especially, this kind of construction must be accomplished efficiently and affordably.

Along those lines, one school of contemporary acoustical thinking holds that it's no more appropriate to custom design and build noise isolation for your project than it is to custom design and build a digital workstation for your production room. Yet that's how most stations are still built. By using laboratory-tested, prefabricated noise and vibration control modules, a station might save a sizable amount on consultant's and contractor's fees. These dollars could then be spent where the result can be more widely appreciated — on better equipment and acoustical room tuning.

The prefabricated concept is not a new idea. Originally developed in the early 1950s for controlling industrial noise, it found initial application in the film industry and sporadically appeared on budget, fast-track audio projects. Until recently, it was not taken seriously by mainstream studio designers. Nowadays, when seeking the maximum acoustical bang for the project buck, the modular prefab approach deserves a look.

Ugly and expensive

Despite the fact that even the earliest attempts at manufacturing prefabricated modules yielded a high degree of acoustical performance, the technology remained obscure.

Some acoustical consultants viewed prefabricated modules as a threat to their existence and therefore did little to promote the technology. Yet the limiting factor on an acoustical consultant's involvement in a project is usually the client's budget, not the consultant's ability. For this reason, other studio designers began taking a different approach: rather than spending a client's time and money designing isolation structures, these consultants focused their attention on other matters that *had* to be custom-designed for each job and used prefabricated acoustical isolation modules wherever else they could.

The consultants' expertise was then exercised where its value to the client was highest — in the realm of acoustical tuning and treatment of rooms. The bulk of the client's sound isolation needs could come "off the shelf," with only modest assistance from the consultant.

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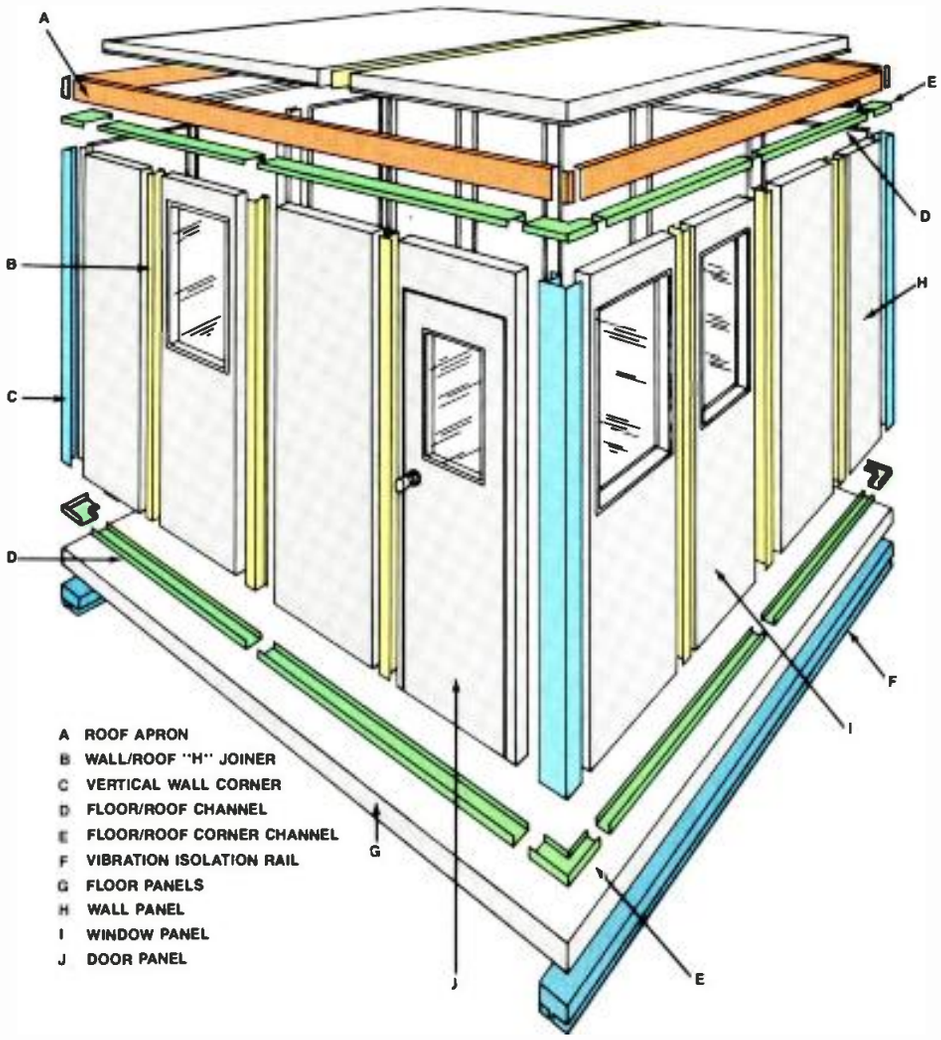

Figure 1. *Exploded pictorial view of a typical modular room. Floor panels (G) are usually of tongue-in-groove design. Floor/roof channels (D), corner channels (E) and joiners (B) are all precut to size. Some manufacturers use tongue-and-groove for wall panels as well, thus eliminating joiners. (Courtesy of Acoustic Systems.)*

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Design vs. execution

Acoustical consultants have always had to rely heavily on proper construction of their isolation-system designs. If a consultant doesn't spend a lot of time supervising the construction of site-built sound and vibration structures, the designs likely won't perform as expected. The most experienced contractors will often miss the acoustical importance of building rooms that stop just short of being waterproof, gas-tight and structurally isolated, as proper studio construction typically requires.

Besides playing watchdog, some consultants resort to overdesign as a hedge against the acoustical deterioration that can result from hidden construction errors. Either of those approaches can increase the final cost of the project.

On studio projects where no acoustical consultant is retained, things can really get out of hand. In acoustical design, a little knowledge isn't just a dangerous thing — it can be your worst nightmare. Lacking the experience to separate the real from the anecdotal, most of these "cookbook" endeavors fall prey to experiment, resulting in ineffectiveness and waste. (There are probably more STC-40$_1$ doors derating STC-60 partitions out there than there are pits in a CD.)

Instead of agonizing over getting their work properly built by a contractor whose only concept of a studio comes from watching reruns of *WKRP in Cincinnati*, some acoustical consultants have taken a second look at modular rooms, analyzing their properties, cost and potential. In many cases, they have found them to be superior.

Rules of the prefab game

Modular components are as ugly today as they were in 1955, bringing up the first of three important design principles for using them: the interior of a modular room should be acoustically treated *just as if it was masonry or dry wall*. The perforated metal wall surfaces that most modular panels come with are no longer acceptable, either acoustically or aesthetically.

Second, whenever floating construction is desired, *only the interior floating chamber should be prefabricated*. Early designs attempted to fit prefabricated outer-shell modules between the existing floors and ceilings of the host building structure, enveloping a floating internal modular room. Difficulties encountered in getting a perfect acoustical fit for the outer shell around beams, pipes and obstructions, while trying to compensate for uneven and out-of-plumb building construction, were major ingredients in the lack of popularity of the entire modular approach to studio construction. The more successful practice of enclosing an internal prefabricated floating chamber inside a field-built acoustical envelope is called *hybrid construction*.

The third consideration for modular design is a financial one. Although it is cost-effective, it is not cheap. Many designers have only considered employing prefabricated rooms on low-budget projects. Modular design makes sense only when the highest standards of sound and vibration attenuation are desired. When compared to field-built structures yielding truly equivalent acoustical performance, modular construction can often save money and will almost always save time.

Modular construction can often save money and will almost always save time.

Design and construction time

Putting the construction specifications for a field-built acoustical structure on a set of plans is difficult and expensive. Although the concept may be simple — build a virtually airtight room — the details and the construction's execution are not. In addition to the basic floor plan, the designer must carefully describe the details of each partition, partition intersections, window and door frames, ductwork and electrical penetrations, plus several pages of complicated procedures and specifications. It can take a good acoustical consultant longer to develop a conventional design than it takes to plan and install a modular project. Specifying modular construction can therefore save 60% to 80% in design costs.

Most contractors have no appreciation for the fact that allowing unsealed seams and penetrations in a partition can waste all of the efforts and money spent on the difference between studio and office construction. For example, unsealed areas totaling just 0.1% of the surface area in an STC-60 partition can reduce the effectiveness of that partition by 30dB.

By contrast, no special details are required for modular construction because all parts have been manufactured and labeled to fit together snugly only one way. A good modular system will include treatment of transmission paths into the enclosure (conduit raceways, ductwork silencers and the like), not just the room boundaries themselves. Proper modular design will also ensure that all room surfaces are totally isolated from the building structure.

Modular assembly procedures

Figure 1 illustrates the assembly of a typical modular room. The first step is placement of isolation rails on the host building's floor. (Isolation is achieved with neoprene or spring assemblies.) Then interlocking floor panels are placed on the isolator rails. Next, the wall, window and door panels are set into prefabricated channels on the floor. Finally, roof panels with integrated ductwork silencers are laid down on top of the side walls — usually from inside the room. Assembly time for the average modular control room or studio usually takes three to five days.

Conventional construction generally requires at least three weeks to erect studs, install, wire, seal outlets and switches, apply multiple layers of gypsum board, frame the windows and hang doors. If a floating floor is needed, this typically adds about two more weeks to the front end of the process. (In the most common method, a wood form must be built, isolated and reinforced, then concrete poured and cured.) Modular construction is a significantly faster process.

Because of the reliability of modular systems' dimensions (a typical room finishes $\pm 1/4$-inch from plans), acoustical treatments and cabinetry can be fabricated while the rooms are being manufactured at the plant, without waiting until the room is finished to take field measurements.

When time is of utmost importance in a project, a modular approach is worth serious consideration. It can be argued that these time savings will have significant value on *every* project, however. Rushing a job either in planning or in construction can compromise the result and stick the facility with a poor piece of work. Typically, the client is also paying for the space during construction, so the sooner it can be used, the less is spent for no return.

Advantages of modular construction

Modular construction can be significantly lighter than field-built construction meeting the same acoustical criteria, sometimes weighing only half as much. It can therefore be used to construct studios in office buildings that could not support field-built floating rooms without expensive structural reinforcement or where sound attenuation would have to be compromised in order to meet structural limitations.

The tight-fitting steel components used in modular construction can also provide the additional benefit of Faraday shielding against RF. Resulting attenuation ranges from 20dB to 50dB, depending on RF frequencies encountered and on orientation of the room and its windows.

Modular wall, roof and ceiling panels typically measure 4'×10'. This is a consideration for getting the materials on-site. Corridor or elevator limitations should be noted beforehand. Smaller panels can be accommodated without acoustical compromise.

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ent selects one of several different types of panels from a manufacturer and provides desired room dimensions, the size and locations of the doors and vision panels, and HVAC and electrical layout. The manufacturer returns a shop drawing for client approval, detailing how the studio will be fabricated, including the most efficient panel sizes.

One drawing is usually all it takes to specify a room. Using springs, neoprene or a combination of both, the manufacturer will engineer the vibration-isolation systems to the resonant frequency of a client's choice and provide a system of HVAC silencers to match a residual noise criterion to the facility's requirements. Some manufacturers will also embed electrical conduit and audio raceways into the panels without reducing the acoustical performance of the resulting structure. The floating modular floor and space beneath it can also provide good management of audio, power and control cables, saving the cost of installing a computer access floor or concrete wireways.

Installation can be handled by factory personnel, a factory-authorized installer, or under the guidance of a factory supervisor using a general contractor's labor.

Keeping score

It is important to distinguish between three types of tests when selecting acoustic materials for a project. Transmission loss (TL) is the measurement of a panel's or component's ability to attenuate noise when used as a barrier between two spaces. TLs are given in decibels for each full or one-third octave band in the audio spectrum. The single number rating derived from these TLs are known as the sound transmission class (STC) of the component.

Noise reduction (NR) is similar in concept to TL, except that instead of measuring a single component, it measures the attenuation of noise achieved by a complete structure. A single number derived from NRs at frequencies in the audio spectrum is referred to as a noise-isolation coefficient or NIC.

Some manufacturers also publish NICs for attenuation *between* two complete structures of similar construction, where the noise originates inside one of them and is measured in the other ("interroom NIC").

When selecting a product, be sure you are comparing data of the same specification and not comparing apples and oranges. Always compare STCs with STCs, NICs with NICs, and so on.

Be aware that it is extremely difficult to predict how various materials will perform together. For example, TLs of individual components are not additive. Two components each having a TL of 25dB may combine to have anywhere from 28dB to 40dB of attenuation, depending on how they are configured together. Laboratory data on even the most common studio partition types is generally unavailable.

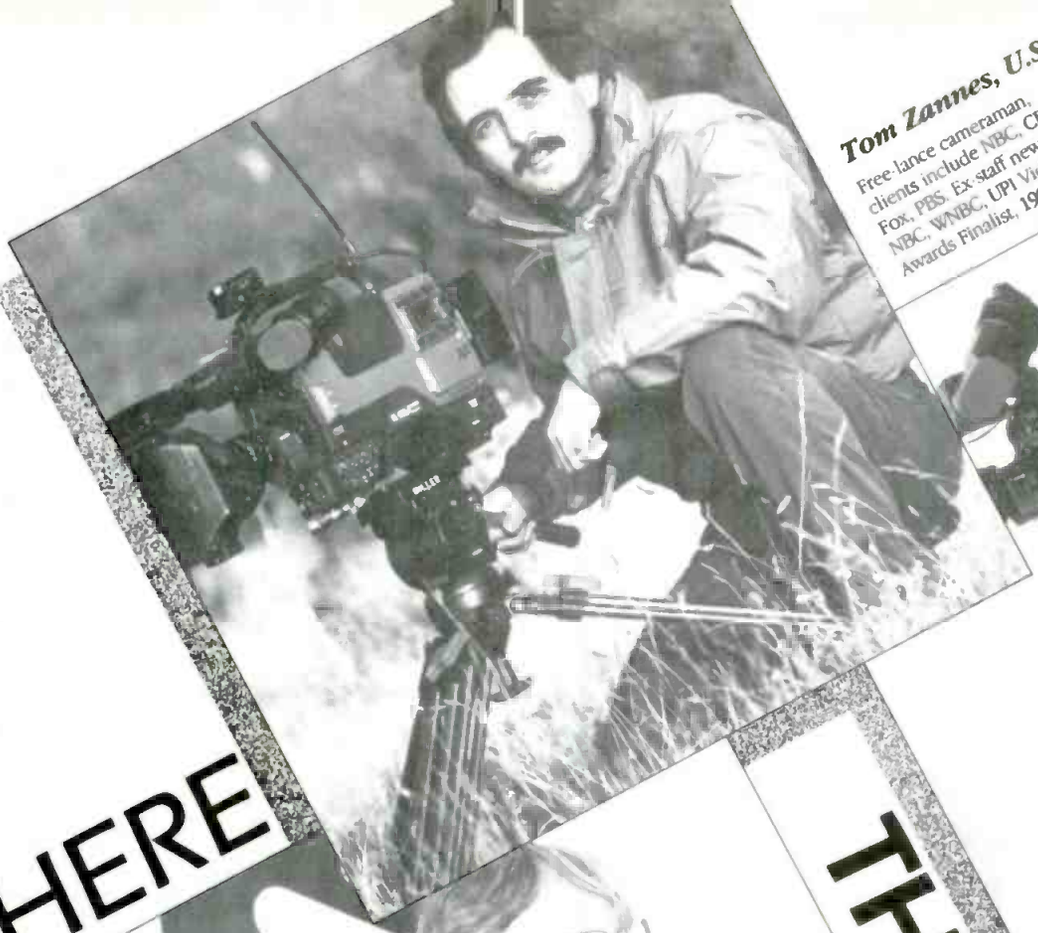
Maximizing a project's impact

New facilities should do more than make the staff more comfortable. A station's sound and capabilities must be improved in the process, or the project's considerable capital investment will not have achieved its full worth.

Among the many choices to be considered in a facility construction project is the method of physical room construction. The modular approach can provide a lower-cost route to good sound isolation, allowing a station to spend a little more of its project's budget on items of more noticeable influence, such as production equipment and the acoustical treatment of rooms. Your listeners will hear the difference.

Endnote:

1. STC = sound transmission class, a rating system for the sound attenuation characteristics of construction materials. The higher the STC rating, the more isolation the material provides. ■



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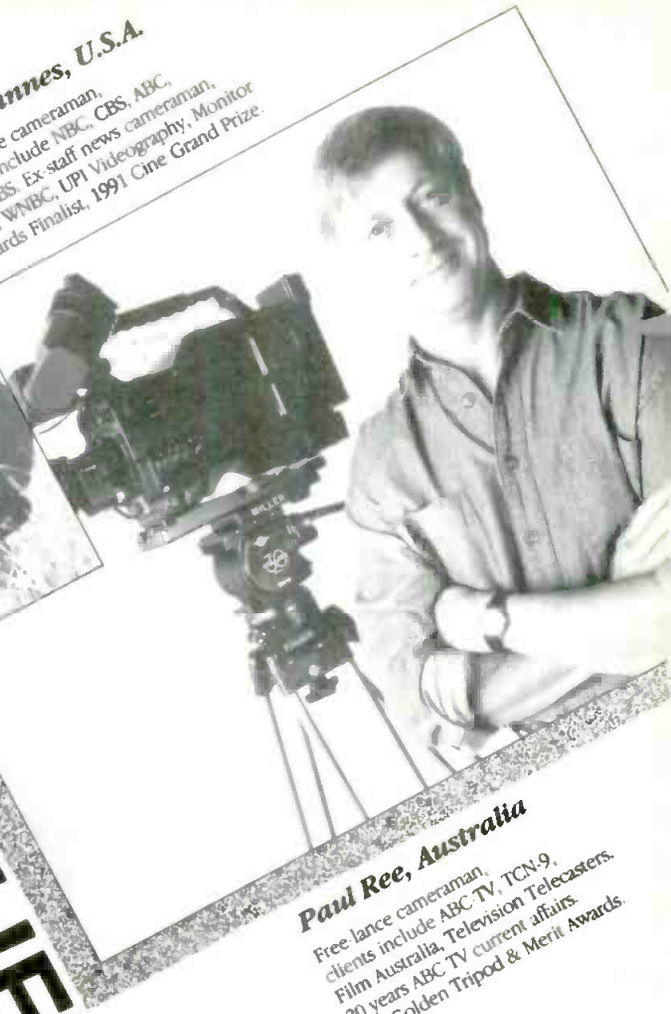

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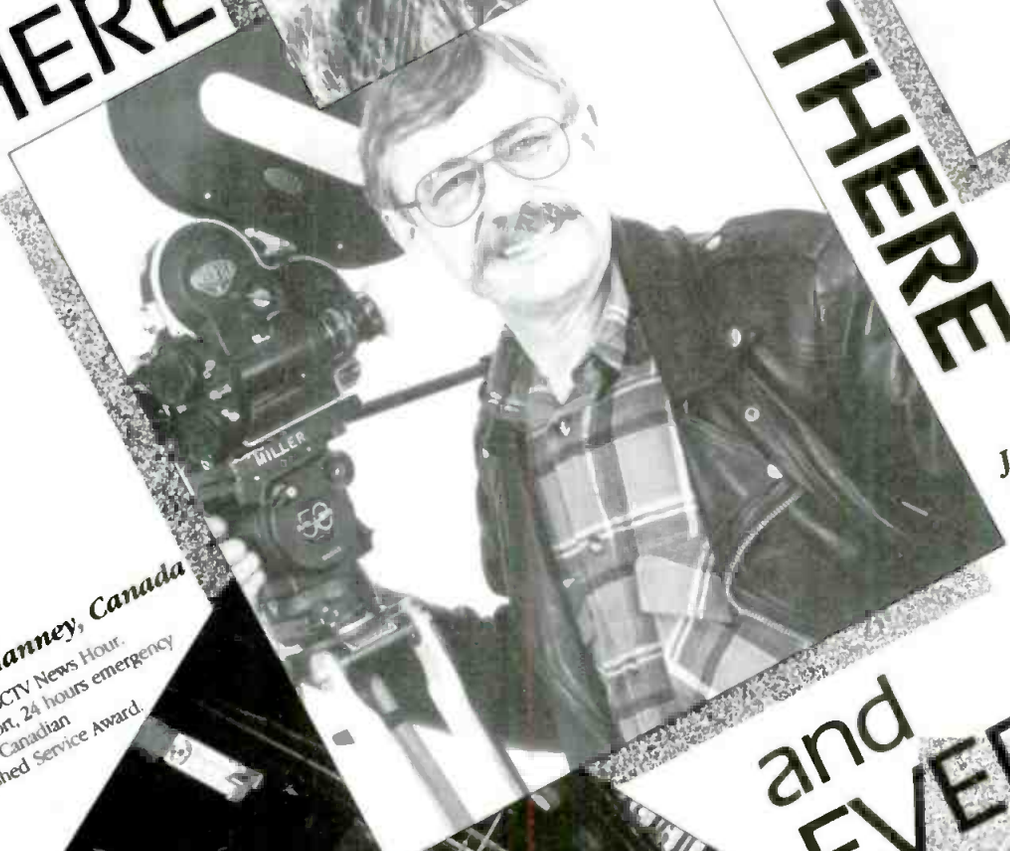

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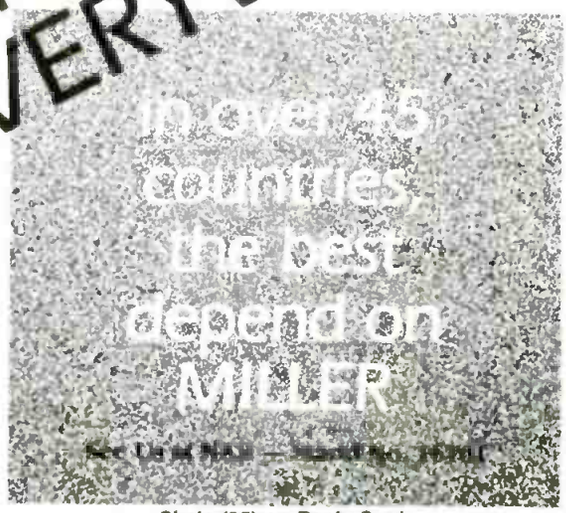

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Exposing acoustical myths

By Richard Schrag

Acoustical design is burdened by many time-honored misconceptions.

The Bottom Line

Acoustical principles are often misunderstood or misapplied. Much of what passes for knowledge in the field is pure voodoo, and traditional studio design is full of common practices that unintentionally limit or even reduce acoustical performance. Relying on "cookbook" acoustics can be a recipe for disaster. Successful projects avoid the fallacies and "pseudoscience," finding ways to ensure that the money and effort you spend will bring proper and predictable results.

Acoustics can be a mysterious science sometimes. Logarithmic addition just doesn't come naturally to most of us, and the concepts of sound absorption vs. sound transmission, reflections vs. room modes, and reverberation vs. resonance aren't always intuitive.

It is little wonder, then, that applied acoustics — especially when the application is studio design — is full of myths, fallacies and misconceptions. Sometimes it's a misunderstanding of the principles. Sometimes it's taking a grain of truth and using it incorrectly in a different situation. Sometimes it's solving one problem but creating a bigger one in the process. Whatever the cause, a second look at traditional design concepts and construction techniques reveals that some acoustical "truths" are false.

Schrag is a consultant at Russ Berger Design Group, Dallas.

Yet some of these misconceptions have managed to become such standard practice that acoustically speaking, they can be downright dangerous if you aren't aware of them. This article takes some prevalent acoustical myths, each of which is encountered frequently in broadcast facility designs, and shows that there may be a better way to get the acoustical performance you need.

Myth No. 1: Absorption improves transmission loss

Absorption means reducing the sound, right? So putting some fuzzy material on the wall will keep the neighbors happy, right? Unfortunately, no. It is true that when sound strikes a surface, some of the

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energy is absorbed and some is reflected from the surface. It's also true that some materials absorb more sound than others. But in most cases, although this may do a lot for the sound *within* the room, it doesn't help much when the problem is sound transmitted *through* the walls or ceiling of the room.

It is tempting to believe that soaking up all the sound will keep it from going somewhere else. Other things held equal, increasing a room's absorption will indeed reduce sound pressure levels in the room. But the rooms we live and work in generally have moderate absorption to begin with, so in a practical sense it is rarely possible to use "normal" finishes to make order-of-magnitude differences in the overall room absorption. As a result, it is difficult to affect steady-state sound pressure levels in the space by more than a few decibels with absorption alone. That doesn't mean that you can't make a room more pleasant to work in or a better monitoring environment, only that you can't make a noisy space significantly quieter by changing the finishes. The harshness of a highly reverberant space doesn't stem from loudness as much as from factors, such as poor intelligibility and the direction and frequency content of the reflected sound.

Even in a completely absorptive (anechoic) environment, the sound pressure level at a wall surface still has a direct sound component, which is dependent only on the sound energy that the source is producing and the wall's distance from it. No amount of absorption can further reduce the level.

Remember, too, that it is much more difficult to keep low-frequency sound from going through a wall than high-frequency sound. It is equally difficult to obtain effective low-frequency absorption over a wide bandwidth (e.g., a full octave or two). So the effect of absorption on sound iso-

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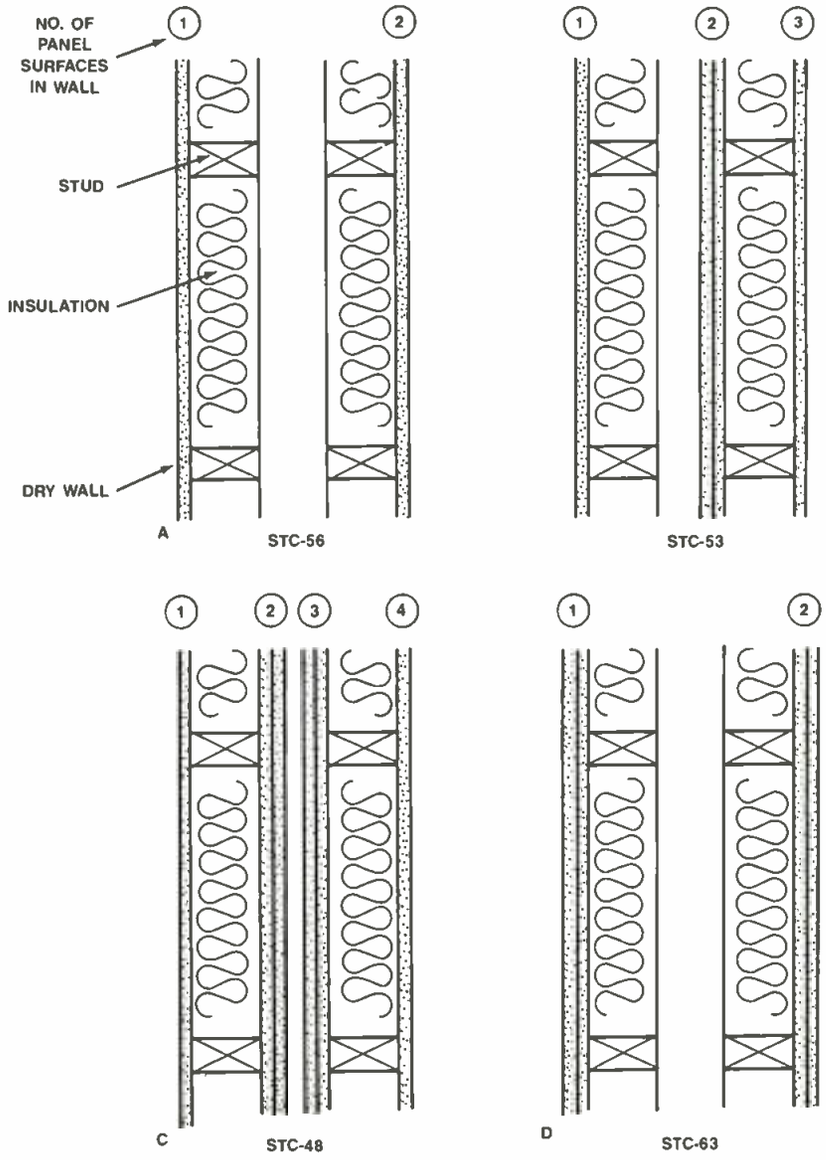

Figure 1. *Plan view of a simple double stud partition (a). Adding dry wall will actually lower its sound isolation if it creates a triple (b) or quadruple (c) wall. A mass-airspace-mass arrangement offers the best use of materials and space. Additional dry wall at the outer faces (d) increases attenuation dramatically.*

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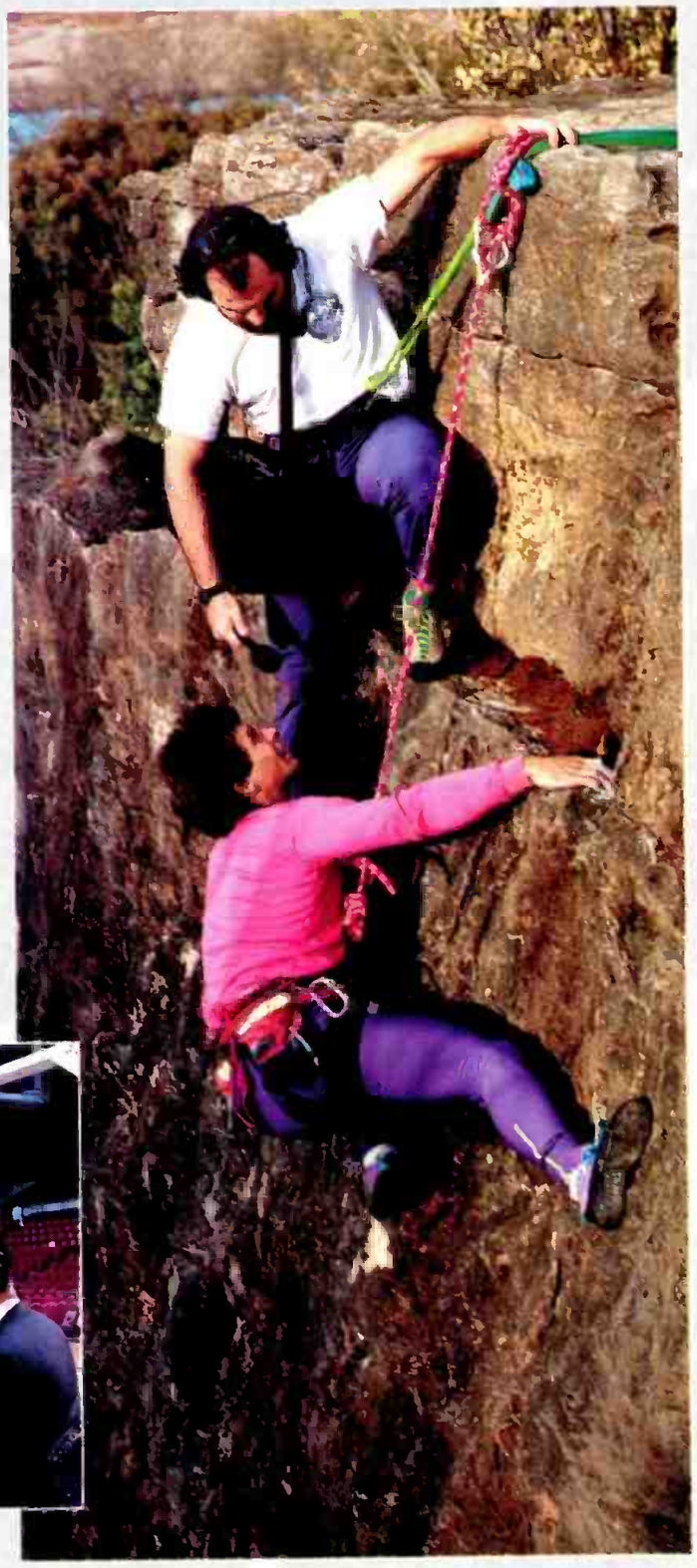

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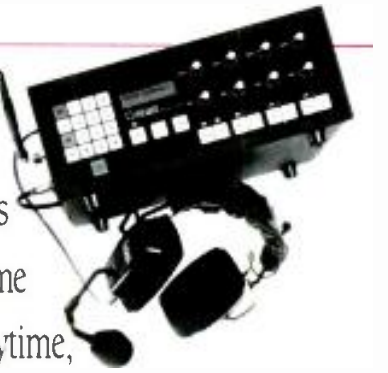

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Continued from page 66

lation is at its least where you need it the most.

Sound absorption can be one effective component of a larger noise control solution for problems involving mechanical equipment. In those cases, the sound power of the noise source is fixed. When dealing with voices or reproduced sound, however, an acoustically "dead" environment sometimes encourages you to speak louder or increase the volume to compensate. This may offset any reduction in the overall room levels, or may actually make them worse.

In the end, transmission loss through a partition is primarily affected by three things: the mass of the materials used, the thickness and assembly of the barrier, and control of flanking and structure-borne paths. Absorption within the rooms on either side of the partition is a relatively minor issue. For sound isolation there is no substitute for heavy, airtight construction, regardless of how you finish it.

Myth No. 2: The 3-panel partition

How many times have you seen magazine articles on studio design in which "high-performance" partitions are detailed? Often these are touted as "triple walls" or described as a seemingly endless stack of different sheet goods with airspaces interspersed among them. ("We used wallboard plus fiberboard plus wallboard then a 1-inch gap plus wallboard plus rubber plus plywood then a 2-inch gap plus. . .") By serendipity these walls may be sufficient for the needs of an individual studio, but they're not always a cost-effective use of materials or available space.

Take the example of a simple double stud partition. Starting with a single layer of gypsum board on the outside faces and cavity insulation (Figure 1a), this wall has a sound transmission class (STC) rating of STC-56. If an attempt is made to "improve" the wall by putting two additional layers of gypsum board on the inner face of one stud (Figure 1b), the STC rating actually decreases to STC-53. Following this "more is better" mindset, if two more layers of gypsum board are added to the inner face of the other stud (Figure 1c), the STC rating is still lower, at STC-48. (Never mind the difficulty in actually *building* this version.)

This seems grossly counterintuitive — more barriers should improve attenuation, not reduce it. Remember that in a cavity wall, transmission loss depends on the mass (and stiffness) of the surfaces *and* on the thickness (and absorption) of the airspace between them. In this example, putting gypsum board on the inner faces of the studs — creating a 3-panel or 4-panel wall — divides the airspace into smaller segments, and the low-frequency sound

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transmission loss (which in this case dominates the STC rating) is reduced.

If only one layer of gypsum board was added to each outer face of the original wall (Figure 1d), an STC rating of STC-63 is achieved. This uses less material and less space than the 4-panel wall (Figure 1c) but gives significantly better performance. To optimize acoustical performance, how the materials are put together is often more important than what materials are selected.

Myth No. 3: Angled glass

In traditional studio designs, interior windows — between a control room and a booth, for example — often have two panes of glass, with one or both tilted a few degrees from vertical. (Sometimes it's three panes — see myth No. 2.) Several reasons are given for this design technique.

Many people contend that taking the two panes out of parallel eliminates resonances (standing waves) in the air cavity between them, which would otherwise limit the transmission loss at the resonant frequencies. In theory, this is a valid concern. In actual construction, however, there is always a practical limit on the overall thickness of the wall into which the window is built. Achieving the tilt by spreading the two panes of glass wider apart at their top edges would put each pane's center of gravity further out from the wall, and the structural support provided by the window frame and its attachment to the wall could be questionable. So, the usual "solution" achieves the tilt by moving the glass in at the bottom of the window, thus putting the two panes close together.

The result is an average airspace between the panes that is sometimes little more than half of what it could be if both panes were vertical. (See Figure 2.) Because sound transmission loss through the assembly is highly dependent on the width of the airspace, the acoustical benefit of angling the glass is often negated by the reduced separation between the panes. For a given overall wall thickness, maximizing the overall airspace between panes minimizes sound transmission through a window.

A second reason for tilting the glass is to redirect reflections of sound from the window. Because of sight line requirements, studio windows are almost always at a height where significant reflections into microphones can occur. Usually the angle necessary to eliminate this problem is more than what the window frame's depth can accommodate. The detrimental reflection just occurs from a different point on the glass, as Figure 2 also illustrates.

There are valid reasons to angle glass in double pane windows, but they have nothing to do with improving the sound transmission loss through the window. One reason is to alleviate flutter echo between the window and an acoustically hard surface on a parallel wall. Another is to reduce the multiple visual reflections that can occur between parallel glass surfaces. But the optimal solutions allow the glass to be kept vertical, relying on good room geometry and finishes to fix the first problem and proper lighting to solve the second.

In any event, the acoustical characteristics of the glass itself, the mounting details, and the interior perimeter absorption (on the boundary surfaces of the space between panes) all have a much greater effect on the sound isolation of the window than the angle of the glass.

Myth No. 4: Acoustically "transparent" materials

The sound-absorbing properties of standard building materials are often given as a *noise-reduction coefficient* (NRC) rating. Unfortunately, this standard measurement takes into account only speech frequencies and ignores the extremes of the audio spectrum. More important, it measures the absorption of a material or assembly in a test chamber with random incidence of sound on a relatively small sample.

In practice, absorptive materials are often placed on walls where the sound is almost always at "grazing" incidence or nearly parallel to the surface. When you drop a rock into the water it sinks, but when you throw it parallel to the water, it will sometimes skip along the surface. Sound behaves in much the same way: many materials that appear "transparent" based on NRC ratings or porosity are actually highly reflective to sound at grazing incidence.

One example is perforated metal, which frequently is incorporated into prefabricated modular acoustical enclosures to provide an "absorbent" interior surface. If a modular room is shaped to provide a reflection-free zone (RFZ) for a specific listening area or if loudspeakers are mounted near the perforated metal surfaces, sound will strike the surface at grazing incidence and the absorptive properties will be rendered much less effective than intended.

Myth No. 5: The field-fabricated door

Doors are almost always the weak link in the sound isolation of an acoustically critical room. Moving parts cannot be built as solidly and airtight as fixed components, and real life products don't seal completely or stay in perfect alignment.

To make matters worse, some manufacturers promote "acoustical doors" with ratings based on tests in which a nonoperable door panel is fixed into an opening. Seeing this, many people (including some studio designers) have made valiant but futile attempts to improve a door's sound-isolation performance by making the door panel better. Years ago it was common to see two solid core wood doors bolted together with a layer of "machine rubber" sandwiched in between. Hey, it may not work, but it sure is bulky and unattractive.

What is usually overlooked, however, is that the door panel itself is rarely the limiting factor. The acoustical leaks are almost always worse at the seals around the perimeter of the door. Even the best field-applied door seal can quickly go out of adjustment and lose optimum contact and

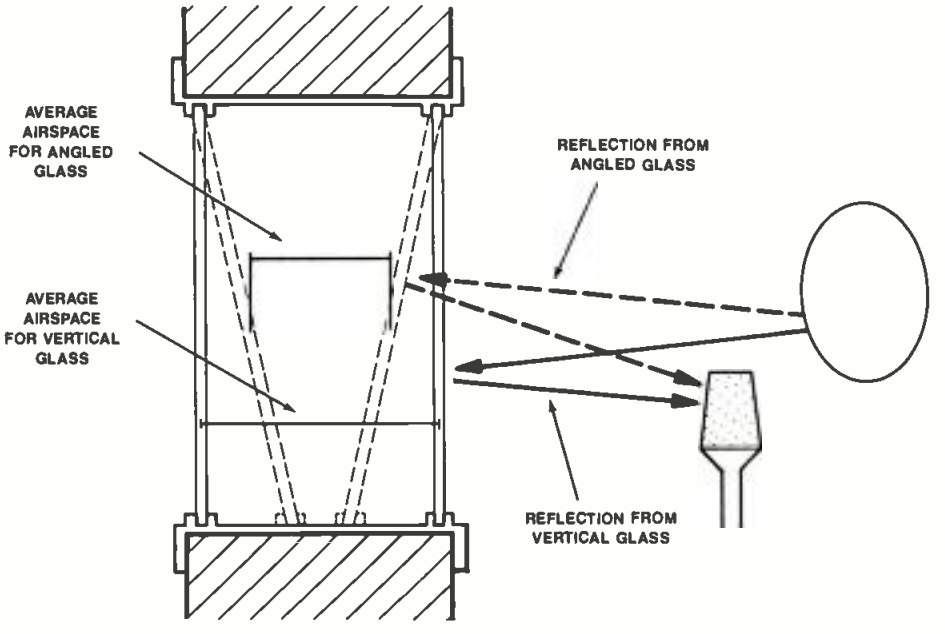

Figure 2. *Angling the glass in a studio window reduces the average airspace between the two panes, thereby increasing sound transmission through it. In addition, angling panes to eliminate sound reflections is generally ineffective. Reflections are not eliminated but simply moved.*

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closure between the door and its frame.

If we consider a 3′ × 7′ door with a gap around its perimeter of only 1/64 inches, the gap represents only 0.1% of the total door area. This is enough, however, to effectively reduce an STC-36 door to an STC-29 rating. More important, if the door panel is beefed up to stop an additional 10dB of sound, the composite transmission loss increases only 1dB. In other words, improving the door panel barely affects the overall performance, because the perimeter seals aren't improving in a proportional manner.

Sound-rated doors — in which the door, frame and seals are manufactured as an integral unit — are the only reliable means of getting acoustical performance that is significantly better than a relatively simple door panel and field-applied seals. Alternatively, using multiple doors in a vestibule arrangement or keeping the door opening separated from the noise sources will help obtain appropriate sound isolation.

Myth No. 6: Mostly right is good enough

Failures in studio construction happen more frequently from lack of attention to detail than from an error in the overall design. One typical example is in building a dry wall partition.

Assume that such a partition is carefully erected with isolated stud framing, filled with acoustical insulation, and finished with multiple layers of dry wall carried from the floor slab all the way up to the metal deck above. Later the electrician uses a claw hammer to run some conduit through the wall, and the plumber puts in a sprinkler pipe or two. You note that there are some gaps around these penetrations and that the dry wall doesn't fit into the corrugations at the deck, so you issue instructions that all gaps are to be stuffed with insulation. That seems harmless enough, but you've probably just wasted half of the effort and materials that went into the wall.

The insulation provides sound absorption, but it isn't a barrier to sound transmission through and around the wall. Even though a 3/4-inch gap along the top of a 15-foot length of wall represents only one square foot of opening, stuffing it with insulation instead of sealing the gap can limit the wall's overall performance by more than 10dB. Actual field tests of a dry wall partition of these dimensions confirm this. Initially the gap had been stuffed with insulation, but later a barrier designed to conform to the gap was installed and sealed airtight into place. This single modification improved the sound isolation from STC-31 to STC-44.

What is important in facility design and construction is *balance*. There is no point in putting a great door into an inferior wall or vice versa. And the best, most expensive partition is only as good as its leakiest electrical box. As the sound-isolation requirements of a room increase, the effect of an acoustical weak link becomes more and more devastating. Each of the components must meet the required performance or they will fail collectively.

Myth No. 7: Reverberation time in the control room

Articles that discuss the acoustical design of a facility often refer to measurements of "reverberation times" (T_{60}) in small spaces, such as broadcast control rooms. Some designers have even gone so far as to specify optimum T_{60} values in the range of 0.5 seconds or less for small rooms.

The definition of reverberation time involves the statistical decay of sound in the reverberant field of an enclosed space. In a small room, particularly one with the type of absorptive finishes generally found in control rooms, there is no location in the room that is said to be in the reverberant field. Nor do the reflections of

sound within the space develop any statistical decay. Certainly the amplitude and time-of-arrival patterns of these reflections are of paramount importance in defining the acoustical environment. However, reverberation time is not an appropriate metric to use in quantifying that information.

Often, the measurements cited for reverberation times in small rooms are questionable. Much of the test equipment used to analyze decay characteristics over full-octave or third-octave bands has a filter slope near the values of the "T_{60s}" themselves. The measurements may have nothing to do with the room; they may be measuring the capabilities of the test gear.

Myth No. 8: You can't hear heat

From the standpoint of audio fidelity, it is desirable to minimize the length of the cables that connect a loudspeaker to its amplifier. What better place, then, for the amplifier but directly beneath the speaker? Unfortunately, if you fall into this trap, saving a few feet of speaker wire may cost you dearly in attendant acoustical problems.

Temperature gradients and air movement between a speaker and listener can drastically affect the sound field, much like heat rising from hot pavement can distort an optical image. This is most commonly noticed at windy outdoor concerts, where the frequency response of a distant PA speaker stack seems to be changing. The cause of this is not the wind "blowing the sound around" and changing its direction by pulling it along with the moving air, as is commonly thought. It is the result of the sound waves passing through air temperature gradients introduced by the moving air currents. The frequency-dependent refraction (bending) of some sound waves and not others results in the changing frequency response. The actual propagation direction of the sound remains relatively unaffected.

In the control room, this same phenomenon can cause perceptible effects, most frequently noticed in shifting of the acoustical stereo image. Putting amplifiers directly beneath the monitor speakers allows them to vent heat directly in front of the speakers, and the thermal turbulence creates audible distortion. Similarly, the heat generated by some mixing consoles (coupled with poor ventilation design) ironically renders them unsuitable for use where accurate monitoring is required.

This same phenomena is often observed where air diffusers for the heating, ventilating and air-conditioning (HVAC) systems have been located incorrectly in a room. In any critical monitoring environment, even seemingly "non-acoustical" heat sources and air flow must be carefully controlled to maintain a sonically neutral sound field.

Beware the acoustical myth

Many more fallacies and misconceptions in acoustics than what we have related here exist, but you get the idea. Individually, the examples in this article may help you avoid specific pitfalls in studio design and construction. Collectively, they serve to illustrate the dangers in believing everything you read in a magazine or see at a world famous studio. The "it's-always-done-this-way" approach may not be based on sound acoustical principles, let alone be the best means to achieve desired results.

Any time an acoustical myth can be identified and replaced with a little common sense or objective proof, acoustics as a science becomes less mysterious, and one less acoustical "truth" will be preached as gospel.

■

Adaptive reuse: fitting a square peg into a round hole

By Bryant Rice and Kevin Schaeffer

Renovating your facility to "fit in" an existing space requires creativity and professional expertise.

If you're looking for the perfect location for an AM/FM radio station, it probably isn't in an office building with 12-foot ceilings and a freeway off-ramp located next door. Nevertheless, KSAN/KNEW in San Francisco successfully made just this type of building their new home. Through the use of experienced design professionals, most of the building's perceived liabilities were mitigated and a few even turned into benefits.

In 1982, KSAN moved and began sharing the then existing KNEW space. The facilities were originally built in 1966 and designed to be only a temporary location. The building was in a state of serious deterioration. The result was two radio stations crammed into cramped spaces with poor adjacencies between departments.

Rice, AIA, and Schaeffer, AIA, are architects with Gensler and Associates, San Francisco.

Square peg in a round hole

In 1989, KSAN/KNEW began the construction of new studios in 15,000 square feet of space in downtown San Francisco. The selected building was constructed in the 1930s and designed for use as a refrigeration warehouse. Converted in the 1950s to office space, the structure has high ceilings and massive floors, both of which are good acoustical features. The building was selected because of the area's prestige and proximity to advertising

The Bottom Line

Today, relocating broadcast or production studios usually means renovating current office space. Few stations have the luxury of building from the ground up. This means new studios must "fit" into the building spaces, not the other way around. Also, because audio studios have demanding requirements, not every building will be suitable. When faced with this challenge, the first step is to obtain professional assistance. Your ideas, combined with creativity and the proper expertise, can result in studios that fit the space — and your needs. $

The window to the lightwell is behind and to the left of the operator's position. The mini-blinds covering the floor-to-ceiling window allow the operator to adjust the amount of light into the studio.

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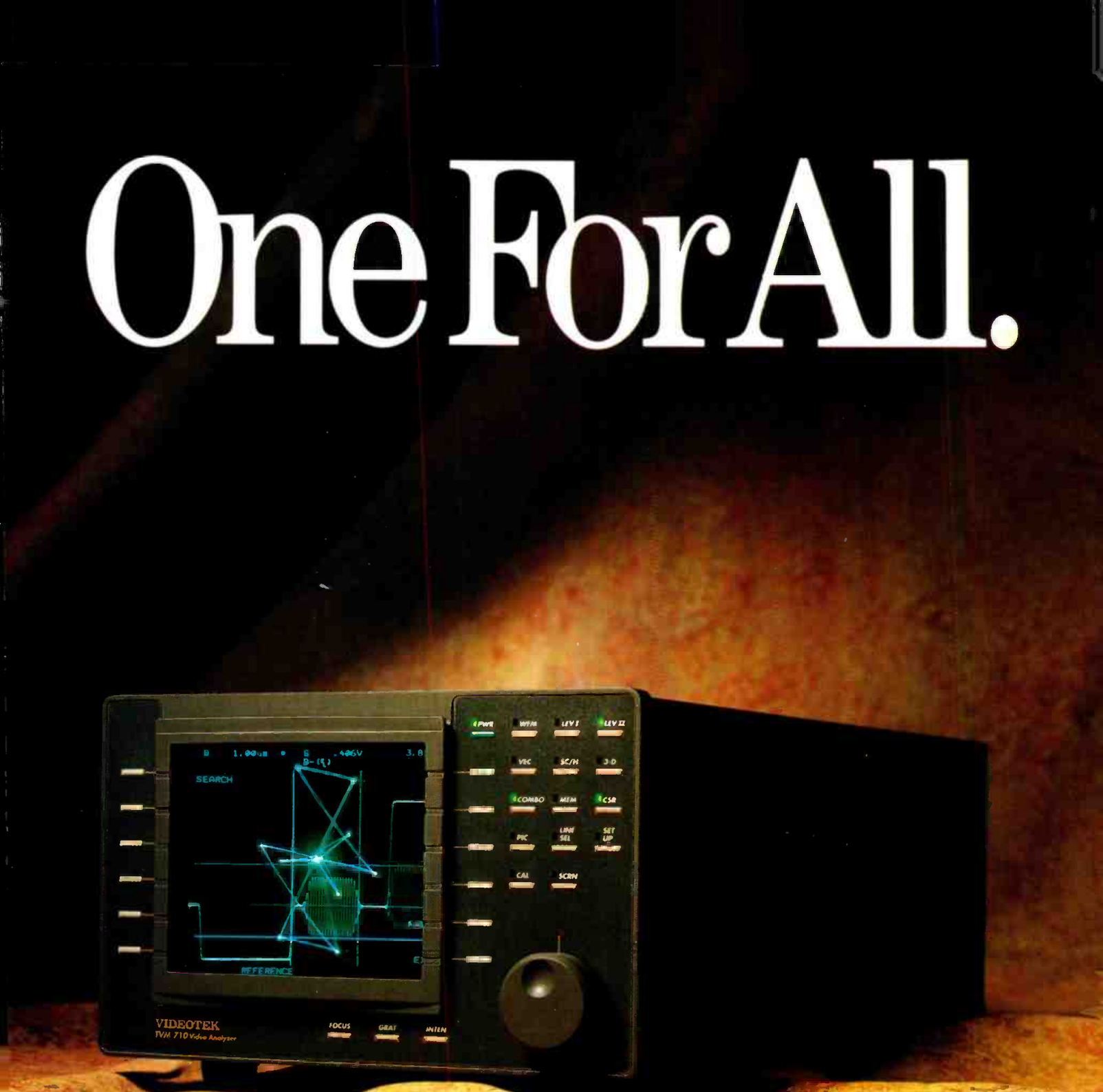

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agencies and other broadcast facilities. The building's technical advantages and disadvantages were given much less consideration.

The structure, located at 750 Battery Street, is a typical office building and houses a variety of tenants. It provides adequate security and mechanical systems, which operate 24 hours per day — such a feature is unusual for a typical office building. The building also has the added benefit of a new 400,000W rooftop-mounted emergency generator — just the kind of additional feature that is important to a broadcaster. Once the decision to use this space was made, it was up to the engineering staff and outside professionals to make it work.

Project teamwork

To a great extent, the success of any studio project depends on assembling a team that can take advantage of the members' various kinds of expertise. Team members should include the station engineer and manager, the architect, the acoustical consultant, the electrical and mechanical systems designers and the project contractor. It's important that communication between these team members be thorough. Missed deadlines are sure to occur unless everyone is aware of their roles and responsibilities.

First develop a list of project priorities.

Early discussions with all team members can save money and avoid problems. For example, acoustical problems should be addressed in the design phase instead of after the facility is built and "fixes" are needed. Allowing the acoustical consultant to work with the mechanical engineers at an early stage will help eliminate the need for later, and potentially expensive, modifications.

Acoustics issues

The acoustical standards for broadcast studios are far different than those for a commercial office building. Broadcast studios have many critical spaces in terms of background noise. With this project, there were significant exterior noise sources: traffic, air-handling units and cooling towers on adjoining buildings. In addition, there were interior-source noises that had to be considered: adjacent tenants, typical office operation and mechanical systems.

The goal of the acoustical consultant must be to maximize sound quality, minimize noise intrusion and eliminate echoes and distortions. The first step for this professional should be a site visit and sound-level measurements. The data obtained will help determine how to address the project's acoustical needs. In this project there were three main acoustic issues.

The first was sound isolation. This was addressed by placement and specification of appropriate materials for walls, floors and ceilings.

The second issue was the mechanical system. Like many other projects, the background noise level criteria will be based on the specific mechanical system.

The final area for concern was the room acoustics — the quality of sound within the space.

Proper sound isolation for broadcast and production facilities is essential. This project posed unique problems because the

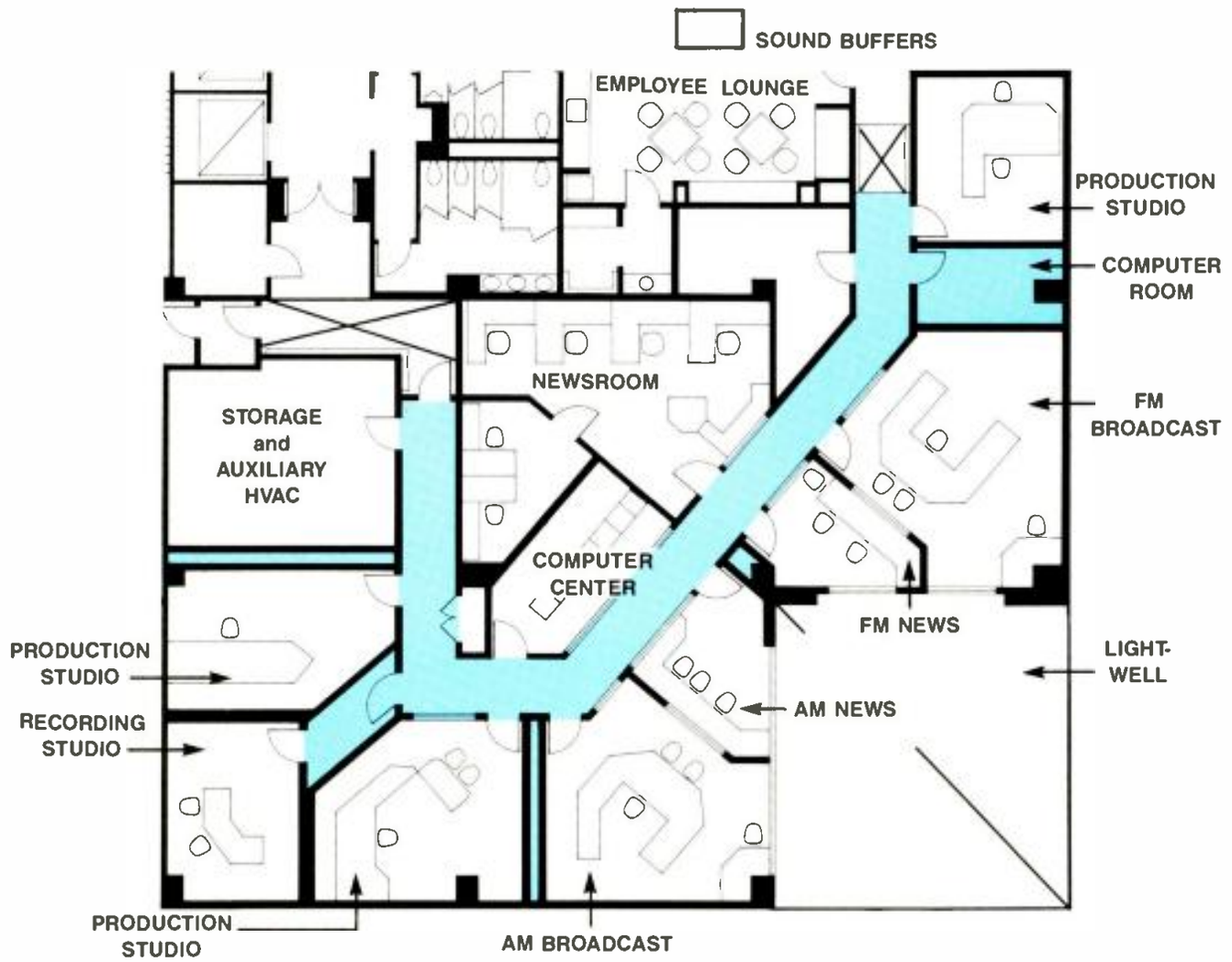

Figure 1. Easy access to all studios is provided by the central hallway. Because it runs diagonally through the spaces, many of the studios have five walls.

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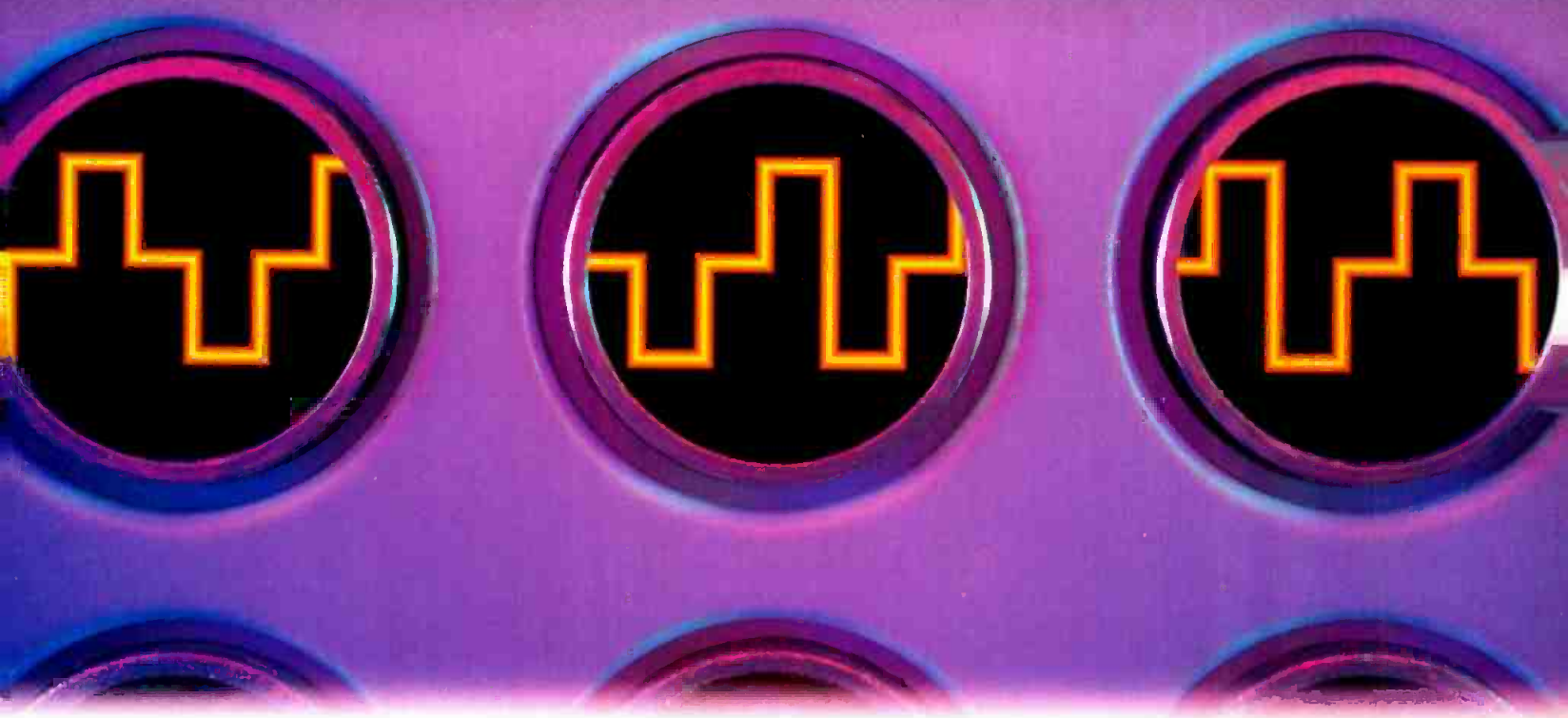

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building was never designed for that function, which initially made sound isolation a significant issue.

It is important to examine the frequency content of the identified noise sources. Office space usually considers only sound transmission class (STC), which is primarily voice-related. Typical office construction is evaluated with STC in mind, normally aiming at a rating of 42 to 45. Although it is critical to address the frequency range for the human voice, noise must also be evaluated at a variety of frequencies below and above the range of an STC rating.

Acceptable noise criteria (NC) must be determined for each production and recording space in the facility. This then becomes the basis for the overall design. Once this value has been determined, the wall, ceiling and floor construction can be specified to maintain these goals.

The unique needs of the radio stations required special consideration with regard to the air-handling systems. The building's centralized mechanical system feeds air down into each floor. This was insufficient for some of the spaces. It therefore became necessary to locate individual air-handling units in certain critical spaces.

This second system serves a number of small spaces where heat builds up because of equipment and human loads. Such increased loads, combined with the sealed nature of acoustically sensitive rooms, demand that a high volume of conditioned air be delivered at a low velocity. There is little room for error in this phase of the design. Every component in the mechanical system (diffusers, fire dampers, even kinks in ducts) has the potential for generating unacceptable levels of noise.

Acoustic solutions

A thorough point-by-point analysis was done, starting at the fan, using manufacturer's data on how much sound it produced. The analysis involved taking measurements along the entire path of the duct run, including elbows and splits, down to each recording room. Because the mechanical room was located adjacent to the recording studio, airborne noise was a real problem. Short duct runs put a premium on duct-borne sound because sound dissipates as it travels through ducts.

The solution was to run a large amount of ductwork within the mechanical room, more than was needed, to let as much noise as possible break out of the ductwork at that location. Normally noise breakout is not encouraged but eliminated. In this situation, the technique aided the studio's acoustical environment. By localizing the noise breakout in the mechanical room, and then isolating that room, noise was reduced in other areas.

Once the recording studio was isolated from unwanted outside noise, quadratic residue diffusers (QRDs) were installed to optimize the quality of sound within the space. QRDs are a highly specialized product made of panels of wood and acoustical absorptive material. They are designed and placed for a specific studio environment to effectively scatter, reflect and absorb sound.

Proper interior planning can be effective in optimizing the acoustics of the studio environment. Here the recording studios were located at the back of the building, as far as possible from street noise. This allowed the studios to open onto a glassed-in lightwell, giving announcers access to natural light. Working off of a diagonal axis at a 37° angle created an interior planning concept with rooms of unusual geometric shapes.

In this case the technique provided three benefits. It resolved adjacency issues and yielded non-orthogonal walls that reduced detrimental parallel sound-reflective wall surfaces and increased studio volume. Figure 1 illustrates the studio section of the facility. The design also placed *buffer* functions (storage or computer space) between production and control areas. Corridors were also used as vestibules between studio functions.

Construction details

Five types of wall construction were used in the KSAN/KNEW project. These walls ranged from a typical interior office partition to a construction that included three layers of gypsum board on a split metal stud. In other words, the studio areas were separated by two walls with an intervening air space. This reduced greatly the transmission of noise from adjacent spaces.

Where sound quality is considered less critical, less expensive wall types using one or two layers of gypsum board with acoustical batts can be used. The detailing of all these walls must take into consideration all penetrations and connections. Electrical outlets should be separated by a minimum of two feet and surrounded by sound-insulating foam. Where walls meet existing construction, such as a concrete slab, a neoprene gasket is used to seal out noise.

Similarly, connections to either the exterior building wall or building glass require special detailing. Insulating joints ensure that sound does not track along the interior of the wall to a potential leak spot. All of these connections employ the concept of gasketing, which allows different constructions to move freely and absorb vibration without passing this movement on to the adjacent wall or floor.

Using a raised floor creates opportunities and concerns about sound isolation. One effective technique to preserve the isolation is to hold the floor away from corridor and studio walls with acoustical foam gasketing. The flooring was built on 2x4 wood sleepers with two layers of decking. Gaskets were used at all door thresholds and wall-floor intersections, which in effect created an isolated floor in each space. By using wood construction instead of a manufactured computer floor, the cost of raised concrete flooring was reduced and it maintained a minimum access space for below-floor cabling. This technique also maximizes ceiling heights within the technical areas. This technique worked because the cabling was limited to Walkerduct runs in limited areas with a minimum of access doors carefully located within the studio spaces.

The studios' glazing and doors were specified with increased sound ratings and custom gaskets. Instead of using complex glazing systems that provide pockets of air between sheets of glass, the designers selected a $^3/_8$-inch laminated glass with a custom-gasketed frame. This improves visibility between studios and also eliminates the maintenance issue of *interior dust* (dust that finds its way to the air pockets between glazing sheets).

Above the ceiling, all suspended ductwork should be hung with isolating hangers. HVAC ducts and units should be hung with decouplers to reduce the transmission of vibration. All conduit connections and pipe/wall intersections should rely on flexible connections and acoustical sealant. One final precaution is to place acoustical insulation batts on top of the gypsum board ceilings and within walls.

The studios use a unique method of locating monitor speakers. Small speakers are mounted on overhead cabinets. The result is that the listener is close to the speaker, thereby requiring less room volume. Production rooms use the same concept with slightly larger speakers. The result is a good sound image at a volume that doesn't blow away the neighboring tenants.

Construction issues

Building radio studios presents a number of challenges. The coordination of the various consultants and contractors poses the most difficulties. In a project such as this, communication should be routed through the project architect. This person or company will be aware of everyone's tasks and schedules and can best prevent conflicts — and expensive delays.

It is also important to define and maintain the user's and consultants' realms of responsibility. In office buildings such as this, many elements must be considered. For instance, because of the reduced slab-to-slab height available in this structure, the electrical conduit, mechanical ducting, life safety systems, sprinklers, diffusers and light fixtures all had to be placed beside one another. It's not hard to imagine how simple miscommunication could result in

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mistakes and having to remove and reinstall subsystems.

The design/build concept

The decision to use fully engineered drawings or to rely on the *design/build* concept isn't something to be taken lightly. The more common method is to design the building on paper and then bid the work. This allows for easier comparison of proposed construction and systems quality.

On the other hand, using design/build contractors usually expedites the project schedule. Design/build contractors are responsible for designing, purchasing and installing their work. In most instances, they are also available for systems maintenance once the project is complete. In cases where a competitive price can be negotiated, a design/build contractor increases the hands-on experience necessary in making early project decisions.

Does this technique work? See for yourself. Although factors later forced a 15% reduction in the overall budget the total project cost came in under budget. The cost of the office spaces was approximately $35 per square foot. The studios' spaces cost approximately $110. In San Francisco, that's definitely cost effective.

Design issues

When planning a new facility, make a list of the facility's needs in terms of space, equipment and personnel. Each room's occupancy (machines, furniture, storage and staff) should be considered. Priorities must be set with a list of potential options, additions or deletions for each space. Adjacencies between spaces or personnel should be listed and categorized as essential, important or convenient. This allows the designer to help the end-user make decisions that will affect the functionality and aesthetic quality of its new home.

Other issues to consider include the proximity of equipment and cabling to central control rooms. Don't forget that round-the-clock operations require careful planning of a night entrance and proximity to building toilet facilities.

The overall design of the KSAN/KNEW facility had to meet the needs of two different clients. The lobby area had to appeal to sales staff with potential advertisers who were more interested in image. The studios needed more functionality and less aesthetics. By careful use of colors and details, it is possible to give the studio and office areas a similar style and feeling.

Fitting in

It was the early definition of goals and parameters that made KNEW/KSAN fit in. This was possible only with the partnership of enlightened station management, dedicated and experienced architects and knowledgeable consultants. The project resulted in a broadcast facility that maximizes design impact, acoustical and transmission quality, as well as efficiency and comfort for its staff.

■

Planning for serial digital video

By Dave Spindle

Serial digital offers digital power with analog convenience.

The Bottom Line

Digital offers TV broadcasters many advantages — lower maintenance, higher quality and unprecedented production capability. But until now, digital required the use of costly and cumbersome 25-conductor cables, patch panels and distribution equipment.

New serial digital systems can use familiar, existing high-quality coaxial cables and patch panels. This can save significant cost and reduce complexity. Careful planning and installation are still required, but serial techniques will ease the transition into the digital domain. **$**

Over the years, video systems have used, almost exclusively, analog composite signals. Those signals, typically NTSC or PAL, required only a single coaxial cable or signal path for distribution, switching and processing. With adequate equalization and high-quality cable, signal paths in the range of 1,000 feet were feasible.

It is only in the past decade that new forms of analog video have come into common usage. These systems are primarily of the analog component or RGB variety. The former was used in Betacam and MII equipment. The latter was used in computer graphics and high-resolution large screen projection applications.

Spindle is CEO, Pesa America, Huntsville, AL.

These new component standards created unique problems. Instead of one signal path, engineers had to contend with three. Cable lengths and types had to match precisely, lest they cause a delay or attenuation in one or more of the signal components. Such errors could resemble a convergence or color balance problem on the monitor.

In the 1980s, TV scientists developed a new component digital format conforming to the CCIR recommendations 601 and 656, also known as 4:2:2 parallel, or D-1. The new standard had obvious advantages. It did away with the analog curses of differential gain and phase, noise and

Serial digital video technology can give you an advantage over your competition. Shown here is one of several Video Post and Transfer production suites that rely on this technology.

high-frequency rolloff. It was only necessary that the equipment at the other end of the path recover 1s and 0s adequately through whatever noise or perturbations existed on the line. Compared to analog, the threshold for recovery was extremely low.

The standard format for the D-1 parallel signal uses eight bits per component, plus a clock signal. This means that 18 parallel wires (nine pairs), fitted with standard 25-pin D connectors, are needed for signal distribution and interconnection. Extra pins in the connector can increase the data to a 10-bit signal, thus enhancing the quality of the signal transfer. System grounds and the cable shield account for the rest of the wires. (See Table 1.)

PIN	SIGNAL LINE	PIN	SIGNAL LINE
1	Clock	14	Clock return
2	System Ground A	15	System Ground B
3	Data 9	16	Data 9 return
4	Data 8	17	Data 8 return
5	Data 7	18	Data 7 return
6	Data 6	19	Data 6 return
7	Data 5	20	Data 5 return
8	Data 4	21	Data 4 return
9	Data 3	22	Data 3 return
10	Data 2	23	Data 2 return
11	Data 1	24	Data 1 return
12	Data 0	25	Data 0 return
13	Cable shield	26	Cable shield

Table 1. *The pin outs of a parallel digital cable. The video signal requires eight pairs plus the clock. The two extra pairs are optional.*

Composite digital

In the meantime, researchers developed another digital standard, based on the composite NTSC or PAL signal. The new standard was dubbed D-2. It also required a parallel cable of 18 conductors with 25-pin D connectors. An additional digital standard, D-3, requires the same cabling and connector arrangements.

As with most high data rate parallel transmission systems, the parallel signal path deteriorates rapidly with distance due to capacitive loading.

As with most high data rate parallel transmission systems, the signal path deteriorates rapidly with distance due to capacitive loading. The range of typical twisted pair cable used for parallel D-1 or D-2/D-3, even with equalization, is under 50 feet. The multiple conductor cables and connector are also expensive and bulky. Parallel digital may be adequate for small facilities or production islands. It is unlikely, however, to serve the needs of a large, integrated video facility, with hundreds of digital sources and destinations spread over long distances.

Serial to the rescue

Recognizing the problems associated with parallel digital video, researchers worked to develop serial digital video solutions. A serial digital system converts the parallel digital video signals of D-1 or D-2/D-3 to a serial datastream. The conversion can take place either in the origination device or in an external serializer. Serial video can be transmitted on a standard 75Ω coaxial cable using standard BNC connectors. Likewise, at the receiving end, the signal is converted to parallel with an internal or external deserializer.

Today's parallel-to-serial conversion schemes use bit rates of 270Mbits/s for D-1, and 143Mbits/s for NTSC D-2/D-3 (177Mbits/s for PAL). The fundamental frequencies are equal to approximately one half the bit rate, but there is also a range of complex sidebands that extend over a wide frequency spectrum. As previously mentioned, however, digital signals are forgiving of the normal analog signal gremlins. Waveform preservation (sideband integrity) is not as critical. This keeps the bandwidth manageable.

By paying adequate attention to attenuation and group delay, it is possible to extend serial digital signals over fairly long distances using standard 75Ω coaxial cable. Lengths up to approximately 1,000 feet are possible, similar to analog composite video. Most state-of-the-art serial digital sources, routing switchers and processing equipment include automatic cable equalizers. These circuits compensate for group delay and restore the signal to the original amplitude.

Serial killers

As with most electronic systems, some problems can arise with serial digital signals. Cable distortions, such as group delay and reflections, should be dealt with by automatic cable equalization within the distribution equipment.

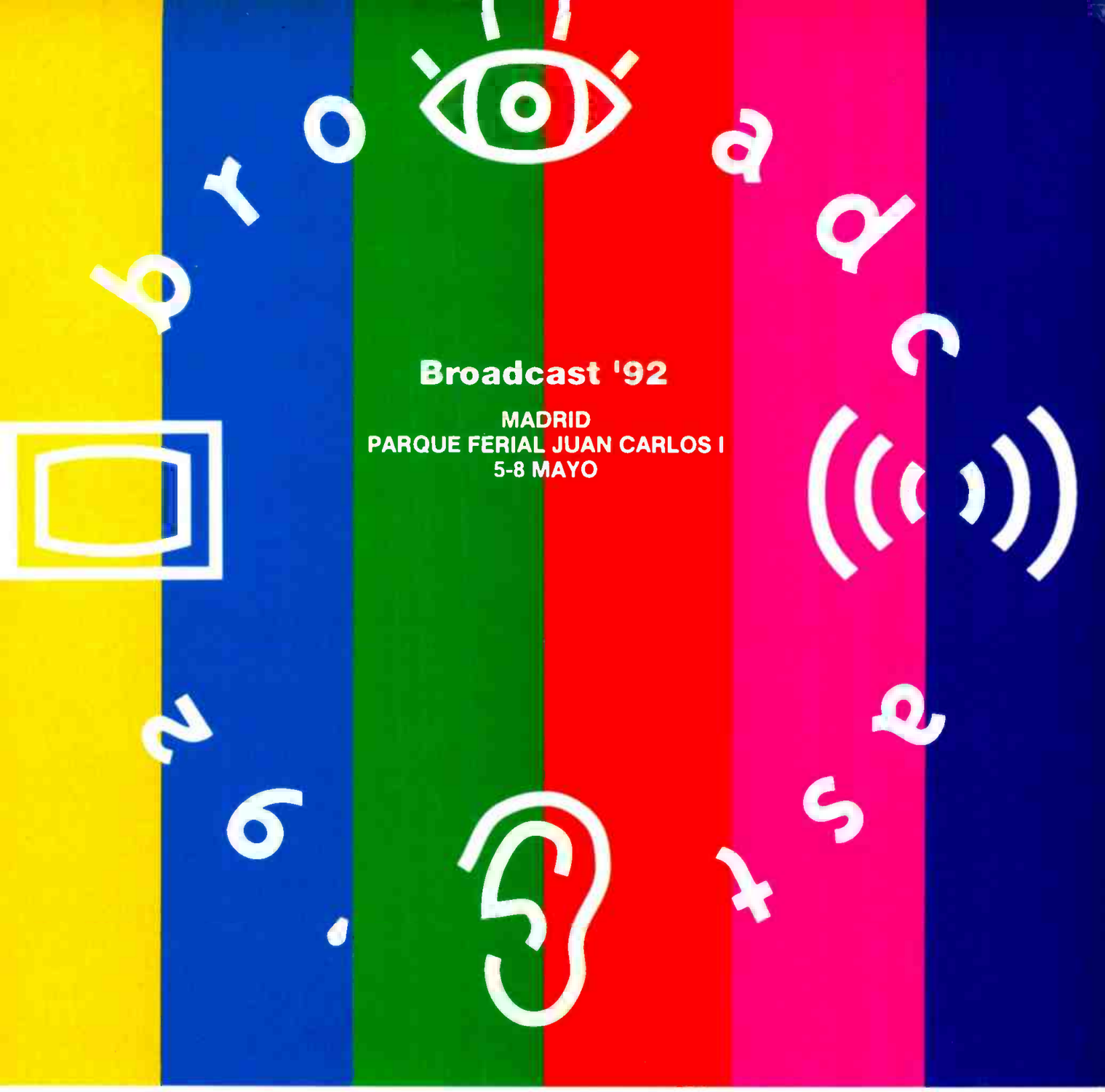
A number of system deficiencies can cause *jitter*, in which the digital pulses shift their position in time, and hence their values. To counter jitter and obtain perfectly reconstituted signals, systems use reclocking (resampling). A clock recovered from the datastream is usually provided for use in decoding the datastream in the distribution equipment. The reclocking devices are typically capable of sensing and switching automatically to either D-1 or D-2/D-3 clock rates. This technique, together with automatic equalization, provides significant transparency for serial digital signals under most system conditions.

The 75Ω cabling should be of high quality and properly installed (no tees please). Low VSWR is important in the serial digital system environment. The cable should have the lowest possible attenuation at the Nyquist frequency, and the best percentage of shield coverage, for lower crosstalk. This type of cable should also have low capacitance values.

One remaining important point must be addressed. In most circumstances, engineers must integrate serial digital systems into existing analog or parallel digital switching and distribution systems. Planning ahead can ensure that future integration will be smooth and seamless. Engineers should provide high-quality coaxial cabling, adequate power facilities and flexible routing switcher architecture and control systems. This will allow for retrofitting serial digital signal paths and control of multiple levels of analog and digital switching as the needs occur.

Best of both worlds

Serial digital video systems can offer the ease of construction and implementation designers have come to expect from analog composite video systems, plus the robustness and high signal quality of parallel digital video. The high data rates in serial systems demand good engineering practices. Care is warranted in the selection of distribution and processing equipment. However, serial digital video is taking its place as a powerful and useful video system format for today's facility design. ■



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The transition process: getting from A to D

By Keith Y. Reynolds

Conversion modules ease the digital upgrade.

The Bottom Line

Converting a broadcast or teleproduction facility from analog to digital need not be fiscally traumatic. Using a series of modular converters and adapters, change, hence cost, can be planned and contained. In addition, these converters make it possible to accommodate old and new equipment into an integrated, modern system.

The evolution to an all-digital facility is moving forward faster than many would like. However, the advantages are enormous. Digital is stable. Tweaks that kept technicians busy all day have been eliminated. Layering and other digital production techniques can produce dazzling presentations not previously possible.

This article explores the advantages of using serial data transmission as a way to ease the switch from analog to digital.

Format wars

The first practical digital videotape recorder (DVTR) used a component digital format, D-1. Although these devices are expensive, they can produce superb results. It is the standard of many teleproduction and post-production facilities.

Analog VTRs were the mainstay of the TV industry for many years. Although many formats proliferated, the most popular professional VTR format was the 1-inch type C. As these VTRs aged, a replacement composite DVTR, D-2, came on the scene. These DVTRs also have analog inputs and outputs. Many facilities use these machines in an analog mode, with expectations to go digital when their stations do.

NHK in Japan led the development of a composite DVTR that uses $^{1}/_{2}$-inch cassettes (D-1 and D-2 use $^{3}/_{4}$-inch cassettes). Although the machine's signal path looks like D-2, it is a different format known as D-3.

The format battles do not end here. Parallel and serial are the two types of digital transmission standards. Parallel digital systems use 25 conductor transmission cables. These can be cumbersome, expensive, and they may not function well if

Reynolds is a product marketing manager, distribution systems division, Grass Valley Group, Grass Valley, CA.

A digital component on-line edit suite at Pacific Ocean Post. Although post applications often use all-digital suites, other production and broadcast applications will continue to rely on a combination of analog and digital hardware as they evolve to an all-digital environment.

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longer than approximately 50 meters.

The serial approach is more practical. With serial, the maximum path length can be increased to 300 meters, and the signal can be routed around a facility using traditional coax cable. Some newer DVTRs include serial digital I/Os.

This leaves us with D-1 parallel, D-1 serial, D-2 parallel, D-2 serial, D-3 parallel and D-3 serial. But there is even more confusion. Many TV facilities not only have serial and parallel digital devices, but they also have composite and component analog devices. How do you cope with this proliferation of formats?

Individual conversion modules and sample rate converters are now available to deal with these problems, making the process almost painless.

Modular approach

One solution is for manufacturers to offer several types of conversion modules that all fit into rack-mount frames. A common power supply, with provisions for an optional redundant supply, will provide high reliability. The rear of the frame can have individual connector panels that mate with the modules. All of the modules could be removed from the front and could be keyed so only the proper module can mate with its connector assembly.

Available modules might include video and audio serial digital distribution amplifiers (DAs), video and audio D to A and A to D converters, serializers, deserializers, digital delay modules, multiplexers and demultiplexers. As other needs arise, modules will become available. The following are specifics about each type of module.

- *DAs*

Analog video systems must often use distribution amplifiers to distribute signals around a facility. The same is true with serial digital signals. These DAs come in two types — fan out and reclocking. The fan-out DA distributes the serial digital data equally to all outputs, without processing. Reclocking DAs equalize the serial input signal for up to 300 meters (1,000 feet) of cable. They recover a clock signal from the input data, reclock the signal to reduce jitter, and distribute it to the outputs. (See Figure 1.)

In this hybrid video world in which we live, analog video signals may need to be converted to digital, and digital signals may need to be converted to analog.

- *A/D and D/A converters*

In this hybrid video world in which we live, analog video signals may need to be converted to digital, and digital signals may need to be converted to analog.

For example, many facilities will own analog composite VTRs for years to come, but they may wish to route their outputs through a serial digital routing switcher along with other serial digital signals. This can be accomplished with an A/D converter. A D/A converter can be used at the receiving end if needed.

A typical A/D receives an NTSC or PAL analog signal from loop-through BNC connectors. Gain adjustments and monitoring capabilities allow proper processing of the input signal. Several serial digital outputs, as well as parallel digital outputs, may be provided. Whether the composite digital

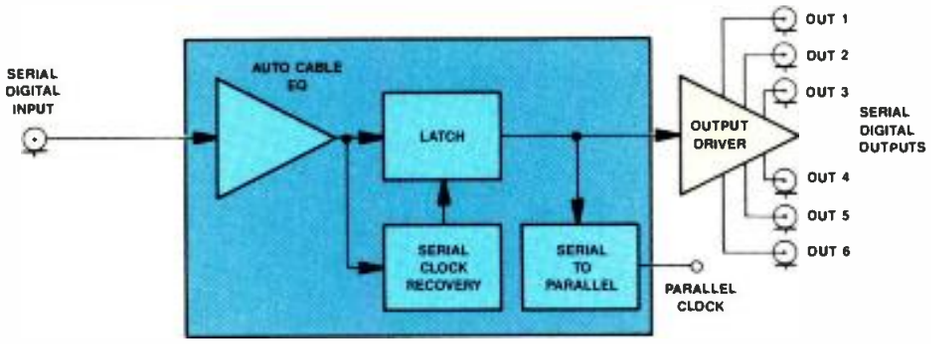

Figure 1. *A typical reclocking distribution amplifier recovers a clock signal from the incoming input signal. The clock signal is used to regenerate the data, which feeds the output driver.*

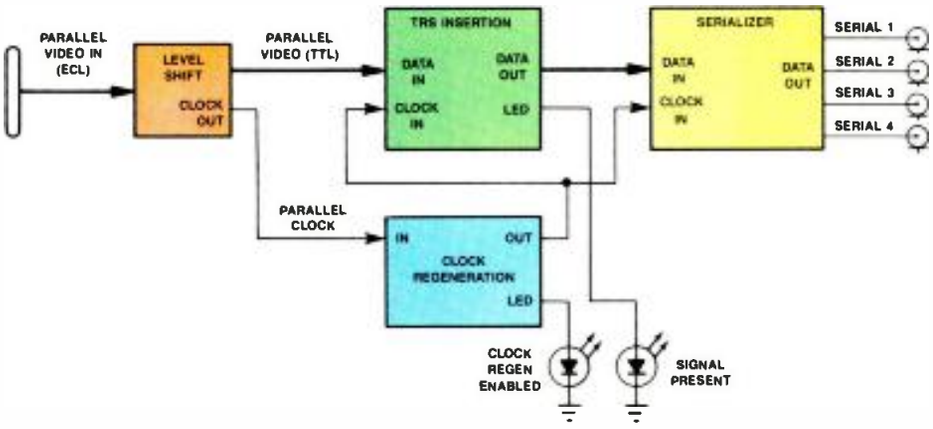

Figure 2. *Many digital devices have only parallel I/O. A serializer may be needed to convert parallel digital video into serial for plant distribution. A timing reference signal (TRS) is inserted to take the place of sync.*

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outputs contain sync or a timing reference signal (TRS) they may be user-selectable.

A typical D/A will accept either composite serial or parallel digital data. If the input is serial, the TRS data is stripped off and replaced by data for sync. After filtering and conversion to analog, the signal is passed through a reconstruction filter and an output driver.

- *Serializers*

Because many digital devices in use today have only parallel I/Os, a serializer may be required. Serializers must convert ECL level, 10-bit parallel signals to serial I/O.

Differences in the component, composite NTSC and composite PAL signals mean that three types of serializers are required. Component digital and composite digital have different serial data rates, (270Mbit/s for component, 143Mbit/s for NTSC D-2 and 177Mbit/s for PAL D-2). Composite digital also requires that the TRS and other ancillary data, such as AES/EBU audio be added to the parallel composite datastream. (See Figure 2.) The location of this data in the composite digital horizontal sync period is shown in Figure 3. This is not a requirement in the component digital format, where the *start of active video* and the *end of active video* words are part of the datastream.

Once the parallel digital signal is converted to serial, it can be routed and distributed around the facility using standard coax cable and patch panels.

- *Deserializers*

Once the parallel digital signal is converted to serial, it can be routed and distributed around the station using standard coax cable and patch panels, and serial digital routing switchers. At its destination, it may be necessary to convert the serial bitstream from the coax back to parallel. This requires a deserializer.

- *Delays*

A famous comedian once remarked that timing is everything. The same is true in digital TV systems. Propagation delay in analog video products is usually measured in nanoseconds. However, the delays of digital equipment are significantly longer — typically microseconds. This is because digital-processing clock cycle increments take time, resulting in delay. Hence digital delay devices for composite and component digital may be required. Framestores could solve the problem, but they are expensive.

A famous comedian once remarked that timing is everything. The same is true in digital TV systems.

For example, a DVTR may go to a digital production switcher and to a routing switcher. The switcher output needs to be in time with the DVTR at the input of the routing switcher. However, the switcher has a delay of approximately one TV line (63.5 seconds). The DVTR output thus needs to go through a digital delay mod-

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Circle (53) on Reply Card

R for new radio profits

By R. Matthew Straeb

RDS may be just what the doctor ordered for FM.

The Bottom Line

Today's forecasts for future radio profits are a bitter pill to swallow, but the radio data system (RDS) might hold a cure. It shows promise for promotion and sales. New revenue can be created from paging, data delivery and "radiotext" services. Call letters and slogans can be displayed on the front panels of RDS radios. Up to 15 different functions are served by RDS. Many systems are already in use abroad, and now RDS is about to hit the U.S. marketplace.

$

Radio data system (RDS) is a significant innovation in the VHF FM audio broadcasting business. It allows broadcasters to transmit radio data inaudibly on a 57kHz subcarrier at approximately 1,200bit/s. RDS gives stationary and mobile listeners new services and information, and it offers the broadcaster an opportunity to increase revenue. Because RDS technology is nonproprietary and an RDS encoder is inexpensive, start-up costs to the broadcaster are minimal.

Installation is also a simple and straightforward process. The only interface that an RDS encoder requires in addition to the actual data input is the 19kHz pilot from the stereo generator. The encoder's output is inserted into the composite FM signal like that of any SCA generator. (See Figure 1.) Monitoring is accomplished off-air with an RDS receiver.

The RDS standard was developed by the European Broadcasting Union (EBU) member countries in a cooperative effort and was published in 1984. The EBU has made this proven standard available for international FM broadcasters in an effort to spread the RDS service worldwide. Today, more than 2,000 RDS encoders are installed around the world and are used for many different applications. These include display of station call letters/logo and program type, alternative frequency switching, paging, traffic management, emergency alerting, radio text, computer interface and location/navigation.

Adding an RDS encoder to the studio racks will allow a station to generate additional revenue. This revenue-enhancing technology is closer than you think. (Photo courtesy of KSAN/KNEW.)

Straeb is marketing manager for Rohde & Schwarz, Lanham, MD.

In 1990, the National Radio Systems Committee (NRSC) formed a subcommittee that is developing a U.S. standard for RDS (U.S. RDS). It is expected to include most, if not all, of the previously mentioned European RDS features and services, as adjusted to fit the U.S. FM broadcast marketplace.

Technical operation

The RDS system uses a 57kHz suppressed-carrier AM subcarrier. During FM stereo broadcasts, it is phase- or quadrature-locked to the third harmonic of the stereo pilot. Data is differentially biphase coded and shaped (digitally filtered), using a bit-rate clock of 1,187.5Hz ($^1/_{48}$ of the subcarrier frequency). The modulation system can be considered as 2PSK with a phase deviation of ±90°. The proposed U.S. RDS standard effects a deviation of the FM carrier (resulting from an unmodulated U.S. RDS subcarrier) that ranges from ±1kHz to ±7.5kHz, depending on the service provided. This corresponds to an injection level range of 1.4% to 10%. Nominal recommended RDS deviation is ±2kHz (2.7% injection).

Figure 2 shows how data is transmitted in 16-bit words, each of which is associated with a 10-bit checkword, for a total of 26 bits called a *block*. The checkword includes all the information required for block and group synchronization and error correction. Four blocks form a *group* (104 bits), which defines the basic message unit of the system. Fifteen different group types are defined, each serving a different function, as detailed in Table 1. Data transmission is fully synchronous and continuous.

Because each group contains only one kind of message and there is no fixed repe-

PGES' total solution

Portland General Energy Systems (PGES) is a power quality systems application group specializing in power quality analysis, prevention and solutions. It is a non-regulated subsidiary of Portland General Electric, which supplies electricity to about 40% of the state of Oregon.

Under the direction of Jeff Harvey, PE, PGES is among the nation's most experienced organizations dealing with power quality problems and issues. The firm has completed more than 300 projects for about 200 customers, leading it into a consultant/project manager role that focuses on power quality applications for new and existing buildings.

A wide range of businesses have sought PGES' power quality consulting and project management services, including health care, retailing, telecommunications, banking, high technology, industrial and commercial firms.

PGES brings its knowledge as power quality specialists to bear as part of the development and construction team, which includes architects, engineers, contractors and developers.

In new construction and remodeling, the firm tries to prevent problems before they occur by helping design electrical systems to meet equipment specifications and performance standards in addition to the National Electric Code's fire and safety regulations.

With its sophisticated testing equipment, PGES' highly trained staff takes a total solution approach to power quality. They understand that there's more to solving a problem than just purchasing and plugging in mitigation equipment. The total solution approach also includes wiring and grounding considerations.

In a recent paper, for example, Harvey points out that simply purchasing mitigation equipment can neglect such important issues as matching the actual load requirements with equipment specification, how and where equipment is installed, equipment delivery and installation, overall planning and project responsibility (potentially, a major problem in power quality problem mitigation) and how heating and cooling systems are affected.

Case studies, papers and handbooks are available...

Through its field operations, managed by Gary Larkins, PGES has found that such energy-saving devices as electronic ballasts, adjustable speed drives and energy management systems are especially susceptible to being affected by or causing power quality problems.

In cooperation with the rest of the subcontractor team, PGES performs acceptance testing as part of the total building commissioning process. This validates energy efficiency measures and performs verification of energy savings. It also shows the impact of energy-saving equipment on the entire electrical system.

Acceptance testing also takes the form of quality assurance in the installation of mitigation equipment. In this way, PGES technicians make sure that equipment meets specifications and they ensure that equipment is installed properly and is operating efficiently.

As part of its mission, PGES also is heavily into education, performing training that ranges from general awareness to technical assistance programs for utilities, architects, engineers, contractors and others who might be logically considered part of the power quality team.

As part of this effort, the firm's case studies, published papers and a power quality handbook are available at no charge by calling 503-464-7000 or writing to PGES at 33 N.W. First Ave., Suite 1, Portland, OR 97209.

tition of the various group types, groups can be inserted in whatever sequence is required to satisfy a particular set of applications. This makes the system efficient, because only those functions that are active need be transmitted, so blocks are not wasted on unimplemented services. (The first four bits of each group's second data block tells the decoder which function that group of data refers to. Some functions [PI, TP, PTY] have databits dedicated to them in *every* group, however. See Figure 3.) Furthermore, these choices of functions can be selected dynamically and vary with the broadcaster's needs.

For example, a broadcaster may rent the subcarrier to a paging company that uses 30% capacity, either full time or during off-peak hours only. The remaining 70% can be used for other services, some of which may also generate revenue, directly or indirectly. A radio station slogan and call letters on the car receiver, alternate frequency switching, clock time/date and emergency/traffic alerting are examples of the indirect approach.

Potential applications

Some examples of services currently provided by RDS-equipped stations in Europe are radio paging, computer downloading with RDS receivers using an RS-232 data port, location and navigation data, electronic bus schedules, pure data service, emergency alerting, stock quotes, weather/sports/news information, traffic updates, sending "radiotext" to an active billboard, and station promotion through display of call letters and slogans. Conceivably, RDS could deliver any service of moderate data rate that would benefit from an inexpensive, wide-area data delivery system.

Broadcast audiences are not the only potential beneficiaries of RDS service. A company in Louisiana has installed an RDS paging system. A county in Texas has an emergency alerting system that uses RDS. In some areas, RDS is being explored for improving or replacing EBS. Meanwhile, many intelligent-vehicle highway

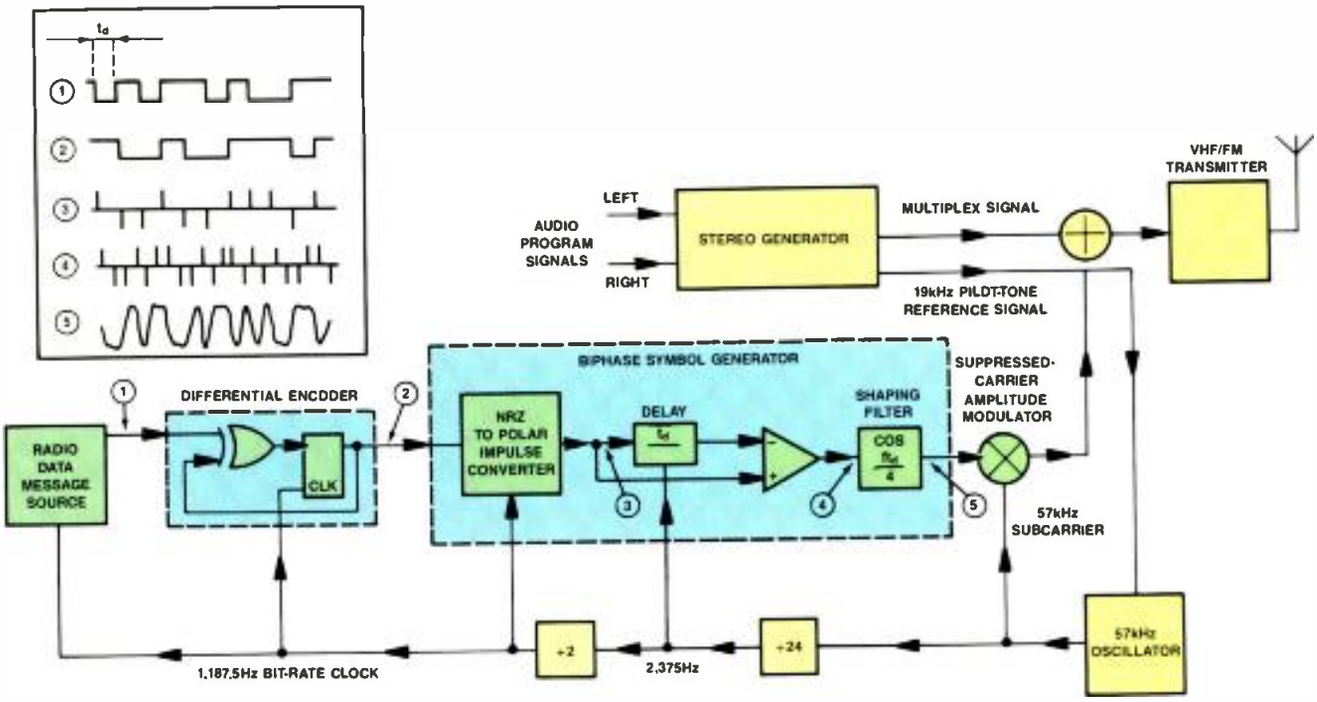

Figure 1. Block diagram of RDS encoding process.

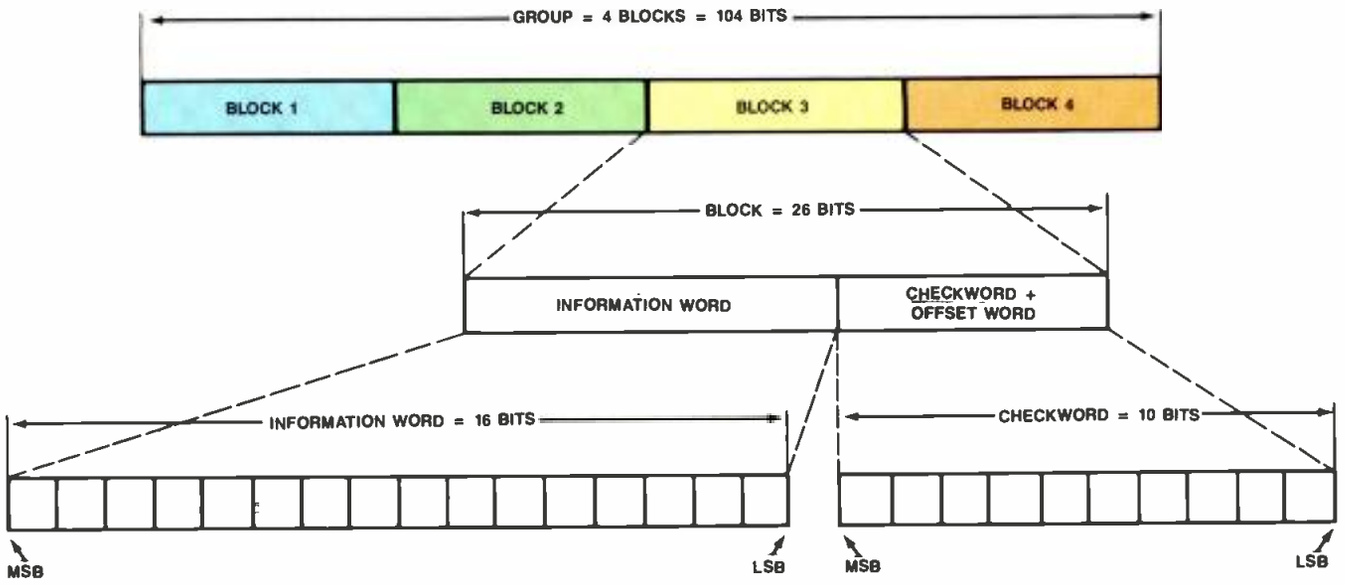

Figure 2. Basic data structure of RDS baseband coding. Note that most significant bits (MSBs) are transmitted first, with least significant bits (LSBs) sent last.

systems are evaluating RDS as a method to deliver data to the automobile.

American home FM receivers of the future may be equipped with larger displays for reading the U.S. RDS radiotext (RT) feature. (Some European models already exist.) When implemented, this service could provide an adjunct service to sponsors, such as running their address and phone number while their commercial is airing. For non-commercial FM uses, pledge-line phone numbers could be run during fundraisers, minimizing the need for on-air announcements. Station request lines or other call-in line numbers could also be listed. Radiotext could also be applied independent of audio programming, providing a separate information or advertising stream similar to an active billboard. This could be programmed in like fashion to a radio station's current recorded-announcement call-in lines (sports scores, weather, news updates, public service hot line announcements and community bulletin boards).

Another interesting concept under consideration involves using a data port on an RDS radio to output tuning and clock data to a recorder, thus providing an accurate survey of listening habits and a welcome alternative to the "diary" system.

Current U.S. RDS status

Work continues on the voluntary U.S. RDS standard in the NRSC subcommittee, involving representatives from EIA, NAB and others. Beyond decisions on technical adjustments of RDS to U.S. standards, three challenging issues have occupied most of the panel's recent deliberations.

First, AM broadcasters have voiced a protest over the system's applicability to only FM stations. Some discussion over alternatives for AM broadcast use has taken place, but as yet, little progress has been made toward that end.

Second, approximately 200 FM stations in the United States already use a 57kHz subcarrier for a national paging service. The past year has seen significant testing and development toward a compatible U.S. standard that will accommodate both systems, with a final compromise recommendation anticipated in 1992.

Third, the program type (PTY) coding remains under fierce debate. This function would allow a listener to sort and scan stations to listen to by format. Obviously, a finite number of PTY codes in a standardized listing of formats is essential for this to be a useful function. Coming to a decision on the number and names of format possibilities has been perhaps the most contentious element of the U.S. RDS standardizing process. Some broadcasters oppose the concept, reluctant to make it easy for their listeners to find their station's most direct competition.

Another difficulty involves the ever-changing nature of radio formatics and the continual need for new format names and descriptors. On the other hand, PTY is a feature that many receiver manufacturers strongly support, with the expectation that its listener-friendliness will be helpful in marketing U.S. RDS radios. Interestingly, PTY codes are generally not used in Europe to date, even among the most comprehensive of RDS implementations.

A related misunderstanding held by some about RDS features confuses the format (PTY) and alternate frequency-switching (AF) functions. Under no circumstances will an RDS radio automatically switch to a competitor's frequency. Each station specifies the alternative frequencies, if any, that RDS radios will switch to when the main signal fades. Incidentally, AM stations *are* accommodated in one respect, in that an AM channel can be among the alternative frequencies that an RDS FM station lists. Thus a receiver can be instructed to tune to a simulcasting (or otherwise related) AM channel when the currently tuned FM station fades.

Ready to roll

Contrary to the opinion of some U.S. broadcasters who believe that RDS is many years away, the NRSC's U.S. RDS

subcommittee is within months of proposing a standard to the full NRSC for a vote on adoption. More than 100 different car radio manufacturers in Europe, Japan and the United States have released (or are prepared to produce) products incorporating RDS features. In addition, there are at least a dozen manufacturers offering families of RDS devices, such as encoders and standalone decoders.

RDS will provide new opportunities for enhancing the public service and revenue-producing potential of FM broadcasters. Station promotional uses can also produce audience growth and listener loyalty. Accurate audience measurement may even be involved. Expenses incurred for a broadcasters' telemetry channels can also be reduced by using the RDS datastream to carry this data.

Proposed digital radio broadcast formats all include auxiliary features seemingly inspired by RDS, but it will be some time before any such system is implemented. Smart listeners need smart radios, and soon. The adaptive nature of RDS means that the future of radio can begin today, assuring FM broadcasters of a healthy and growing service for the future.

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2. "EBU Tech. 3244 and Supplements 1-4." European Broadcast Union, Geneva, 1984, 1987 and 1989.
3. "System for Automatic Tuning and Other Applications in FM Radio Receivers for Use With the Pilot-Tone System." CCIR Recommendation 643 (1986).
4. *EBU Review - Technical*, No. 245, February 1991. (Various articles in this all-RDS issue.) European Broadcast Union, Geneva.
5. "RDS Replaces EBS?" Gerald M. LeBow. *Proceedings of the 1990 SBE and Broadcast Engineering Conference*, October 1990.
6. *Broadcast Data Systems*. Peter L. Mothersole and Norman W. White. Butterworth & Co., London, 1990.

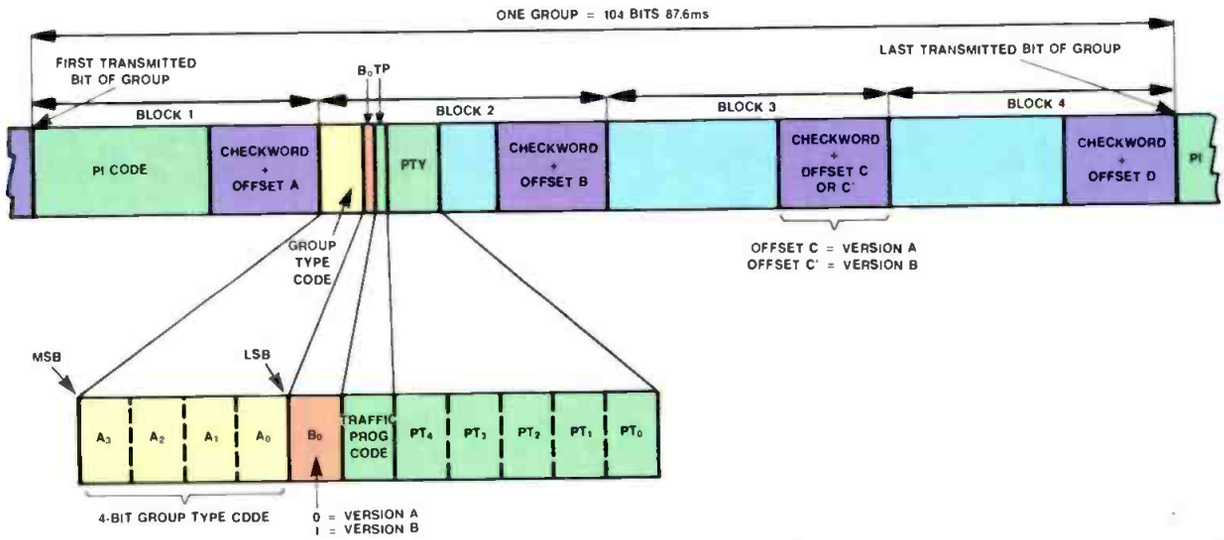


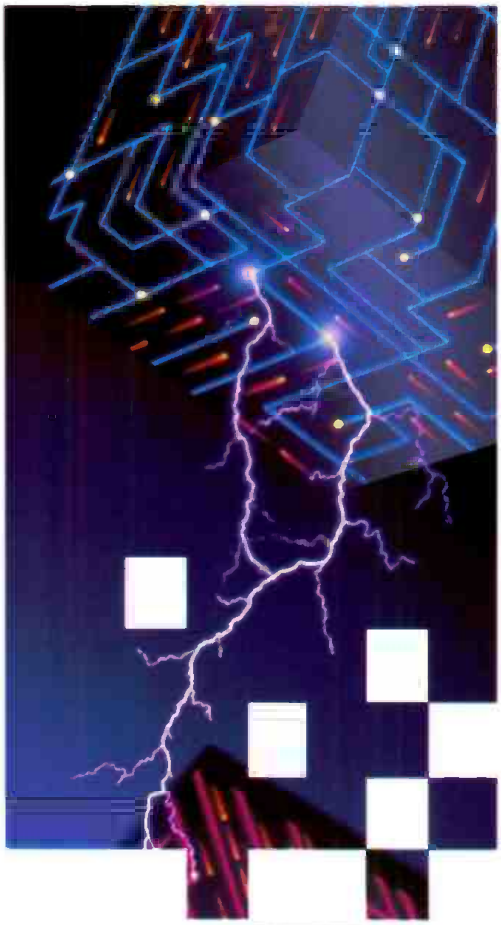
Figure 3. *Message format and general addressing of RDS data groups. Note that PI, TP and PTY data appear in all groups, with all other functions carried in unspecified (blue) sectors. Addressing of these sectors varies with group type, as specified by 4-bit group type code at beginning of block 2. Version A/B accommodates two variants of each group type.*

	FEATURE TITLE	FUNCTION PROVIDED
PI	Program Identification	Unique numeric code for each station
PS	Program Service	8-character station call letters/logo display
PTY	Program Type	Format identifier
TP	Traffic Pgm. ident.	Tells whether station provides traffic info.
AF	Alternative Frequencies	Translator/network hand-off information[1]
TA	Traffic Announcement id.	Tells radio to announce traffic msg. channel
DI	Decoder Identification	Control data for listener's processing equip.[2]
PIN	Program Item Number	IDs each program, for automatic recording uses
RT	Radiotext	Alphanumeric announcement display
EON	Enhanced Other Networks	Related stations for referral to listener[3]
TDC	Transparent Data Channel	For software downloads or other data delivery
IH	In-house application	For Broadcaster's own use (control data, etc.)
CT	Clock Time and date	Real time display of date and local time
RP	Radio Paging	Alphanumeric "smart" paging system[4]
EWS	Emergency Warning System	Delivers emergency information.

NOTES:
1. Monitors up to 25 alternate channels (including AM stations) specified by currently tuned station and automatically switches to any one whose signal strength exceeds the current station.
2. Can switch in a complementary noise-reduction system's decoder circuit, for example, or other optional audio processing or function in listener's system.
3. Provides list of other RDS-equipped FM stations to the listener.
4. Frequency-agile pagers automatically seek appropriate RDS stations in their current location.

Table 1. *The 15 currently defined RDS functions and a brief description of each.* ■

THE SS7 SUMMIT.



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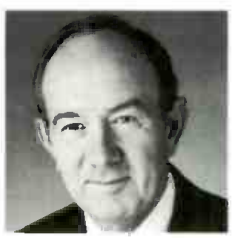
Luncheon Keynote Speaker
Alfred Sikes
Chairman, FCC



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William Blatt, Assistant Vice President, Technology Planning, Northern Telecom
Joel Engel, Vice President of Technology Management, Ameritech Services
Dennis Foster, President, GTE Mobilenet
Nick Kauser, Senior Vice President & Chief Technology Officer, McCaw Cellular
Michael Hanson, President, Ameritech Direct
John DeFeo, President & CEO, US West NewVector
Robert C. Nitschke, Vice President, Client Services, ITN
Raymond J. Bonelli, Manager, CCS7 Network Services & Support, AT&T Network Systems
Jess Sherwood, Director of Engineering & Operations, ITN, Inc.
Paul R. Zielinski, Director of Regulatory Policy & Industry Relations, Rochester Telephone
Richard E. Tice, Product Manager–LIDB, BellSouth
Jay Kitchen, President, National Association of Business & Educational Radio
Karen Shinevar, Vice President, McCaw Cellular
Michael Warr, Technical Editor, Telephony
William T. Pruett, Director, Technology Strategy, BellSouth
Robert G. White, District Manager, PCS Market Analysis, Bellcore
Rhonda Wickham, Editor, Cellular Business
James Butler, District Manager, CCS Product Management, Bellcore
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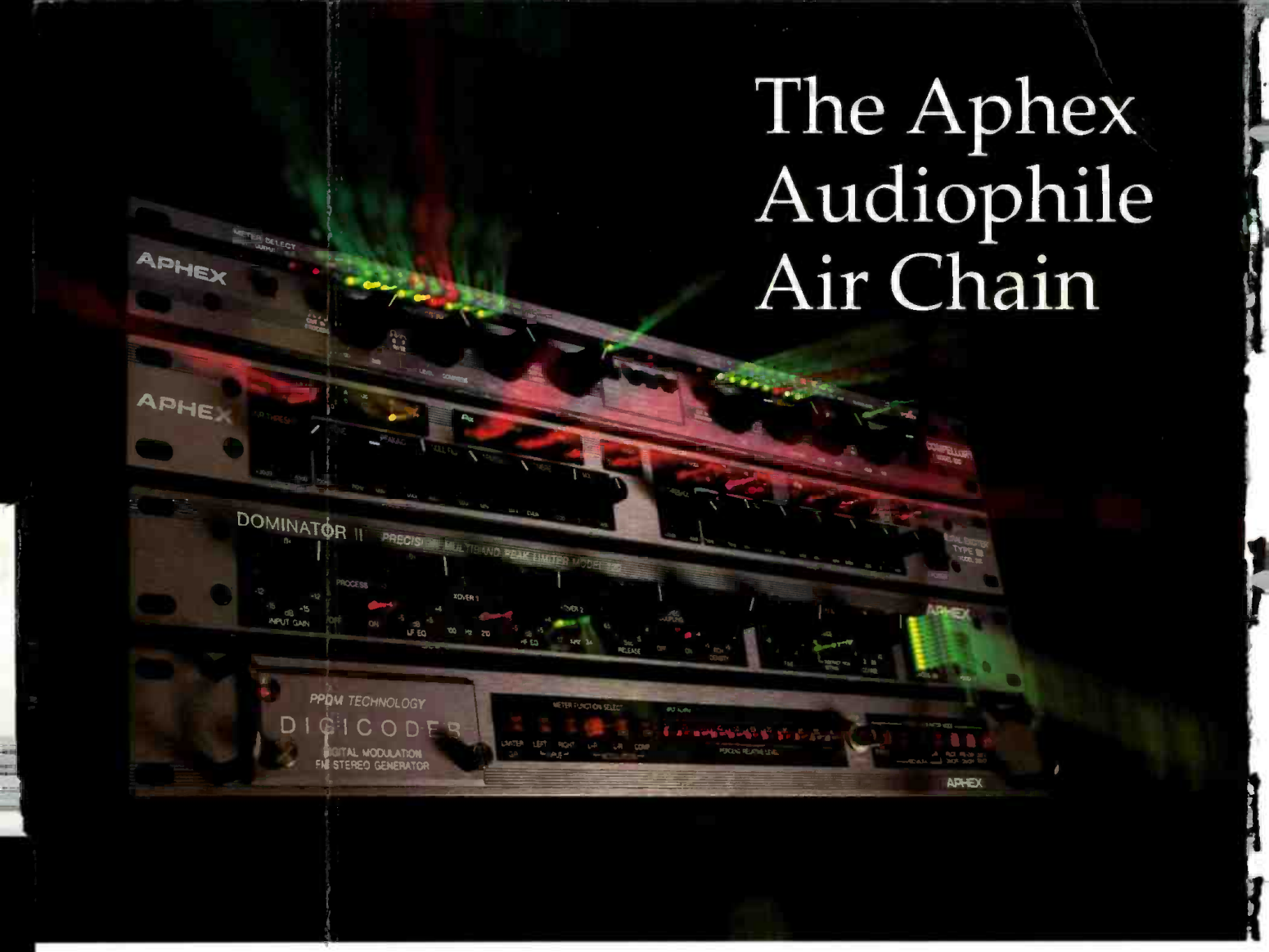
Steve Titch, News Editor, Telephony
Jack Harry, Director of Architectural and Strategic Planning, United Telecom

Circle (38) on Reply Card

The Aphex Audiophile Air Chain



Smart broadcasters know that quality sound is essential to attract and keep loyal listeners ... and advertisers.

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If you want to be a winner in the "no win modulation wars", contact your dealer to arrange a demonstration of the Aphex Audiophile Air Chain. You can't buy better quality at any price.

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NAB '92 Equipment Exhibitors

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include an ad-
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il 13-16, 1992). For
production indus-
a look at technolog-
ients that have occurred
past year. Based on informa-
provided by NAB dated February
20, this overview surveys the plans of
more than 720 manufacturers, distrib-
utors and service providers.

Building this Review

We begin the process of collecting information from the manufacturers on about December 1 each year. From then on, it becomes a challenge to get a 100% response from the manufacturers, if possible. As it turns out, a surprising number of companies move during the year. Often it seems that they forget to let anyone know. This year, as in the past, new names appear on the scene, while a few of the others change theirs.

Once contact is established with the manufacturer, a new phase begins - trying to pin down some solid facts. When the request for information is originally mailed, many are uncertain of what they plan to exhibit. The question is whether or not the *pet project* will be ready in time. Can we talk about it before the show? Should it be revealed? or is there the chance that some last minute difficulty will cause them to leave it at home. This year, a large percentage of companies were uncertain about the products they would show, either as featured, established products or new introductions.

In this issue

Following our traditional format, there are three parts to this preview. A fold-out map, immediately preceding this page, will help you to plan your tour of the show. Be aware that locations for some of the exhibitors may change by the time everyone arrives in Las Vegas, as manufacturers continue to jockey for *better* positions up to the 9:00am show opening on Monday, April 13. Placements on this map were correct as of the Febuary 20.

In the Exhibitor section, following this page, you will find all known exhibitors listed alphabetically. Companies were asked to indicate what established products would be featured in their exhibit. If no *features* were indicated, we have included a generic statement of the type of products the company offers. If they informed us of new product introductions, you will find "*See new products under ...*", which gives a key to the product locations in *New at NAB*, starting on page 135.

New at NAB, a compilation of new product introductions, is arranged by categories according Table 1, page 135. In our terminology, *new* is defined as any product brought to market following NAB '91. Upgraded and enhanced versions of previous products as well as production models of previously shown prototypes may also be included.

Both the *Equipment Exhibitor* list and *New at NAB* include reader service numbers to bring you in contact with the manufacturers for more information about their offerings.

At the show

Las Vegas will have a somewhat different appearance this year, compared to last. We are told that construction is complete. Instead of walking around the scrap iron and construction material lot, a new (North Hall) exhibit area will greet visitors. Figure 1 indicates the layout of this year's exhibition areas. North Hall houses exhibits primarily targeting the radio segment of the industry. However, it will also include audio manufacturers whose products are of interest to video production and TV broadcast. You'll want to check up on that area for your audio needs.

South Hall, the remaining exhibit space, includes manufacturers with products for video production and TV broadcast.

An adjunct to the NAB convention is HDTV World, occuring concurrently in the Hilton Center exhibit facility. We suggest you set aside a few minutes to tour the latest in advanced, high-resolution video.

For those planning to attend this year's exhibition, you should have received a registration packet from NAB and have already submitted your registration form. With an expected attendance of 50,000, of which at least 5,000 will be international visitors from 25 different countries, accommodations have been filling rapidly. For those uncertain about going, this issue will give you some ideas of what you will see.

If it turns out that you are unable to go, don't fret. The June issue of **Broadcast Engineering** will include information on those products that appear unannounced, as it were, as well as more details about some of those in this preview. In the past, some of those surprise announcements have been significant to the industry.

See you in Vegas!

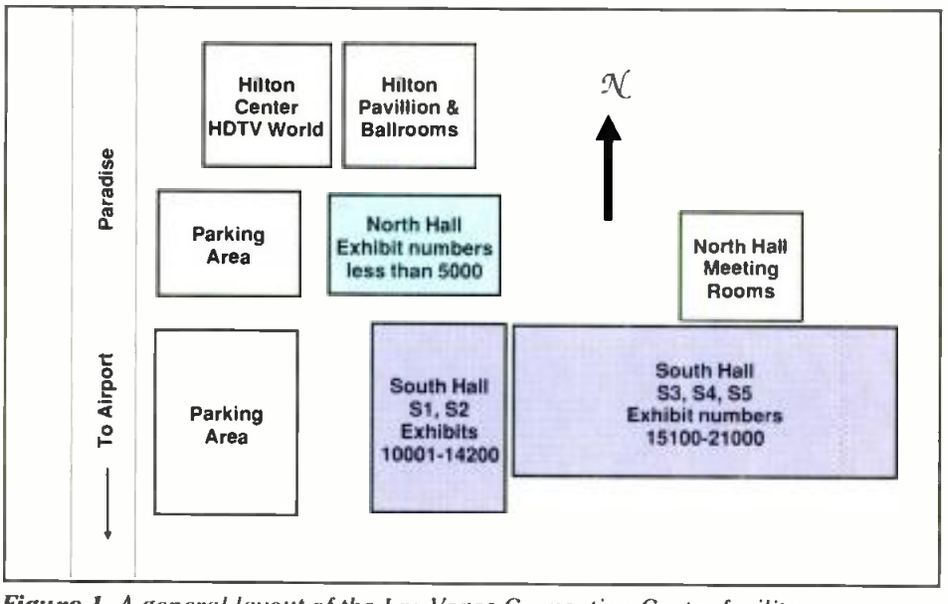

Figure 1. *A general layout of the Las Vegas Convention Center facility.*

A.F. Associates 19634
AVS graphics and titling generators, standards converters; Radamec automated camera support products. (*See new products under V1, V4*)
Circle (501) See ad index

Abbott & Company 18481
Electrical wiring, power connector products; electrical panels.
Circle (502)

Abekas Video Systems 11251
Digital video products, *A51* special effects; *A84/66* component digital switcher, cache, layering systems; titlers; digital disc recorders. (*See new products under V2, V3, V5*)
Circle (503) See ad index

Accom Inc. 19271
Video processors, *ICM-4224* image compositing module; editing controllers, *Axial 2020* on-line system. New products announced at the show.
Circle (504)

Accu-Weather 13727
Weather graphics services, *Ultragraphix, Amiga* weather graphics systems. (*See new products under S8*)
Circle (505)

Accurate Sound Corp. 2602
Audio recording, logging products.
Circle (506)

Acoustic Systems 11119
Announcer facilities, *BB-660* voice-over booth.
Circle (507)

Acoustical Solutions/Alpha Audio 12901
Acoustic treatments for studios, *Sonex* materials; *Portable Isolation Booth*. (*See new products under S5*)
Circle (508)

Acrodyne Industries 15712
TV transmitters, exciters, *TLU/1KS* solid-state 1kW, *TLU/1KACE* tetrode 1kW UHF systems. (*See new products under R1, R3*)
Circle (509) See ad index

Adams-Smith 13714
Editing and transport synchronization products; time-code equipment.
Circle (510)

ADC Telecommunications 19652
Signal distribution products, *ProPatch* for audio/video, *I.C.O.N.* audio distribution frame. (*See new products under S6*)
Circle (511) See ad index

Adelaide Works 13063
Telecine utility packages *Scan/R* database.
Circle (512)

ADM Systems 18442
Audio mixers, *STV/24; CH/20, CH/27* stereo/mono audio distribution products. (*See new products under A1*)
Circle (513)

Adrienne Electronics 18580
Signal routing switchers, *AEC-1, -2* 10×1 or ×2; ESbus interface, analyzers for IBM/PCs *PC-207M*; time-code units. (*See new products under V2*)
Circle (514)

Advance Products 20106
Utility equipment tables, carts; mobile projector tables.
Circle (515)

Advanced Designs 11606
Weather radar, weather graphic display systems.
Circle (516)

Advent Communications 16233
Satellite communications units, *Mantis 1500, 1900* Ku-band flyaway systems for SNG/TV, data; *Lynx SNG* vans for SNG/TV, data, telephony, digital radio. (*See new products under R6*)
Circle (517)

AEV/Elenos 5418
Audio mixers, *MMS, BSM* series; audio processors; digital spot recorders; telephone hybrids; *Telereport 10* portable telephone interface; TV translators, FM transmitters; *ERDS 3100* RDS encoder; clock systems.
Circle (518)

Afterglow Inc. 17053
Distributor; digital serial coders by Miranda; telecine products by Fosterdene, Video Engineering, Perfectone.
Circle (519)

Aircraft Music Library 16124
Production music libraries.
Circle (520)

AKG Acoustics 2800
Audio processing products, *dbx* noise reduction, noise gates; *MicroMic* microphone; *K270HC* headset mic; Orban *FH-8200* digital audio processor.
Circle (521) See ad index

Alamar Electronics 12527
Automation control products, software.
Circle (522)

Alcatel Telspace 10956
Microwave link products, *TM 400* series for video, sound.
Circle (523)

Alden Electronics 16106
Graphics systems for weather, *WS-5500* Weatherworks workstation.
Circle (524)

Alesis 1212
Digital audio products, *ADAT* multitrack recorders and remote-control equipment. (*See new products under A4*)
Circle (525) See ad index

Alexander Batteries 13738
Battery products, *BP1/1A/1A-11, TA 6500, BP90*. (*See new products under V9*)
Circle (526)

Alias Research 15182
Graphics software, *Animator, PowerAnimator* 3-D modeling, rendering and animation products.
Circle (527)

Allen Avionics 16207
Video processing products *HEC-2000* video hum eliminators; video delay lines; digital signal distribution equipment. (*See new products under V3, V4*)
Circle (528)

Allen Osborne Associates 15570
Transportable masts; production utility products.
Circle (529) See ad index

Allied Tower 4226
Communications towers for broadcast, microwave.
Circle (530)

Alpha Imag
Digital signal
video product
digital routing s
products under S2
Circle (531)

ALTA Group
Video recording and p
(*See new products under*
Circle (532)

Altec Lansing
Audio products, automati
1674C; temper-proof equalizer
Circle (533)

Altronic Research
RF signal power measuring equ
Model 672 5kW and *Model 640105* du
VHF air-cooled loads. (*See new pro*
under S3)
Circle (534)

Amber Electro Design 4806
Portable and programmable audio system measurement products, *3501* and *5500* test systems. (*See new products under S3*)
Circle (535)

AMCO Engineering 16412
Electronic equipment enclosures, *Frugal Frame* vertical console series. (*See new products under S5*)
Circle (536)

AMEK Consoles/TAC 13351
Audio mixing consoles, *Hendrix, SR6000* and TAC *Bullett* systems; console automation. (*See new products under A1*)
Circle (537)

American Broadcast Systems 12804
TV automation equipment, *MicroCart 50* cartridge systems. (*See new products under S1*)
Circle (538)

American Studio Equipment 17882
Motion picture equipment; grip products; rental programs.
Circle (539)

Ampex Corporation 17101
Video recording systems, *VPR-200, -300* series D-2; video effects equipment, *ADO series*; videotape editing systems; *Alex* titler. (*See new products under V5*)
Circle (540) See ad index

Ampex Recording Media 17101
Recording media for audio, video, all formats. (*See new products under S7*)
Circle (541)

Amtel Systems 11317
Editing control equipment, *E-Trax* workstations and *E-Pix* interface products. (*See new products under V2*)
Circle (542)

Anchor/ROH 4920
Audio presentation equipment.
Circle (543)

Andrew Corporation 16646
Satellite communications products, *ESA37APT* transportable TriFold antenna and *APC300* SmarTrack controller for inclined orbits. (*See new products under R1, R6*)
Circle (544)

Angenieux Corporation 18037
Video camera lens systems, *20x8.5, 15x6.5* ⅔" and *20x7, 15x5* ½" cameras. (*See new products under V1*)
Circle (545)

Anixter Brothers 11547
Microwave, STL antennas.
Circle (546)

Anritsu America 16369
Test, maintenance products for link analyses.
Circle (547)

Antenna Concepts 10662
UHF *Blaster* and *Sizzler* antennas; *FM Tracker* antenna.
Circle (548)

Antenna Technology 13725
Earth station antennas, *Simulsat multibeam* 3.5m, 7m antennas; *Parabolic* satellite antennas, 1.8m to 32m; related electronics for audio, video, data communications.
Circle (549)

Anton/Bauer 13418
Battery/charger and lighting products, *Logic* series batteries and *Ultralight* portable accessory lights. (*See new products under V9*)
Circle (550)

Anvil Cases 19343
Transport cases for delicate equipment, *A.I.R.* isolated rack types.
Circle (551)

Aphex Systems 1906
Audio processing, spectral exciter systems, *Compellor 302* and *Dominator II* dynamics level controllers. (*See new products under A2, R3*)
Circle (552) See ad index

Applied Research & Technology 5220
Audio equalizers, the *HD* series; *MDC-2001* Stereo Master audio processor.
Circle (553)

Arcoustics 18285
Circle (554)

Arrakis Systems 1702
Audio mixers, *Systems 6, 12, 18*; studio furniture.
Circle (555)

Arriflex 17276
Motion picture camera systems, *Arriflex 535* with support products and *ARRI geared head*; lighting products. (*See new products under V9*)
Circle (556)

ASACA ShibaSoku 15746
Video monitors; signal generators, *TG70A6* NTSC/HDTV system; magneto optical disk recording equipment; captioning products; signal-conditioning equipment, *TG98AX* ghost signal generator. (*See new products under A4S1V2V3V5V8*)
Circle (557)

ASC Audio Video 11948
Videotape editing systems *CASE* systems, *Clean & Trace* software.
Circle (558)

Associated Production Music 16422
Production music and effects libraries, the *APM* "The Best of the Best" mini package, *Broadcast 2* production package for broadcasters. (*See new products under S8*)
Circle (559)

AT&T 19326
Telephone services; program transmission products.
Circle (560)

AT&T Network Systems 13922
Circle (1209)

AT&T Graphics Software Labs 18483
Graphics software, *TOPAS* and *PANORAMA*. (*See new products under V2, V5*)
Circle (561)

ATI Audio Technologies 12203
Audio mixers, *BC8DSL/R* and *BC12DSR*; **signal distribution products, the** *DA10,000* series; headphone amplifiers. (*See new products under A1, A6*)
Circle (562) See ad index

Atlas/Soundolier 11055
Studio microphone booms, stands; custom console configurations. (*See new products under S5*)
Circle (563)

Audi-Cord 3227
Audio cartridge recorders/players, the *DL series* and *S series*.
Circle (564)

Audio Accessories, Inc. 13744
Signal distribution products, *RS-422 serial* data patch field; prewired audio patch panels.
Circle (565) See ad index

Audio Action 10651
Production *Music Library* on CD format. (*See new products under S8*)
Circle (566)

Audio Animation 1624
Audio processing products, *paragon—digital* audio transmission processor. (*See new products under R3*)
Circle (567) See ad index

Audio Broadcast Group 4206
Studio furniture; facilities design; equipment distributors.
Circle (568)

Audio Developments 16128
Portable audio mixing systems; audio processors *AD151, AD152*; *AD153* audio distribution amps.
Circle (569)

Audio/Digital 16236
Audio processing, delay products, *TC-4 digital processors* with profanity delay.
Circle (570)

Audio Kinetics 11633
Editing utility products *transport synchronizers* and *emulators*. (*See new products under A3*)
Circle (571)

Audio Precision 3900
Audio system analyzers, *System One* and *System One Dual Domain*. (*See new products under S3*)
Circle (572) See ad index

Audio Processing Technology Ltd. 1302
Audio processing devices providing digital compression, the *apt-X 100* system. (*See new products under A4, S1*)
Circle (573)

Audio Services Corporation 5112
Audio mixers, recorders, microphones, speakers and accessories, *Professional Sound MilliMic* and *ASC wireless boom pole*. (*See new products under A1, A4, A6*)
Circle (574)

Audio Technica US 11906
Portable audio mixers, microphone products, *AT 4033* studio and *AT 831R* remote-powered miniature cardioid condenser

mics. (*See new products under A6, S1*)
Circle (575)

Audiopak **2326**
Cartridge recording media broadcast *A-2, AA-3 and AA-4* cartridges. (*See new products under S7*)
Circle (576)

Auditronics **3902**
Audio mixing systems, *210 series* radio on-air and *900 series* TV news/production consoles. (*See new products under A1*)
Circle (577) See ad index

Aurora Systems **19306**
Electronic graphics products, the *AU/240* and *AU/250GT* systems. (*See new products under V5*)
Circle (578) See ad index

Autogram **4525**
Audio mixers for radio broadcast, production, *Pacemaker* series.
Circle (579)

AVCOM of VA **12903**
Portable spectrum analyzers, *PSA series*, SPCP satellite receivers. (*See new products under S3*)
Circle (581) See ad index

AVID Technology **19676**
Digital non-linear editing systems, *Media Composer 200, 2000* series. (*See new products under V2*)
Circle (582)

Avitel Electronics **11058**
Signal distribution products, *3200 series* modular DAs and *digital video* patch panels. (*See new products under S2*)
Circle (583)

AVS Applied Video Systems **19634**
Standards conversion products, *EOS*; *Sigma* video processors; *Manuscript* titling systems. (*See new products under V4, A5*)
Circle (584)

B&B Systems **12147**
Audio measurement, monitoring products, *Phasemonitor* and *Imagescope*.
Circle (586)

BAF Communication **16246**
Satellite communications systems, *CF series* production and news vans; trailer-mounted antennas; *ENG/EFP SD-22* 22-foot production vehicle.
Circle (587)

BAL Components **16207**
Serial, digital *DigiStream 3* interface products; *NanoDelay* HDTV delay modules; *Synchrotime* frame synchronizer; comb filters; utility video switchers.
Circle (588)

BARCO Industries **18804**
Video monitors, *CVM series*; video projectors, *HDM* series; *BVRS, BARS* signal routers; CATV head-end equipment, *FSM860* head-end monitor/supervisor system. (*See new products under V6*)
Circle (590) See ad index

Barco-EMT **18804**
Digital cartridge recorders, players *EMT-460, -461*; *EMT-710* audio router. (*See new products under A4, A5*)
Circle (591)

BASYS **18777**
Automation products, the *Automated Newsroom Systems* and *LKT 200 Multichannel* system. (*See new products under S1*)
Circle (593)

Beaveronics **13717**
Studio clock, timing systems.
Circle (595)

Bec Technologies **N.A.**
Fiber optic and wired analog/digital interface products. (*See new products under A4*)
Circle (596) See ad index

Beck Associates **10949**
Custom consoles, racks, editing carts. (*See new products under S3*)
Circle (597)

Belar Electronics Lab **3920**
Modulation monitoring products for radio, TV; *FMMA-1 The Wizard* digital FM analyzer; *RFA-4* agile FM RF amp with memory presets. (*See new products under R4*)
Circle (598) See ad index

Bencher **11118**
Graphics camera support products, *Copymate II* and *M2* copy stands. (*See new products under V1*)
Circle (599)

Benchmark Media Systems **11301**
Audio signal control and distribution products, *MIA-4* pre-amps, *LoudMouth* reporter control station.
Circle (600)

BEXT **3918**
FM transmitters, amplifiers, exciters, *PTX 30* and *LCFM* composite receiver. (*See new products under R2*)
Circle (601)

beyerdynamic **12230**
Wireless equipment, *DS170H* hand-held and *DS170P* pocket microphones and *NE170* diversity receivers; headphones. (*See new products under A6*)
Circle (602)

BGW Systems **1325**
Audio amplifiers, monitors. (*See new products under A6*)
Circle (603)

Bio-Electronics **16669**
Video signal sources, *SG-4* blackburst generator, and titlers, *MCG-2* microcharacter generator. (*See new products under V3*)
Circle (604)

Blue Feather **10149**
Video prompting systems, the *Prompt Box*. (*See new products under V5*)
Circle (605)

Bogen Photo **16766**
Line of camera support products, *Mini-Pro* tripods.
Circle (606)

Bowen Broadcast Service **4225**
Replacement parts for RCA automated cart equipment.
Circle (607)

Bradley Broadcast Sales **1024**
Distributor; *Telos* telephone systems; *Unity* audio processors; audio signal bandwidth filters.
Circle (608)

Bretford Manufacturing **18276**
Equipment mounting products, wall, ceiling mounts; *BBPN48-E8* wide-body A/V table, *VRC70E* TV/VCR security center. (*See new products under S5*)
Circle (609)

Broadcast Electronic Services 13417
Video signal distribution and format conversion products, *GPI Network 4104×* router and *Betabox* interformat editing unit. New products announced at booth.
Circle (611)

Broadcast Electronics 2312
FM broadcast transmitters; digital audio storage equipment, *AV-90 AudioVAULT*; cartridge recorders; audio mixers.
Circle (612)

Broadcast International Group 19340
Distributors.
Circle (613)

Broadcast Microwave Services 12301
Microwave radio equipment, *BMA-3000 Autotrac King* antenna pedestals, *TBT-50A* frequency-agile portable transmitters.
Circle (614)

Broadcast Supply West/BSW 1620
Distributor, approximately 200 lines of professional audio, RF/radio products.
Circle (615)

Broadcast Video Systems/BVS 16742
Signal distribution and video processing products, the *D100-NTSC* comb filter decoder and *MASTERKEY* downstream keyer. (*See new products under S2, V3*)
Circle (616) See ad index

Broadcasters General Store 5426
Distributor of audio products for radio, *Telos Systems* digital hybrids and *Frank Foti Unity 2000*. (*See new products under A4, A7, S1*)
Circle (617)

Bryston 4809
Audio monitors, *Model 7B-PRO*.
Circle (618)

BTS Broadcast Television Systems 18001
Signal distribution, routing products; facilities control equipment *BCS 3000, MCS 2000* systems; video cameras, *LDK 9, 91*; video noise reducers; telecine systems, *FDL 90*. (*See new products under S2, V1, V2*)
Circle (619) See ad index

Burk Technology 4812
Remote-control systems, *AutoPilot* multisite units.
Circle (620)

BURLE INDUSTRIES 16753
Power devices for RF transmission; camera tubes.
Circle (621) See ad index

C.E.T. 15170
Transmitter systems, *Advantage Line* VHF, UHF, MMDS, point-to-point. (*See new products under R1, R5*)
Circle (622)

Cablewave Systems/RF Systems 1924
Antenna products, *Bogner* wideband and MMDS, ITFS, FM and STL antennas; high-power *FlexWell* transmission line. (*See new products under R1*)
Circle (623) See ad index

Calaway Editing 18046
Videotape editor controllers, *CE-210, -100* systems. (*See new products under V2*)
Circle (624) See ad index

Calculated Industries 20157
Handheld timecode calculators.
Circle (625)

California Switch & Signal 16122
Test & measuring equipment.
Circle (626) See ad index

Calzone Case 17567
Equipment transport products, *Titan, Ultime* series. (*See new products under S4*)
Circle (627)

Camera Mart 5556
Distributor; rental programs; video, audio production equipment.
Circle (628)

Camera Platforms Int'l 16473
Camera support products.
Circle (629)

Canare Cable 11121
Signal-distribution products, *242U-VJ22W-C* video patchbay; tools, wire, connectors, *BCP-C4B* 75Ω BNC crimp plug; audio transformers. (*See new products under S3, S6*)
Circle (630) See ad index

Canon USA/Broadcast Optics 15719
Hi8 camcorders, laser transmission systems; camera lenses, *J14a*×8.5BIRS and J33a×11B IAS. (*See new products under S1, V1*)
Circle (631) See ad index

Capitol Production Music 4320
Music libraries.
Circle (632)

Carpel Video 16527
Evaluated recording media, ¾" KCA U-matic, 1"; clocks/timers; utility products. (*See new products under S1, S7, S8*)
Circle (633)

Cartoni USA 18437
Fluid head and tripod camera support products, the Beta and C series.
Circle (634)

CBSI Custom Business Systems 3908
Broadcast and related accounting systems, *Classic* and *Elite* traffic and billing, *InterAcct* accounting systems. (*See new products under S1*)
Circle (635)

CCA Electronics 2208
Broadcast AM, FM transmitters, exciters.
Circle (636)

CCOR/Comlux 13356
Fiber-optic equipment, *Models 3681/3682* digital optical transmitter/receiver; *3903/3904* dual 9-bit digital video coder/decoder; digital audio equipment. (*See new products under A4*)
Circle (637)

CEL Electronics 10257

Video encoders, *P171*; standards converters, *Standi* and *Tetra* series; *Maurice, Myriad* digital effects. (*See new products under V3, V4, V5*)
Circle (638) See ad index

Central Dynamics 12441
Video encoders, *Stage*1*.
Circle (639)

Central Tower 2500
Towers for broadcast, communications, *CTI SS/STX* truss self-supporting and *CTI GT series*.
Circle (640)

Century Precision Optics 18437
Wide-angle optical adapters, slide-to-video transfer equipment. New products an-

nounced at show.
Circle (641)

Channelmatic 17430
Automation equipment, *ADCART* random access ad insertion systems and *CompEdit* automated tape compiler/editor. (*See new products under S1*)
Circle (642) See ad index

Chapman/Leonard Studio Eqpt. 18181
Lighting, camera support products.
Circle (643)

Chester Specialty Cable 11104
Audio, RF, video cable products.
Circle (644)

Chimera 17586
Lighting products, *Quartz* and *Daylite* Cine Banks. (*See new products under V9*)
Circle (645)

Christie Electric 11120
Battery chargers/analyzers, *CASP/1200* and *CASP/2000* systems.
Circle (646)

Chyron 19306
Electronic graphics and titling systems, the *SuperScribe* and *iNFiNiT!*. (*See new products under V5*)
Circle (647) See ad index

Cine 60 16429
Lighting products, batteries, chargers.
Circle (648)

Cinekinetics 15666
Camera support devices for portable, remote production.
Circle (649)@CNAME = Cinema Products 12533
Camera support products, *SteadiCam*; camera control systems.
Circle (650)

Cinemills 16776
Lighting products; studio furnishings.
Circle (651)

Circuit Research Labs 4208
Audio processing equipment, *Audio Signature* 4-band stereo and *MBL-100* news/talk AM processing systems; FM generators; event sequencing systems. (*See new products under R3, S1*)
Circle (652)

Clark & Associates 5114
Digital audio products, multichannel, hard disc recorders; audio delays; automation products for radio, TV, cable; SMPTE TC PC cards; video titling, multichannel switcher status displays. (*See new products under A4*)
Circle (653)

Clark Wire & Cable 11763
Wide range of *Ribbon* stereo audio cable; video cable in various colors. (*See new products under S6*)
Circle (654)

Clear-Com Intercoms 13706
Intercom, communications products, *Matrix Plus* digital intercoms and *Multichannel* party line intercom/IFB systems. (*See new products under A8*)
Circle (655) See ad index

Clipper Products 20161
Utility, equipment carts.
Circle (656)

CMC Technology 11708
Replacement video head assemblies for *VPR 1-inch C*; upper drum refurbishing for *BVH 1-inch C*. (*See new products under V2*)
Circle (657)

CMX 19306
Videotape editing systems, *OMNI 1000*.
Circle (658) See ad index

Coaxial Dynamics 12905
RF wattmeters, RF loads.
Circle (659)

ColorGraphics Systems 18046
Videographics workstations, *DP/MAX*. (*See new products under V5*)
Circle (660) See ad index

Colortran 17724
Lighting products and control systems, *compact Elite* controllers and *ENR series* dimmers.
Circle (661)

Columbine Systems 17019
Broadcast automation products. (*See new products under S1*)
Circle (662)

Comark Comm./Thomson-CSF 15733
UHF TV transmitting equipment, *40/35kW IOT* visual or common V/A amplifiers; *70kW ESC HPA* with EEV 5-cavity ESC devices; *aural carrier corrector* for common amplification systems. (*See new products under R1*)
Circle (663) See ad index

Comband Technologies 13133
Terrestrial microwave products; *ProBand, ComBand* wireless cable systems.
Circle (664)

Communications Graphics 4318
Promotional products.
Circle (665)

Communications Data Services 10349
Circle (666)

Comprehensive Video Supply 12438
Camera support products; editing software packages, *Log Master, Edit Master, Cue Master*; portable audio mixers.
Circle (667)

Compprompter 17969
Electronic newsroom software *ENR V2.3*. (*See new products under S1*)
Circle (668)

Computer Assisted Technologies 13705
Facilities, equipment maintenance, *B-CAM*.
Circle (669) See ad index

Computer Concepts 4814
Radio automation products, *DCS* digital commercial system and *Audio Switcher*. (*See new products under S1*)
Circle (670)

Computer Engineering Associates 19336
Computerized newsroom equipment the *CEA Newsroom System*. (*See new products under S1*)
Circle (671)

Computer Prompting 17075
Video prompting products, the *CPC-100* teleprompter and *CPC-500* closed- and open-captioning system. (*See new products under V5*)
Circle (672)

Comrex 13101
Audio *Frequency Extenders* for remote audio pickups with integrated mixing; *Digital Audio* codecs. (*See new products under A1*)
Circle (673)

There's only one sure way to see the future of optics: look into Fujinon's *New* A14X8.5EVM hand-held lens

Quite simply, you won't find a more advanced, ergonomically designed hand-held lens than the new A14X8.5EVM from Fujinon. Drawing on the same technology and expertise that Fujinon puts into its HDTV lenses, the A14X8.5EVM delivers unprecedented performance and functionality in a lightweight package.

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FOCUSED ON THE FUTURE

See us at NAB Booth #15854

Circle (62) on Reply Card

Today's expanding vision of video technology includes CCIR 601 component digital, composite digital, component analog, composite analog... with proposals for several Advanced Television Systems and HDTV. Not to mention overlapping video markets from desktop to prime time; from personal to global video.

To satisfy these diverse demands—today and tomorrow—Panasonic has a vision of video recording systems that deliver the right level of performance at each production stage in analog and digital, in composite and component.

These systems all feature RS-232C or RS-422 Serial Digital Control interfaces; expanded interconnectivity, so signals pass between terminal equipment at the highest quality levels; superb digital interfaces between analog and digital, or from component digital to composite digital; and a family of videotape cameras offering digital signal processing for every format.

Panasonic has implemented this vision with its 1/2-inch videotape technology in S-VHS, MII and D-3 videotape recording systems: a vision which includes enhanced MII videotape recorders; small format component digital recording and even HDTV.

Visit Panasonic at Booth 18019. And share the vision.

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Broadcast & Television Systems Group

For more information call: 1-800-524-0864
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Comsat World Systems 15866
International satellite program distribution systems.
Circle (674)

Comsat General 19276
Circle (679)

ComStream Corporation 5504
Satellite reception electronics, the *ABR200* digital audio receiver and *IBAN* integrated digital audio network.
Circle (675)

Comtech Antenna 12806
Satellite communications products, *5M motorized* antenna system, *EC6* offset transmit satellite antenna. (*See new products under R6*)
Circle (676)

ComTek 11127
Wireless microphone equipment, the *MRC-82 Camera Companion* receiver, and *IFB-72* cuing and talent feedback system. (*See new products under A6*)
Circle (677) See ad index

COMWAVE 12447
ITFS, MMDS equipment, *SB100AAD 100W transmitter, SB1-8* multichannel transmitter. (*See new products under R5*)
Circle (678)

Concept W Systems 15766
Camera operation control systems, *CAMPLEX CP-201B* and *RVS-230* return video switcher. (*See new products under V1*)
Circle (680)

Conifer 16107
MMDS antennas, electronics, *QL-3010* dual-band and *QL-1010A* single-band block downconverters. (*See new products under R5*)
Circle (681)

Connectronics 13724
Connector products, *One Piece* series of adaptors.
Circle (682)

Consultronics Limited N.A.
Audio system analyzers, the portable *PC3000* stereo audio analyzer and *PG3000* portable stereo signal generator. (*See new products under S3*)
Circle (683)

Continental Electronics 3418
Complete line of AM, FM radio transmitters and associated equipment. New products introduced at the exhibition.
Circle (684) See ad index

Control Concept 16641
Power protection/conditioning equipment, the *Isolatron* and *Isolatrol* active tracking filters. (*See new products under S3*)
Circle (685)

Cooper Ind./Belden Div. 16225
Complete range of wire, cable products, *1505A* precision video cable and *1508A-1519A* Belden series 24-gauge multipair snake cables. (*See new products under S6*)
Circle (686) See ad index

Corporate Computer Systems 5108
Audio transmission codecs, *Micro 56+* 7.5kHz and *Micro 66i* 7.5kHz dual rate units. (*See new products under S1*)
Circle (687)

Cortana Corporation 4625
Lightning, static-protection products, *Stati-Cat, Stati-Kitty* and *Stati-TomCat* systems.
Circle (688)

Countryman Associates 12205
Microphone products, the *EMW* series.
Circle (689)

Crouse-Hinds CAM-LOK 15659
Electrical connectors, power distribution products.
Circle (690)

Crouse-Kimzey 5410
Audio distributors; Otari Prodisk 464 digital workstation; Denon *DN970FA CD* player. (*See new products under A1, A4, A6*)
Circle (691)

Crown International 4818
Audio system products, the *CM-230* tridundant microphone and *D-75* monitor amplifier. (*See new products under A1, A6*)
Circle (692)

CSI Camera Support Int'l 15568
Camera support, dollies, tripods, pan/tilt heads. (*See new products under V1*)
Circle (693)

CTE International 5424
FM broadcast transmitter products, exciters, power amplifiers. (*See new products under R1*)
Circle (694)

Cycle-Sat 13347
Program distribution services, transmission security equipment, the *Cyclecypher.*
Circle (695)

Daniels Publishing Group 12909
Publications listing broadcast equipment technical data, applications information; equipment buyers' guide.
Circle (696)

Data Center Management 20085
Newsroom automation equipment.
Circle (697)

Data Security 11544
Recording media degaussers, models *MP-14* and *TC-14.*
Circle (698)

Datatek 13914
Signal routing, distribution equipment, the *D-2400* and *D-2500* series switchers. (*See new products under A4, S2*)
Circle (699) See ad index

Dataworld 1626
Broadcast industry database; reports, research services.
Circle (700)

daVinci 18046
Color-correction processors for video, telecine *Renaissance Hi-Res Kilovectors.* (*See new products under V3*)
Circle (701) See ad index

DDA 1214
Audio recording, post-production consoles *DDA Profile, DDA DMR-12.* (*See new products under A1*)
Circle (703)

Decision, Inc. 2100
Software for business management and information services for radio and TV, *Broadcast System III.*
Circle (704)

Delta Electronics 2826
Broadcast transmission monitoring products, *SM-1* splatter monitor, *OIB-3* operating impedance bridge. (*See new products under R3*)
Circle (706)

Denny Manufacturing 10959
Backgrounds, props for video, photographic work.
Circle (707)

DENON 4909
CD cart recorders, *DN-7700R* and *DN-970* players. (*See new products under A5*)
Circle (708)

DeSisti Lighting/DESMAR 15876
Lighting products.
Circle (709)

DeWolfe Music Library 20005
Production music libraries.
Circle (710)

Di-Tech 13107
Signal distribution systems, *Model 9002* virtual matrix control system, *Model 8560* expandable AFV routing switcher. (*See new products under S2*)
Circle (711)

DIC Digital 18738
Magnetic recording media, *MQ series* digital audiotape and *Microfinity series* 8mm videotape. (*See new products under S7*)
Circle (712)

Dielectric Communications 1708
Antenna products, *TDM* antenna and low-power UHF TV antennas. (*See new products under R1*)
Circle (713)

Digidesign 12063
Digital audio recording systems.
Circle (714)

Digital Arts 19040
Digital graphics equipment, *DSG 386/486* drawing, animation software, *Render V3.3* software; *Digital Artist Series* systems. (*See new products under V5*)
Circle (715)

Digital F/X 12941
Desktop video production equipment, *Video F/X* and *Soft F/X* packages. (*See new products under V5*)
Circle (717)

Digital Processing Systems 10654
Time base correction, synchronizer products, *DPS-265* synchronizer; *DPS-295* transcoding TBC. (*See new products under V4*)
Circle (718) See ad index

Digital Vision 18883
Digital video processing products, *DVNR 1000* noise, film grain reducer, *DVCC 1000* YRGB (4:4:4:4) color corrector. (*See new products under V3*)
Circle (719)

Display Devices 16471
Large screen projector support systems, *Datalift* series.
Circle (720)

DN Labs 16478
Studio, ENG lighting equipment, *DURAPAR 1200* single-ended/sealed beam and *DURAPAR 2500* HMI PAR lighting systems. (*See new products under V9*)
Circle (721)

Dolby Labs 4514
Noise-reduction systems featuring *Dolby B, C, S* technologies; *DP5500 DSTL* digital FM

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LANIER RESPONDS

Copying Systems Division

Circle (63) on Reply Card

STL. (*See new products under A2, A4, R5*)
Circle (722) See ad index

Dometic Corporation 16770
Mobile, standby power generators.
Circle (723)

Dorrough Electronics 12206
Signal measurement products, the *Dorrough Loudness* and *Composite Video Luminance* meters.
Circle (724)

DSI Communications 13940
Engineering, construction firm; specialization in video, RF system design, construction, maintenance.
Circle (725)

Duggan Manufacturing 10951
Equipment case, container hardware.
Circle (726)

Dwight Cavendish 16673
Videotape duplication equipment, *Copymaster 250-5* and QC-2500 monitor system. (*See new products under V2*)
Circle (727)

DX Communications 11313
Satellite receivers.
Circle (728)

DYNAIR Electronics 16706
Signal distribution products, *Dynasty* and compact *Dyna Mite* **routing switchers.** (*See new products under S2*)
Circle (729) See ad index

Dynatech Corporation 18046
See: ***Alpha Image; ALTA Group; Calaway Editing; ColorGraphics Systems; daVinci; Dynatech NewStar; Quanta; Utah Scientific.***
Circle (730) See ad index

Dynatech NewStar 18046
Newsroom automation equipment, *NewStar I, Version 5.0* Leader Election system. (*See new products under S1*)
Circle (731) See ad index

Echolab 13733
Video production switchers, *DV-7(C)*; *Tempest* digital effects. (*See new products under V3, V8*)
Circle (732)

Econco Broadcast Service 4624
Rebuilt power transmitting tubes, klystrons. (*See new products under R2*)
Circle (733)

Editing Machines Corporation 15169
Non-linear video editing equipment, *EMC-2* digital and *EMC-PC* laptop editors. New products announced at booth.
Circle (735)

Editing Technologies Corp. 15669
Video editing products, *Ensemble* editors and *Easy Edit* package. (*See new products under V2*)
Circle (736)

EDX Engineering 1321
Engineering software, *SHOWMAP V4.10* for coverage based on terrain data, *RPATH V6.10* for microwave and STL path analysis. (*See new products under S1*)
Circle (737)

EEG Enterprises 16219
VBI data products, *VDR-2* data receiver, *TVCD100* line-21 encoder.
Circle (738)

EEV 17730
UHF TV power products *IOT7340, IOT7360* inductive output tubes and *KSC3371* 70kW ESC klystrons.
Circle (739) See ad index

EG&G 4221
Tower lighting products, *FlashGuard* beacons.
Circle (740)

egripment 15878
Camera support products, *Skymote, Dino* and *Dinky* dollies and accessories.
Circle (741)

Electro-Voice 1214
Microphone products, models *635A, RE50* for ENG/EFP use. (*See new products under A6*)
Circle (742)

Electronics Research 1020
FM transmission antennas, *Panel* types and *Super High Power* side-mount systems. (*See new products under R1*)
Circle (744)

Electrorack Products 20110
Equipment rack systems.
Circle (745)

Electrosonic Systems 20041
Video display systems, *Procube II* and *PICBLOC 3*. (*See new products under V6*)
Circle (746)

EMCEE Broadcast Products 16728
Transmitter systems for MMDS, VHF, UHF, *TTS, TTU* and *TTV* series.
Circle (747)

EMCOR Products/Crenlo 12833
Electronic equipment cabinetry, *ESQ* and *10 series* modular enclosure lines.
Circle (748) See ad index

Energy-Onix 3604
AM and FM transmitter products, the *MK series* 1-tube FM systems and *conventional plate-modulated* AM models. (*See new products under R1, R3*)
Circle (749)

ENG Mobile Systems 16112
Products for remote production, *Camera transport cradle* and *NITEK* NiCad battery maintenance products.
Circle (750)

Ensemble Designs 20178
Video production equipment, the *DS-2* stillstore and *TC-400D* TBC/D-2 controller. New products announced at show.
Circle (751)

Enterprise Electronics 13414
Doppler weather radar equipment, *DWSR-90CTV* systems. (*See new products under V5*)
Circle (752)

Equipment Broker (The) 18183
Broadcast, production equipment brokers.
Circle (753)

ERGO 90/Ergo Industries 16745
Equipment rack, mounting utilities.
Circle (754)

ESE 13701
Time-code products, *ES-488* SMPTE generator, reader, inserter; *ES-247* quad 1x6 video DAs; signal generators. (*See new products under S2, V2*)
Circle (755) See ad index

ETC-Electronic Theatre Controls 19250
Lighting control products, *response* series dimmers, *microVision*FX control, effects consoles.
Circle (756)

Eventide 1421
Time modification systems, *Ultra-Harmonizer H3000B*; video delays, *BD1002*. (*See new products under A2, A4*)
Circle (758)

Evertz Microsystems 20006
Time-code equipment, *4015* film footage encoders; *7100* transport emulator. (*See new products under V2*)
Circle (759)

F. J. Westcott 15571
Light modification products, *Illuminator* reflectors; backgrounds. (*See new products under V9*)
Circle (760)

Faroudja Laboratories 13422
Video signal processing products *CTE-SN/CFD-SN* encoder/decoder, detail enhancers and *CTC-2* component transcoders. (*See new products under V3*)
Circle (761)

Fast Forward Video 11541
Time-code products, *P2* portable generator, *F30* generator.
Circle (762) See ad index

Fiber Options 17684
Fiber-optic transmission systems. (*See new products under S1*)
Circle (764)

Fiberbilt Cases 16741
Production equipment cases, *#624* and *#909* carrying cases.
Circle (765)

Fidelipac 1920
Audio products, *Broadcast Audio Series VI* mixing consoles and *Dynamax CT-90* cart machines. (*See new products under A1, A4*)
Circle (766)

FirstCom 4626
Production assistance products, *Personal Music* and *New FirstCom* libraries.
Circle (767)

Flash Technology 1618
Tower lighting products, beacons.
Circle (768)

FloriCal Systems 11315
TV automation products, *ShowTimer* pre-air and *TimeShifter* tape delay systems. (*See new products under S1*)
Circle (769)

FM Systems 18282
Microwave, STL products.
Circle (770)

Focal Press 16768
Reference, educational material, *Millerson's* "Technique of Television Productsion" and *McCavitt, Starr & Pringle* "Electronic Media Management." (*See new products under S8*)
Circle (771)

FOR•A 15870
Audio mixers, recorders; video products, the *HMC-1010* capture system and *PVM525* production mixer; TBCs, synchronizers, effects systems, still-stores, display and projection products; scan converters; edit controllers. (*See new products under A1-4V234568*)
Circle (772) See ad index

Fostex 17428
Audio recorders, *G-24, G-16* with Dolby S;

The Auditronics 800 Clean Air Policy.

What we surround ourselves with says a lot. The Auditronics 800 series says you won't settle for anything less than pure, seamless audio. More standard features than the others. Tomorrow's technology with the freedom to add options. The 800 says you know that when you own the best, the sky's the limit. Write or call for a free brochure.

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Circle (64) on Reply Card

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D-20 4-head RDAT recorder with time code. (*See new products under A4*)
Circle (773)

Frezzolini Electronics **13408**
TV lighting products, *Mini-Fill*; battery products, the *SC-2* battery manager system. (*See new products under V9*)
Circle (775)

Fujinon Optics **15854**
Lens systems, *A14x8.5ERM, A55x*; remote-control camera support, *CPT-10*. (*See new products under V1*)
Circle (776) **See ad index**

Furman Sound **10955**
Audio processors, mixers, equalizers.
Circle (777)

Future Productions **16771**
Videocassette duplication products, *RIF-24* controller, *SR-DP5G* router.
Circle (778)

FWT **3224**
Guyed, self-supporting communications towers, antenna supports; communications equipment buildings.
Circle (779)

G&M Power Products **16427**
Batteries, chargers, maintenance products.
Circle (780)

Garner Industries **13722**
Recording media erasure products, *Model 1400* and *The Eliminator* tape degaussers. (*See new products under S7*)
Circle (781)

GDI/Generic Designs **18476**
Machine control products.
Circle (782)

GE American Communications **13906**
Satellite communications services for radio/TV broadcast; includes broadcast TV, syndication, news gathering, international, occasional use; digital audio, SCPC network programming, business video and VSAT.
Circle (783)

GE Lighting **11601**
Lamps for stage, studio, *Linear Halogen-IR* improved efficiency.
Circle (784)

GE Support/RCA Broadcast **1326**
Field maintenance service for existing RCA equipment; stage, studio lamps. (*See new products under R1*)
Circle (785)

Gefen Systems **5224**
Background music systems, *CDJ* classical music and *M&E* organizer for MAC & IBM/compatible. (*See new products under A4, S8*)
Circle (786)

Gennum/Video-Broadcast **18278**
Integrated circuit products for wideband video applications, *GX4000* crosspoints; *GY4102A* video toggle switches. (*See new products under S3*)
Circle (787)

Gentner Communications **1712**
Audio processors, bandwidth extenders, telco hybrids, intercom systems; digital audio workstations. (*See new products under A2, A4, A8*)
Circle (788)

GEPCO International **12747**
Complete lines of audio and video cable products. (*See new products under S6*)
Circle (790) **See ad index**

Getris Images **19685**
Electronic graphics products, the *VENICE* system. (*See new products under V5*)
Circle (791)

GML, Inc. **1406**
Audio mixers, *Focusrite* consoles and console automation equipment. (*See new products under A1*)
Circle (792)

Gorman Redlich **4224**
EBS and weather service equipment, *Model CEB* EBS encoder and decoder and *Model CRW* weather radio.
Circle (793)

Gotham Audio **3906**
Distributors, audio products.
Circle (794)

Graham-Patten Systems **16242**
Edit suite mixers, *D/ESAM 800* digital system. (*See new products under A1*)
Circle (795) **See ad index**

Grass Valley Group **16933**
Signal management systems, *Series 7000*, routers, fiber-optic products; videotape edit controllers; production switchers *#3000*; *DMP-700* effects; Dubner graphics systems. (*See new products under V2, V5*)
Circle (796) **See ad index**

Grass Valley Group/Graphics 16933
Video titling and graphics equipment *GF-50* Graphics Factory and *DSS-4* still-store. (*See new products under V5*)
Circle (797)

Gray Engineering Labs 16468
Time-code products, *DTR-313* TC data transmitter/receiver and *TCQ-143* TC analyzer. (*See new products under V2*)
Circle (798)

Great American Market 16415
Lighting utility equipment; grip products.
Circle (799)

GTE Spacenet 16976
Satellite program distribution/relay services.
Circle (800)

Guicar Television 18480
Video tape libraries of production material as well as test signals. (*See new products under S3, S8*)
Circle (801)

H. L. Dalis 16638
Distributor for *Belden Wire & Cable* and *Neutrik* connector products.
Circle (802)

Hallikainen & Friends 2224
Audio mixers *TVA series* and programmable transmitter control systems, *DRC190*. (*See new products under S1*)
Circle (803)

Hamlet Video International 16406
Waveform, vector displays on standard video monitors, the *Video Scope* series; *MatchCam* camera setup utility. (*See new products under S3*)
Circle (804)

Hardigg Industries 20109
Equipment transport cases.
Circle (805)

Harris Allied Broadcast Eqpt. 2218
Radio and TV transmitters, associated products; *Gates* medium wave, *DX series* AM, *Platinum series* FM and UHF transmitters; *Wavestar* TV transmission antennas; audio loggers, workstations; CD cart machines; digital recording equipment; satellite, ENG products. (*See new products under R1*)
Circle (806) See ad index

Harrison by GLW 13925
Audio mixing consoles and control equipment, *SeriesTen B*. (*See new products under A1*)
Circle (807) See ad index

Henry Engineering 5500
Audio, control interface products and dubbing products, the *Fast Trac* automatic dubbing workstation. (*See new products under A1, A2, A4, A6*)
Circle (808)

Hewlett-Packard 16855
Test equipment, signal analysis.
Circle (774)

Hipotronics 5110
Power control equipment, *Peschel* automatic voltage regulators and variable transformers.
Circle (809) See ad index

Hitachi Denshi 17046
Video cameras, ENG, *SK-F300S* studio models; monitors, video recorders, *VL-D500* D-2 digital VTR. (*See new products under V1*)
Circle (810)

HLC/Killer Tracks Music 4906
Production music libraries.
Circle (811)

Holaday Industries 11607
Magnetic field, RF radiation metering products, *HI-3624 ELF* and *HI-3012* field-strength meters.
Circle (812)

Hoodman 11707
Video monitor sunshades.
Circle (813)

Horita 11847
Time-code products, *TRG-50PC* with TC Toolkit; *CSG-50* color bar, sync, tone generator. (*See new products under V2*)
Circle (814)

Hotronic 13427
Audio delays, solid-state video recording devices, video processing equipment. (*See new products under A2, V2, V4*)
Circle (815)

Howe Industries 10652
Custom transit cases and shipping containers.
Circle (816)

Hughes Communications 16250
Broadcast satellite services, program distribution.
Circle (817)

Hughey & Phillips Inc. 5218
Tower lighting products, *KG225* strobes.
Circle (818)

IBSS Canada 1322
Camera support, mounting products for ENG helicopter applications.
Circle (820)

IDB Communications 15750
Satellite communications systems, the *Flyaway Phone* satellite terminal in a suitcase.
Circle (821)

I-DEN Videotronics 19282
Range of TBC products, *IVT-7*, synchronizers; video wall processors; standards converters; *Jazz* digital effects systems; scan conversion units. (*See new products under V5*)
Circle (822)

Ikegami Electronics (USA) 18558
Video cameras, *HK-355* field/studio and *HL-55A* portable ⅔" 3-FIT CCD models; video monitors. (*See new products under V1, V6*)
Circle (823) See ad index

ILC/Daymax 17679
Lighting products based on metal halide lamps; *DSB-575W* ballasts.
Circle (824)

illbruck/SONEX Acoustical Products 5200
Acoustical material, treatments, *SONEX* acoustical foam and *ProSPEC* barriers and composites. (*See new products under S5*)
Circle (825) See ad index

Image Devices 17583
Information not provided.
Circle (826)

Image Logic Corp. 15574
Videotape editing software, *Log Producer* logging system for PCs and *Log Producer 22* automated logging on Betacam Model 22 players. (*See new products under V2, V5*)
Circle (827)

Image North Technologies 16367
Graphics, titling and display equipment, *Inscriber V3.01* character generator and *RTX* on-line display system. (*See new products under V5, V6*)
Circle (829)

Image Video 11307
Signal routing, distribution equipment, *9000 series* high-density router and *10K Plus* control system. (*See new products under A1, S1, S2*)
Circle (830)

Imagine Products 10758
Tim-ecode equipment and editing software, *The Executive Producer* software package. (*See new products under V2*)
Circle (831)

IMC/International Music Corp. 1002
Akai digital recorders, *DD1000* MO disk recorders; *S1100* stereo digital samplers; Hill Audio mixers. (*See new products under A4*)
Circle (832)

Industrial Acoustic/IAC 5126
Acoustic, sound control products. (*See new products under S5*)
Circle (833)

Inline 16371
Signal distribution products, *IN2055* video DAs, *IN2000* universal computer interface. (*See new products under S2*)
Circle (834)

Innovision Optics 15660
Special-purpose camera lens systems, *Series 5000* and *Probe* lenses for ½" and ⅔" cameras; *Lumenyte* fiber-optic lighting. (*See new products under V1, V2*)
Circle (835)

Inovonics 1418
Audio processing systems, *Model 250* digital controlled system; FM generators, *Model 706* FM/FMX system. (*See new products under A2, R4*)
Circle (836)

Insulated Wire/Microwave Prod. 4908
Circle (837)

Intelligent Resources 18483
Graphics for Macintosh PCs, *Video Explorer RGB* and *VideoBahn*. (*See new products under V5*)
Circle (838)

Intelliprompt 11333
Video prompter systems using IBM PCs, *Intelliprompt II+*.
Circle (839)

Intelvideo 20009
Video encoding, decoding, enhancement products, *IV-5* pre-coder/color detailer and *IV-6* digital color encoder. (*See new products under V3*)
Circle (840)

International Datacasting Corp. 4524
Reception equipment for satellite data transmission, *SR250* and *IDC FM/FM receivers.*)
Circle (841)

International Tapetronics/ITC 1208
Audio recording systems, *ITC 99B, Series 1* cartridge machines; digital recording products; audio signal control products, *Audio Switcher*. (*See new products under A3, A4*)
Circle (842)

Intraplex 5206
Digital audio transmission equipment, *PT/PR-150, 4500MDAC* codecs, *3800VRM* variable rate multiplexer. (*See new products under S1*)
Circle (843) See ad index

IRIS Technologies 16239
Audio, video switching systems, *MX-816, MX 3200VLR-B*.
Circle (844)

IRT Electronics Pty Ltd. 17682
FO transission systems, *VA-391/392* transmitters, receivers; *Vimcas/Viscal* vertical interval audio transmission products. (*See new products under A6*)
Circle (845)

ITELCO spa 15705
Radio, TV transmitters, STL products.
Circle (846) See ad index

ITS/Information Transmission 12136
UHF TV equipment, the *ITS-20A* UHF exciter-modulator and *ITS-1230* 1kW solid-state UHF transmitter.
Circle (847)

J-Lab 12436
Video production utility products; *CFS-1* field, portable video switcher; *DA-1* with hum-bucking, EQ 6-output; *DA-2* 1x4 audio DA with tone source. (*See new products under V1*)
Circle (848)

J.N.S. Electronics 1418
Signal distribution products, *the Frame* 8000 series and *CD-quality* audio routers. (*See new products under S1, S2*)
Circle (849)

James & Aster Music 4400
CD libraries; *Classical, Medieval, Renaissance* selections.
Circle (850)

James Grunder & Associates 06
Feral Industries TBCs, frame synchronizers, video switchers, 6119(Y/C); Hamlet Video test equipment; *DTC-1504* Video International standards converter; Yamashita scan converters, sync generators.(*See new products under S3, V4*)
Circle (851)

Jampro Antennas 3824
TV and FM broadcast transmission antennas, circularly polarized models. (*See new products under R1*)
Circle (852) See ad index

Jaymen Broadcast/Besco 10756
UHF TV transmitters.
Circle (853)

JBL Professional 16236
Audio monitoring products, *Control Series* speakers, *SR series* power amplifiers; audio processors. (*See new products under A2, A6*)
Circle (854) See ad index

Jefferson Pilot Data/JDS 13911
Broadcast business systems, software.
Circle (855)

JEM-FAB (Franklin Beemish) 20168
Digital signal distribution products, *Model One D-Patch, RS12B* machine control; routing switchers; B-MAC monitors. (*See new products under S1*)
Circle (856) See ad index

Jensen Tools 13426
Numerous tools and tool kits for video, audio technicians, broadcast engineers; various metering, signal source products, *JTK-5000* computer maintenance kit; *Fluke Model 87* DMM. (*See new products under S3*)
Circle (857)

Jonathan Manufacturing 16373
Equipment rack products.
Circle (859)

JVC 16756
Video cameras, recording, editing equipment; video monitors; microphones, audio recording equipment. (*See new products under V1, V2*)
Circle (860) See ad index

K&H Products 16466
Camera support products; equipment transportation cases, *Shoulder Case* for Sony BVW 400, *Camera Case* for Sony DXC-537. (*See new products under S4*)
Circle (861)

Kangaroo Video Products 16421
Production bags, utility products.
Circle (862)

Karl Heitz 13730
Mic fishpoles; camera support equipment, *GITZO* tripods, fluid heads, monopods, related equipment. (*See new products under V1*)
Circle (863)

Kavouras 12227
Weather radar products, displays, *RADAC 2100* color radar accessing system and *TRITON* Doppler radar. (*See new products under*

V5)
Circle (864)

Kay Industries **4220**
Power-phase conversion products, *Phasemaster APW* for 3-phase power from 1-phase input.
Circle (865)

Keltec Florida **11641**
Satellite communications products; *H40-50Ku* and *R60-300Ku* TWT amplifiers. (*See new products under R6*)
Circle (866)

Keystone Communications **11933**
Production services.
Circle (867)

Kings Electronics **16643**
Connectors, *TITE PAK* series digital video jackfield; *KCM-5000 series* cable management program.
Circle (868) See ad index

Kintronic Laboratories **4824**
Antenna phasing, isolation products for AM/MW radio facilities, *custom AM/MW* directional phasing system and *Isolator* for multi-antenna installation on an AM tower. (*See new products under R1*)
Circle (869)

Klark-Teknik **1214**
Digital audio systems, *DN735* RAM recorder, *DN726* stereo delay line.
Circle (870)

Kline Towers **1412**
Design, fabrication and erection of guyed, self-supporting, platform and multi-array towers, space frame structures and special type antenna structures for broadcast and military applications.
Circle (871)

Knowledge Industry Publications **15671**
Industry reference publications.
Circle (872)

Knox Video **16666**
Video graphics equipment, titlers, *imagrPRO* and *Studio 40* desktop post-production system.
Circle (873)

Korg USA **N.A.**
Multiple effects processors, *A1, A2*. (*See new products under A4*)
Circle (874)

Koto Luminous Corp. **5503**
Metal-halogen, argon lamps.
Circle (875)

Kowa/Electronics & Optics **4303**
Magneto-optical disk recording for audio. (*See new products under A4*)
Circle (876)

L. E. Nelson Sales **11102**
Stage and studio lamps by *Thorn* and *GE*. (*See new products under V9*)
Circle (877)

L. Greenberg Electronic Prompting **20171**
Computer-based prompting systems, *Telescroll PC* color prompter and *LG 300* universal camera display system. (*See new products under V5*)
Circle (878)

Laird Telemedia **16360**
Video titling products, the *Legend-SE* series; video processing productions, *CKM-4 series* multilayer keyers.
Circle (879) See ad index

Lakeside Associates **5208**
Production facility design, construction; consulting service.
Circle (880)

LDL Communications/Larcan **19258**
VHF TV transmitters, *type TTS30M* and transmitting antennas, *ADC LAMBDA* low VHF CP system. (*See new products under R1*)
Circle (881)

Leader Instruments **11701**
Audio, video and RF test equipment, *5100* component/composite multistandard waveform monitor and *425* component/composite signal generator. (*See new products under S3*)
Circle (882) See ad index

Lectrosonics **15673**
Wireless microphone systems, *Pro-Mini* ENG and the *H185* plug-on transmitter mics. (*See new products under A6*)
Circle (883) See ad index

Leightronix **20111**
Video automation equipment models *TCD-RT* and *MINI-T-IR*. (*See new products under S1*)
Circle (884)

Leitch Video **19924**
Image still-stores, the *Still File* system and signal distribution products, *HEDCO 16X* series routers. (*See new products under S1, S2, S3, V2, V3, V4*)
Circle (885) See ad index

LEMO USA **11327**
Audio, video connectors.
Circle (886)

Lenco **12663**
Signal distribution products; test and measurement equipment, *Phaselcon* IEC-835 system timing unit; audio monitor amplifiers. (*See new products under A6, S2, S3*)
Circle (887)

Leonetti Company **20134**
Studio lighting products, *Sunray HMI* and *EB series* electronic ballasts. (*See new products under V9*)
Circle (888)

Lester Audio Laboratories **4304**
Fiber-optic audio transmission equipment, *DAS-2000* system. (*See new products under A3*)
Circle (889) See ad index

Lexicon **15708**
Digital audio workstations, *Opus*; *Model 2400* stereo audio time compressor, expander systems.
Circle (890)

Lightning Eliminators, Consultants **16206**
Lightning damage prevention systems, *Spline Ball Ionizer* dissipation arrays.
Circle (891)

Lightning Master Corp. **11062**
Lightning, power-protection systems. (*See new products under S3*)
Circle (892)

Listec Video **16719**
Video prompting equipment, *A-6000* PC prompter software and *A-5501* Scrollbox-Plus electronic prompter. (*See new products under V5*)
Circle (893)

LNR Communications 4600
Satellite communication products: *LVE-14* video exciter; *DSA-10* digital satellite audio system; *ATIS-1* automatic ID device.
Circle (894) See ad index

Logitek 4820
Audio mixing systems. *Mariner* water-resistant unit, *Stereorack* and *TR2* mixers; audio level metering systems. (*See new products under S3*)
Circle (895) See ad index

Louth Systems 13350
Automation systems in cooperation with Generation Systems. (*See new products under S1*)
Circle (896) See ad index

Lowel-Light 17569
Lighting equipment, *Tota-light* and *Omni-light* series. (*See new products under V9*)
Circle (897)

LPB 1918
Audio mixing consoles for audio production, on-air radio broadcast.
Circle (898)

LTM Corp. of America 17878
Lighting products. *Superlite 12k* HMI and *Cinepar 2500* HMI lighting systems. (*See new products under V9*)
Circle (899)

Lucasey Manufacturing 16670
Luggage, equipment case hardware.
Circle (900)

Lyon Lamb Video Animation 13113
Animation systems, *Mini VAS-2* systems; *RTC* real time scan converter. (*See new products under V2*)
Circle (901)

M/A-COM 15567
Microwave products.
Circle (819)

Macromedia/DHK Group 4401
Digital audio recorders. *Audisk DAR* with hard drive medium.
Circle (902)

Macrovision 11053
Videotape non-duplication products.
Circle (903) See ad index

Magni Systems 19246
Signal monitoring products. *Magni Monitor*; graphics equipment, *Signal Creator*. (*See new products under S3, V5*)
Circle (904)

Magnum Tower 4321
Manufactured radio, TV and communications towers.
Circle (905)

Mainframe Computer Graphics 16367
Newsroom graphics products. *INSCRIBER* titling environment.
Circle (906)

Major Engineering 10162
High-density storage systems for *D2, Beta, M-II, VHS* videotape cassettes.
Circle (907)

Management Graphics 20138
Digital film recorders, *Solitaire 8, 8xP*; 35mm film camera products. (*See new products under V7*)
Circle (908)

Manhattan Production Music 5122
Production music, audio effects libraries.
Circle (909)

Marconi Communications 3127
Radio communications products; transmitters, test, measurement products.
Circle (910)

Mark Antennas/Radiation Systems 11305
Grid-type microwave antennas. (*See new products under R5*)
Circle (911)

Mark IV 1214
See: ***DDA, Electro-Voice, Klark Teknik, MIDAS, Vega Wireless***

Marti Electronics 2624
STL and ENG products, *STL-10* studio transmitter link and *RPT-30* ENG transmitters.
Circle (912)

Matco Mfg. & Test 16379
Video record/playback automation, *MA-201* automated playback system; *MA-300* tape duplication control. (*See new products under A1*)
Circle (913) See ad index

Matrox Electronic Systems Ltd. 10252
Integrated video production systems, *Personal Producer* and *ILLUMINATOR-16*, combining effects, graphics and editing functions. (*See new products under V5*)
Circle (914)

Matthews Studio Equipment 17081
Camera support products, *ITE* pedestal, pan/tilt series; *MC 88* crane; *SPAGS* spacer bags.
Circle (915)

Maxell Corporation of America 18812
Recording media for Betacam SP, D-2, D-3 formats.
Circle (916) See ad index

MCL Outside
TWT amplifiers for *M/N 10961* 700W C-, *M/N 10999* 300W Ku-band.
Circle (917)

Media Computing 11107
Broadcast automation packages, *PROtec* and *ANGIS* systems. (*See new products under V5*)
Circle (918)

Media Concepts 11042
Used broadcast TV production equipment.
Circle (919)

Media Touch Systems 5203
Automation control products, *AutoPLAY* satellite-studio integration; *MIDAS* digital audio playback unit.
Circle (920)

Merlin Engineering Works 11322
Video processing equipment, *ME-278-S* synchronizer; *ME-981/-991* data encoder, decoder.
Circle (921)

Micro Communications 19043
Broadcast antenna products, feedlines, power combiners, *954000* UHF, VHF all-band antennas and *55500* switchless combiners. (*See new products under R1*)
Circle (922)

Microdyne 17573
Satellite communications products; *CSD-SDU* spectrum display for earth stations; *CSD-BQX* exciter; *CSD-BQR* receiver.
Circle (923)

Micron Audio Products 17872
Complete line of *Micron* wireless mic systems, accessories; *SQN* portable audio mixers.
Circle (924)

Micron Tool/Cammate 15685
Camera support systems, *Black Magic* boom extensions with remote head, pan/tilt control.
Circle (925)

MicroNet 18478
Program transmission services by domestic satellite and terrestrial video in Northeast and Texas. (*See new products under S8*)
Circle (926)

Microsonics 18176
Circle (936) See ad index

Microtime 18801
Video effects systems, *IMPACT* family; time base correctors, synchronizers. (*See new products under V5*)
Circle (927) See ad index

Microwave Modules, Devices 16372
Microwave components.
Circle (928)

Microwave Networks 10751
Microwave radio equipment, *MVR 1000* series and *MicroNet* 15GHz, 18GHz and 23GHz products. (*See new products under R5*)
Circle (930) See ad index

Microwave Radio 13901
ENG, microwave radio products, *FLR/FLH* direct modulation and heterodyne systems and *ProStar 2T2WB* 2GHz portables.
Circle (931)

MIDAS 1214
Audio mixers, *MIDAS XL3-40, XL-82* matrix. (*See new products under A1*)
Circle (932)

Miller Fluid Heads (USA) Inc. 16101
Camera support systems, *System 20* and *System 30* ENG products. (*See new products under V1*)
Circle (933) See ad index

Minolta 11705
Light meters, analyzers, *CA-110* LCD and *CA-100* CRT color analyzers.
Circle (934)

Miralite Communications 13444
Satellite communications products, *7900 LNB*; *Space Line* digital telephone service system.
Circle (935)

Modulation Sciences 5118
Audio processors, *StereoMaxx* spatial image enlarger; modulation measurement equipment, *ModMinder* digital FM peak deviation monitor; communications equipment. (*See new products under R4*)
Circle (937)

Mohawk Wire & Cable 17681
Wiring and cable products; camera, VTR cables. (*See new products under S6*)
Circle (938) See ad index

Mole-Richardson 16376
Lighting products, lamps, fixtures.
Circle (939)

Montage Group 11627
Video editing systems, *Montage III* picture processor, non-linear editing system.
Circle (940)

Moseley Associates 3424
Analog, digital STL products, the *DSP 6000* digital STL. (*See new products under R3, R5*)
Circle (941) See ad index

MSE Video Tape Services 13944
Videotape products.
Circle (942)

Multidyne Electronics 12908
Signal distribution products, *VPDA-2* video/pulse DAs with EQ; test products, *TS-16* NTSC V/A test generator; solid-state audio recorders. (*See new products under A4, S2, S3*)
Circle (943) See ad index

Musikos 4808
Production music libraries.
Circle (944)

MYAT 5407
Rigid coaxial transmission line components and accessories.
Circle (945)

MZB/Gray 11311
System designers, production vehicles; distributors.
Circle (946)

N Systems 19301
ENG microwave equipment. (*See new products under R5*)
Circle (947)

Nady Systems 2503
Wireless mic systems. *301 UHF, 950 UHF* and *2000 VHF*.
Circle (948)

Nagra-Kudelski 12506
Analog and digital audio recording products. (*See new products under A4*)
Circle (949)

Nalpak Video Sales 20015
Utility grip products, *TP 1460* TuffPaks, *RP series* molded rack cases.
Circle (950)

National Supervisory Network 5209
Transmission plant monitoring service.
Circle (951)

National Transcommunications 17683
Video processing technology; satellite uplink, downlink products; broadcast network facilities. (*See new products under V2*)
Circle (952)

Nationwide Tower Company 5125
Tower products, *E series* guyed, solid-rod towers; installation, maintenance services.
Circle (953)

Nautel 4520
Solid-state AM, FM radio broadcast transmitters. *AMPFET ND50* 50kW and *AMPFET ND10* 10kW AM systems. (*See new products under R1*)
Circle (954)

NCC, Inc. 13718
Consulting services, facilities design. (*See new products under S9*)
Circle (955)

NDG Phoenix 18579
Software products for graphics and facilities management, the *Studio Management* and *Library Management* software. (*See new prod-*

ucts under S1, V5)
Circle (956)

NEC Technologies **12456**
Video display units, *DM2710* Data Smart and *CM2791* Multimedia monitors. (*See new products under V6*)
Circle (957)

Nemal Electronics International **11643**
Precision audio and video cable, *#1570* and *#2201A*. (*See new products under S6*)
Circle (958)

Neotek **4903**
Audio mixing consoles, *The Elite* and *The Elan* models. (*See new products under A1*)
Circle (959)

Network Music **13127**
Production music libraries.
Circle (960)

Neumann USA **18169**
Microphone products, *RMS-191* stereo and *KRM 81* shotgun microphones. (*See new products under A6*)
Circle (961) See ad index

Neutrik USA **4300**
Audio cable, connectors; test equipment. (*See new products under S6*)
Circle (962)

Neve/AMS Industries **3400**
Audio consoles, *Neve 66* series TV/production mixers; audio processing systems; analog, digital audio recorders; stereo microphones; audio editor/workstation systems, *AMS Logic 1*. (*See new products under A1,A2,A3,A4,A6*)
Circle (963)

New England Digital **11629**
Hard disk digital audio recorders, workstations, *PostPro* and *PostPro Plus* editing system. (*See new products under A4*)
Circle (964)

NewsMaker Systems **16678**
Newsroom automation interface products for titlers.
Circle (965)

NewTek **11547**
Video production products, the *Video Toaster*.
Circle (966)

Nikon Photo/Electronic Imaging **18172**
Camera lenses for studio, ENG, *S9x5.5B* Nikkor and HDTV units *R10x12AED-HD2*; optical converters. (*See new products under V1*)
Circle (967) See ad index

Norpak **16126**
Teletext data transmission products, *TTX6X0* receivers with integrated VCR.
Circle (968)

Norsat International Inc. **17971**
Satellite communications systems, receivers. (*See new products under R6*)
Circle (969)

Northern Technologies **20160**
Information not provided.
Circle (970)

Nova Systems **13943**
TBC, synchronizer products; *Nova 950* processor/transcoding TBC and *NOVASync* synchronizers. (*See new products under V3, V4*)
Circle (971)

NPR Satellite Services **4609**
Radio program distribution service.
Circle (972)

NUCOMM **19601**
Antenna products for ENG and other microwave applications. (*See new products under R5*)
Circle (974)

nVision **11151**
Digital audio accessories, *NV4448* sample rate converter and *NV3512* routing switch. (*See new products under A4*)
Circle (975)

Nytone Electronics **16119**
Film/slide transfer equipment, 35mm slide system with pan, zoom, fade functions between slide. (*See new products under V7*)
Circle (976)

O'Connor Engineering Labs **17029**
Camera support products, *Ultimate 5-15* and *Ultimate 10-30* fluid heads for portable cameras. (*See new products under V1*)
Circle (977)

Odetics Broadcast **18732**
Videocassette playback automation systems, *BTM* break-tape-manager; *TLC-2400* time lapse logger; *TCS90* library management unit.
Circle (978) See ad index

Omicron Video **13441**
Signal distribution products, *Model 500 series* A-V routing switchers and *Model 200 series* A/V DAs; video keyers, gen-lock systems. (*See new products under S2, V3*)
Circle (979)

Omnimusic **13743**
Production assistance products, *Music* and *Omni-FX* sound effects libraries.
Circle (980)

OpAmp Labs **18180**
Audio, video signal distribution, switching equipment, *A-24/2ML* audio and *VA-16* 1x16 video/audio press feed boxes. (*See new products under S2*)
Circle (981) See ad index

Optical Disc **10745**
Video disc recording systems.
Circle (982)

Optimum Productions **11060**
Versioning, providing translations of English videos into other languages.
Circle (983)

Options Int'l **11158**
Specialty, replacement telecine products. (*See new products under V7*)
Circle (973)

OptoDigital Design **20012**
Fiber-optic products for signal distribution, routing, *LightSpeed-12* for digital audio. (*See new products under S2*)
Circle (984)

Orban/div AKG Acoustics **2800**
Audio processing systems.
Circle (985) See ad index

Ortel **10060**
Fiber-optic links, *10000TVRO FL* connecting earth station antennas with receivers.
Circle (986)

Otari 2806
Audio mixing systems; audio recording equipment. (*See new products under A1, A4*)
Circle (987) See ad index

Pacific Radio Electronics 11051
Racks, panels; precut holes accommodating various manufacturers' connector products.
Circle (988)

Pacific Recorders/Engineering 3812
Audio mixers, *Productionmixer, LS series* audio line switching systems.
Circle (989)

Paco Electronics USA 12803
NiCad battery products; *DP series.*
Circle (990)

PAG Ltd. 13408
Batteries, chargers and analyzers, *PAG SFI* NP1 fast charger and *PagLok* batteries and associated products. (*See new products under V9*)
Circle (991)

Paltex 19267
Video keyers, titling systems; video editing controllers, *Abner, Europa* and *ECS* series equipment. (*See new products under V5*)
Circle (992)

Panasonic 18019
Video cameras, recorders, *D-3 VTRs* and cameras; *M-II, S-VHS* recorders and cameras. (*See new products under V1, V2*)
Circle (993) See ad index

Panther 17884
Camera support equipment, *Super Panther* and *Mini Panther* camera dollies. (*See new products under V1*)
Circle (763)

Patch Bay Designation N.A.
Label, designation strips for patchbays.
Circle (994)

Peerless Sales 18576
Monitor/TV wall and ceiling mounts, the *Jumbo* and *Designer* series. (*See new products under S4*)
Circle (995)

Penny & Giles 4918
Signal controls, faders; *M3000* linear, *MRF 11* rotary motorized series; T-bar controls.
Circle (996) See ad index

PEP 15901
Videotape editing products, *Shotlist* software; *DigiSpot* digital recorder, player cart replacement.
Circle (997)

Perrott Engineering Labs 16419
Batteries, accessories, maintenance products; lighting products.
Circle (998)

PESA Chyron Group 19306
See: ***Aurora Paint Systems, Chyron Graphic Systems, CMX Editing Systems, Pesa Switching Systems.***

PESA Switching Systems 19306
Signal routing products, the *RM5000* 100MHz A-V router with *RC5000* controller; graphic titling systems; video monitors. (*See new products under S2, V5*)
Circle (999) See ad index

Philips Components 16723
Video camera tubes, UHF klystrons. (*See new products under V1*)
Circle (1000) See ad index

Philips Lighting 18178
Lamps for stage, studio.
Circle (1001)

Philips TV Test Equipment A/S 16523
Test and monitoring systems, *PM5640* video signal generators; *PM5686* NICAM modulator; *PM5664* waveform, vector monitor.
Circle (1002)

Photomart Cine-Video 10954
Information not provided.
Circle (1003)

Pinnacle Systems 18808
Video production workstations, *Prizm with DVEator* and the *3000* graphic design workstation. (*See new products under V5*)
Circle (1004)

Pioneer 17024
Optical rewritable disc video recording systems; *RM-V2000 CUBE* video projector systems. (*See new products under V2*)
Circle (1005) See ad index

Potomac Instruments 2626
RF test/measurement products, *1900 series* directional antenna monitoring system and *FIM series* MF(AM)/VHF/UHF field-intensity meters.
Circle (1007) See ad index

Practel Sales International 20166
Information not provided.
Circle (1008)

Prime Image 10442
TBCs, synchronizers *EXCELL 6.5 Model 600*; still-store products, *accESS Model 500*. (*See new products under V4*)
Circle (1009)

Pro Battery 11115
Battery products.
Circle (1010)

Pro-Bel Ltd N.A.
Audio, video signal routing, distribution systems, *HD series* analogue and digital routing switchers. (*See new products under S2*)
Circle (1011)

Production Garden Library 11608
Production music libraries, *Broadcast 100* and *AV/Video 200* series. (*See new products under S8*)
Circle (1012)

Professional Design Products 20114
Information not provided.
Circle (1013)

Professional Sound Corp. 4402
Distributor; portable audio mixers, *PAM42*, *Seeport* units; *MilliMic* lavalier microphone.
Circle (1014)

Progressive Image Technology 19682
Computer to video scan converters.
Circle (1015)

Promusic 2601
Music and sound effects library products. (*See new products under S8*)
Circle (1016)

Q-TV 17029
Computer-based prompting systems, *QCP Mark I* and *Mark II* ComputerPrompTer systems. (*See new products under V5*)
Circle (1017)

QEI 4518
STL products, *CAT-LINK* digital STL/TSL; *710 digital* stereo generator; FM transmitters, exciters. (*See new products under R4*)
Circle (1018)

QSI Systems 16633
VDI signal, data products. (*See new products under V4*)
Circle (1019)

Quality Video Supply 13341
Utility video furniture.
Circle (1020)

Quanta 18046
Video titling equipment, the *Delta* series. (*See new products under V5*)
Circle (1021) See ad index

Quantel 19319
Electronic paint, titling systems; image libraries; video editing systems; standards conversion products. New products announced at the booth.
Circle (1022)

Quickset 12508
Camera support products; *QKTH-30 Huskey* and *QRTH-2B Apollo* fluid head systems. (*See new products under V1*)
Circle (1023)

R-Columbia Products 13445
Wireless intercom products, *TR-470/R1-60* IFB/ENG headphones; *6058/PT* ENG/IFB pocket telephone. (*See new products under A6*)
Circle (1024)

Radamec EPO Ltd 19634
Automated camera support equipment, *ARC* advanced robotic control; *Cue Computer* for simultaneous multicamera movement, data tablet, touch screen interfaces. (*See new products under V1*)
Circle (1025)

Radiation Systems Inc. 11305
Earth station products, *Series 5000* controller and *240AT* transportable station. (*See new products under R6*)
Circle (1026) See ad index

Radio Computing Services 1426
Music library software, *Selector* for scheduling and *Songtrack* reearch systems. (*See new products under S1*)
Circle (1027)

Radio Design Labs 5406
Utility audio products, *Stick-on series* amplifiers, mixers, relays; *ACM-2* AM noise monitor.
Circle (1028)

Radio Systems 4826
Audio mixers, the *RS series*; audio recorders, *RS-2000* cart machine and *RS-DAT* digital audiotape recorder. (*See new products under S1*)
Circle (1029)

RAM Broadcast 5114
Audio products; *S.A.S. 32000* router, *SX-18* audio on-air mixer. (*See new products under A8*)
Circle (1030)

Ramsa Audio/Panasonic 18019
Professional audio mixers, monitors; R-DAT systems, *SV-3700*, *SV-3900* with RS-422 control. (*See new products under A1, A6*)
Circle (1031)

Introducing multi-cassette software so ahead of

its time, it solves problems before they occur.

Sony's new 2100 multi-spot software can't actually see the future. But it can make yours run smoother.

It works with our Library Management System™ to put your entire commerical library—up to 10,000 spots—on line. This lets you conserve shelf space, minimize library tasks and avoid lost spots.

In fact, we've redefined the concept of multi-spot software. Our system prevents play-back conflicts by automatically making two copies of each commercial.

And it can perform multiple tasks at the same time. So you can record new spots, create a back-up reel, and edit the playlist—all concurrently, even while you're on air.

In addition, system-wide redundancy is provided for security.

Of course, it's an easy upgrade for current Sony LMS owners.

To learn more, call 1-800-635-SONY, ext. 752, and look into the future of multi-cassette software.

SONY

Rank Cintel 18667
Telecine systems, *URSA* digital integrated video —studio. (*See new products under V7*)
Circle (1032)

Reach Electronics/Veetronix 16736
Paging products, *2VR82 VIP II* SA tone and voice systems and *2VR153 VIP III* monitor high-band tone and voice systems; red push-button switches.
Circle (1033)

Rees Associates 16738
Architectural services. (*See new products under S9*)
Circle (1034)

Register Data Systems 2206
Business software packages for broadcast, the *Traffic Master* and *System SIX/SEVEN systems*. (*See new products under A4, S1*)
Circle (1035)

Research Technology Int'l/RTI 13746
Videotape evaluation and cleaner systems, *TapeChek* and *Lipsner Smith* ultrasonic film cleaners. (*See new products under S7*)
Circle (1036)

RF Technology 16115
Field, field-tunable microwave for STL, TSL, ICR, the *RFL series*; portable microwave systems, *UPL* portable transmitters. (*See new products under R5*)
Circle (1037)

Richardson Electronics 12307
Power transmitting tubes, *NL347* 1kW UHF device and *UL1057* power tetrode to 960MHz. (*See new products under R2*)
Circle (1038)

Rohde & Schwarz 13918
Audio, video, RF test and measurement equipment; TV demodulators. (*See new products under S3*)
Circle (1039)

Roland Corporation 1700
Hard disk recorder, production systems *DM-80*; *SpaceSound* effects; *SN-550* digital noise eliminator; MIDI products. (*See new products under A4*)
Circle (1041) See ad index

Rosco Laboratories 17453
Color filters for lighting, *Coloroll scroll*.
Circle (1042)

Ross Video 13933
Video production switcher systems, *RVS 630* and *RVS 216A*.
Circle (1043) See ad index

RRN Inc. 5227
Radio station promotion programs.
Circle (1044)

RTS Systems 15860
Intercom systems and interface products, *TW Series* and *CS9500* digital matrix; headsets; audio distribution products. (*See new products under A6, A8*)
Circle (1045) See ad index

Rules Service Company 5226
FCC rules publications.
Circle (1046)

Russco Electronics N.A.
Audio mixing, phono reproduction, headphone and signal distribution products. (*See new products under A1, A5, A6, S2*)
Circle (1047) See ad index

Sachtler 18512
Camera support, pan/tilt and tripod products, *System 80 II (8081)* and *Set 270DB (S270DB)*. (*See new products under V1, V9*)
Circle (1048)

Samson Technologies 11330
Wireless microphone systems, *Concert series II*, *MRI* wireless receiver.
Circle (1049)

San Francisco Satellite 16773
Satellite signal relay services.
Circle (1050)

Sanix Corporation N.A.
Bulk audio/videotape eraser systems. (*See new products under S7*)
Circle (1051) See ad index

Sanken/Developing Technologies 11603
Microphone products, the *COS-11* lavalier and *CMS-75* stereo M-S instruments. New products announced at the show.
Circle (1052)

Scala Electronic 1206
Parabolic antennas for STL, ICR.
Circle (1053)

Schedulall by Vizuall 10753
Software for facilities managment, *ScheduAll*. (*See new products under S1*)
Circle (1055)

Schmid Telecommunication 1318
Audio test, measurement systems, *RESCO* network monitoring, control system.
Circle (1056) See ad index

Schwem Technology 16680
Camera lens systems motion stabilization technology.
Circle (1057)

Scientific Atlanta 13929
Satellite communications equipment, earth station antennas, *7530A* video receivers, *8860/61* antenna controllers. (*See new products under R6*)
Circle (1058)

Selco/Sifam 4324
Equipment replacement components, *R32AF* VU meters and *Collet Knobs*.
Circle (1059)

Sennheiser Electric 18169
Headphone and microphone products, the *MKH70-P48* mic and *UHF2B* wireless system. (*See new products under A6*)
Circle (1060) See ad index

SESCOM 16502
Audio signal distribution products, ADA-1 DA; ENG utilities, the MB-2 Field News Bridge. (*See new products under A6*)
Circle (1061)

Shereff Systems 15662
PC-based titlers, *Pro Video VGA-16*. (*See new products under V5*)
Circle (1062)

Shively Labs 2102
FM broadcast antennas and multistation combiner systems.
Circle (1063)

Shook Electronics USA Outside
Mobile production vehicle design, construction, *MOD-20-27KU* TV production vehicle with Ku-band facilities. (*See new products under S9*)
Circle (1064)

Shure Brothers 11901
Audio mixer and microphone products, *FP410* portable automatic mixer and *VP64* hand-held ENG microphone.
Circle (1065) See ad index

Siemens Components 15680
Transmitter power devices.
Circle (1066)

Sierra Video Systems 10742
Audio-video signal distribution products; *BetaKey* chroma-keyer demonstration; *Smart 3-port* serial control system for routers. (*See new products under S2*)
Circle (1067) See ad index

Sigma Electronics 18816
Modular distribution products, *Series 2100*; TV sync, text generators *Series 400*. (*See new products under S1, S2*)
Circle (1068) See ad index

Sinar Bron Electronik AG 10849
Lighting products.
Circle (1069)

Sira Sistemi Radio s.r.l. 19334
FM, TV transmission antennas, *UTV-01* and *3VTV* panel antenna designs. (*See new products under R1*)
Circle (1071)

Skotel 17728
Time-code equipment, *TCT-421* VITC/LTC translator; *TCG-313 FTK* film-to-tape transfer equipment.
Circle (1072)

SkyTel 11542
Personnel paging system via satellite, using *SkyPagers*.
Circle (1073)

Snell & Wilcox 15882
Standards conversion systems; film-to-tape converters.
Circle (1074)

Solid State Logic 1302
Audio mixing consoles, the *SL 5000M* production system and digital audio post-production equipment, *ScreenSound*. (*See new products under A1*)
Circle (1076)

Sonic Solutions 1706
CD recording equipment, *SS-105* pre-mastering system; audio utility *NN-100* NoNoise sound restoration system. (*See new products under A4, A5*)
Circle (1077)

Sony Communications/Broadcast 11711
Complete line of CCD cameras; *D-1, D-2* video recorders; digital peripherals, bit rate converters; analog, digital audio products; video effects systems; *LMS Automation products*. (*See new products under A4, S1, V1, V2, V3, V5*)
Circle (1078) See ad index

Sony Recording Media 11711
Video recording media, *SBT series* Betacam metal professional medium. (*See new products under S7*)
Circle (1079) See ad index

Sound Ideas 12906
Production music, effects products.
Circle (1080)

Sound Technology 4512
Audio test, measurement equipment.
Circle (1081)

Soundcraft 16236
Audio mixer systems, *SAC 200* production and on-air consoles, *Delta series* consoles with audio-for-video interface. (*See new*

Eye Fidelity — Toshiba's 2,000,000 pixel (perfect) picture.

Toshiba launches professional broadcasting deep into the core of High Definition TV with the world's first HDTV CCD Color Camera.
The Toshiba HSC-100. Its 2,000,000 pixel CCD image sensor with 100 percent aperture ratio delivers a sensitivity of f5.6 at 2,000 lux, an S/N ratio of 52 dB and a wide dynamic range of 72dB.

The HSC-100 is solid state through and through, so there's no registration, no geometric distortion, no magnetic interference during panning and tilting, no microphonic noise caused by external noise and vibration. Additionally, it puts 1000 TV lines on screen:
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Circle (69) on Reply Card

products under A1)
Circle (1082)

SoundTracker 5501
Digital sound editing systems.
Circle (1083)

Sprague Magnetics 2600
Replacement audio heads; record head services.
Circle (1084) See ad index

Sprocket Video Technologies 10142
Digital utility devices, serializer, deserializers. (*See new products under V3*)
Circle (1085)

Stainless/SG Communications 16519
Tower products, services.
Circle (1086)

Standard Communication 19901
Satellite communications products, the Agile Omni Broadcast *MT-830* and International *MT-830T* satellite TV receivers. (*See new products under R6*)
Circle (1087)

Stanton Magnetics 3124
Phono pickups, *890AL DJ Pro*; headphones.
Circle (1088)

Stanton-Video Services Unltd. 16479
Camera support products.
Circle (1089)

Star Case 11113
Transport cases for equipment, components, rack-mount types. (*See new products under S4*)
Circle (1090) See ad index

Steenbeck 17869
Video, film editing, transfer systems.
Circle (1091)

Stellavox/Digital Audio Tech. 4508
Professional R-DAT systems, STELLADAT portable and STELLAMASTER studio units. (*See new products under A4*)
Circle (1092)

Storeel 17424
Videotape storage systems, *STOR-MAX/DD* and *Room Stretcher*. (*See new products under S4*)
Circle (1093)

Strand Lighting 18042
Lighting fixtures, control products.
Circle (1094)

Studer ReVox 3406
Audio mixers; CD players/recorders, *D740*; audio tape recorders, *A807A* 4-track; telephone hybrids; R-DAT recorders; speakers; audio workstations. (*See new products under A4*)
Circle (1095)

Studio Technologies 13407
Intercom, IFB products; microphone accessories, *Mic PreEminance* pre-amp; audio processors, *AN-2* stereo simulator. (*See new products under A8*)
Circle (1096)

Sundance Technology Group 11563
Video editing products with MAC software control, *Q-CUT* editing, *Q-BASE* scene logging database. (*See new products under V2*)
Circle (1097)

Sure Shot Satellite Network 20105
Ku-, C-band transportable earth stations; production facilities and transportable equipment.
Circle (1098)

Swintek Enterprises 13401
Wireless mic, intercom products, *Mark 200* intercom and *Mark Q/ENG* microphone. (*See new products under A6*)
Circle (1099)

Switchcraft 5215
Full range of audio components, accessories. (*See new products under S6*)
Circle (1100)

SWR Inc. 15730
RF feedline products.
Circle (1101)

Sylvania Lighting 12201
Stage, studio lamps.
Circle (1102)

Symbolics/Graphics Div. 13358
Electronic graphic and animation products, the *S software* series. (*See new products under A4, V5*)
Circle (1103)

Symetrix 1424
Audio processing products, *528 Voice* processor and *511A* single-ended noise-reduction system. (*See new products under A2*)
Circle (1104)

System Associates 13431
Broadcast, production equipment brokers.
Circle (1105)

Systems Wireless 20136
Wireless microphone systems, Vega UHF T677/R662; intercoms, Clear-Com MS-212 equipment. (*See new products under A8*)
Circle (1106)

t.c. electronic A/S 12963
Audio processing and digital equipment, the *TC8201* AES/EBU digital audio test generator and analyzer and *TC1128* programmable equalizer. (*See new products under A2*)
Circle (1107)

T.E. Products 20169
Automation systems, *StudioPro*; signal distribution products, *VAS-1600* router. (*See new products under S1*)
Circle (1108)

Taber/AVSC 16501
Recording media degaussers.
Circle (1109)

Tally Display 11963
Information not provided.
Circle (1110)

Tamron Industries 13429
Camera lens products; video slide-to-video conversion products.
Circle (1111)

Tannoy Ltd. 4302
Speaker products, *PS-88* subwoofers; *DMT studio monitor* series.
Circle (1112)

Tapscan 4325
Marketing research systems, *QualiTAP*, *TargetONE*.
Circle (1113)

TASCAM 12951
Audio recorders, *BR-20T* center time-code track; *CD-301* CD players; audio mixers. (*See new products under A1, A3, A4, A5*)
Circle (1114) See ad index

Taurus Communications Inc. 16366
Satellite transmission services.
Circle (1115)

TEAC 5120
Communications recorders, *CR-310, -320*; *LV-250SCR* motion, *LV-231ASCR* still recorders.
Circle (1116)

Teatronics/Lighting Innovations 17876
Lighting controllers, *echelon*, with *MD series* modular dimmers.
Circle (1117)

Techni-Tool 11644
Special-purpose tools.
Circle (1118)

TEKNO 20073
U.S. distributor for Balcar (France) lighting products, Fluxlite and Electronic Flash systems. (*See new products under V9*)
Circle (1119)

Tekskil Industries 19038
Videoprompting systems, *Companion* and *14"* Easy View studio prompter.
Circle (1120)

Tektronix 18032
Audio, video, RF test, measurement products, *VM700A* video measurement set, *TSG-1050/-1125/-1250* HDTV generators; sync sources, synchronizers; waveform, vector monitors; *Avanzar* video scan converter. (*See new products under S3, V3, V4*)
Circle (1121) See ad index

Tel-test 17753
Automation products, *MC²SS* master control switcher; *ACC* air-channel control automation.
Circle (1122)

Telcom Research 13737
Time-code products, *T102* generator, reader.
Circle (1123)

Telecast Fiber Systems 20011
Cable utility products, reels. (*See new products under S6*)
Circle (1124)

Telemetrics 19673
Camera support and control products, *robotic pan/tilt* systems and *ENG camera* triax adapters. (*See new products under V1*)
Circle (1125) See ad index

Telepak San Diego 13405
Equipment transport products; convenience items *T-Brief Producer/Director* briefcase.
Circle (1126)

Telescript 16823
Prompting systems, software for IBM/compatible PCs; *Monitors* in 12", 17" sizes; switching-type power supplies. (*See new products under V5*)
Circle (1127)

Television Engineering 13117
Mobile TV production, ENG vehicles; system design, construction; IFB controller. (*See new products under S9*)
Circle (1128)

Television Equipment Associates 13411
Video filtering products, *Brickwall* types and switched *video delay* boxes. (*See new products under S3*)
Circle (1129)

Telex Communications/Pro A-V 15860
Audiotape duplication units, *Model 6120* high-speed system; wired, wireless microphones and the *ENG-4* portable wireless re-

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Circle (70) on Reply Card

ceiver; headsets. (*See new products under A3, A6*)
Circle (1130)

Telos Systems **1024**
Telephone hybrid products, the Telos *LINK* telco-intercom interface and *Telos ONE* hybrid. (*See new products under A7*)
Circle (1131)

Tennaplex Systems **15715**
Broadcast antenna products, *Kathrein* FM, TV systems.
Circle (1132)

Tentel **12808**
Recorder maintenance equipment, *T2* tape tension gauges and *TSH* 6-function spindle height gauges. (*See new products under S3*)
Circle (1133)

Texscan MSI **15682**
Titling, video message systems.
Circle (1134)

TFT Inc. **2508**
STL systems, *Model 9100/9107* composite STLs and *Model 8900* booster/reciter for FM repeater applications. (*See new products under R4, R5*)
Circle (1135)

Theatre Service & Supply **13740**
Studio furnishings, *studio cyclorama* curtains, track systems; *scenic supplies* and grip equipment.
Circle (1137)

Thermodyne International **16973**
Equipment transport cases.
Circle (1139)

Thomson-CSF **15733**
See: ***Comark Communications, Thomson Broadcast, Thomson Digital Image, Thomson-LGT***

Thomson Digital Image/TDI **15733**
Electronic graphic software packages, *Explore V2.3* and TDI-AMAP. (*See new products under V5*)
Circle (1140) **See ad index**

Thomson Electron Tubes/Devices **11908**
RF power devices for terrestrial broadcast applications; HPA, TWT devices for satellite, microwave communications.
Circle (1141) **See ad index**

Thomson Broadcast **15733**
Digital video processing products, *Colorado* color manipulation; *4:2:2* keyer for mixing, keying; TTV series CCD cameras, *TTV1250* HDTV portable camera. (*See new products under S2, V2, V8*)
Circle (1142) **See ad index**

360 Systems **1018**
Audio control switchers, *Model AM-16* and digital cartridge recorders, *Digicart*. (*See new products under A4*)
Circle (1143) **See ad index**

3M Pro A/V Products **18012**
Audio, video recording media, *DCS* digital videocassettes, *PB* Betacam SP cassettes. (*See new products under S7*)
Circle (1144) **See ad index**

Tiffen Mfg. **15656**
Lighting modification gels.
Circle (1145)

Time Logic, Inc. **15669**
Editing products, *TLC* editing systems; *ADPU-200/E* tape control automation. (*See new products under S1, V2*)
Circle (1147)

TimeLine **4403**
Time-code products; transport synchronizing systems.
Circle (1148)

Timewave USA **4606**
Formerly Soundmaster; digital audio products, Timewave/Soundmaster audio editing system and SoundStor workstation. (*See new products under A3, A4*)
Circle (1149)

TM Century 21 **2525**
Radio station automation, *Digital Commercial System* using hard disk storage. (*See new products under S1*)
Circle (1152)

Toko America **16970**
Video filters, *HBF, DCL06, DCL08* for HDTV, *HDF-2000* high performance. (*See new products under S1*)
Circle (1153)

Torpey Controls & Engineering **13413**
Utility timing products, *CLK-22A* analog/digital time displays and *STW-5* digital timer. (*See new products under S1*)
Circle (1154)

Toshiba/Video Systems Group **19646**
Special-purpose video cameras *IK-M40A/C40A* miniature color and *IK-T30A* compact 3-CCD color cameras.
Circle (1155) **See ad index**

Total Spectrum Mfg. **11841**
Studio automation equipment; robotic camera support products, *SportsFocuser* and *ACP AutoCam* series.
Circle (1156) **See ad index**

TouchVision Systems **18740**
Videotape editing control systems, *D/Vision* and *D/Vision Pro*. (*See new products under V2*)
Circle (1157)

Tower Structures **10755**
Tower products, services.
Circle (1158)

TRF Production Music Libraries **20156**
Production libraries, the *BMG/RCA* and *Carlin* music series. (*See new products under S8*)
Circle (1159)

Trident Audio **10654**
Audio consoles for broadcast, tele-/post-production, *Vector 432*.
Circle (1160)

Troll Technology **13901**
Remote-control facilities for microwave equipment, steerable antennas, transmitters, receivers and associated equipment, *TouchStar Master* and *Slave* systems. (*See new products under R5*)
Circle (1161)

Trompeter Electronics **12801**
BNC connectors; patching, distribution products.
Circle (1162) **See ad index**

TrueVision **19284**
Electronic graphics cards, engines, *Targa+* and *NuVista+*. (*See new products under V5*)
Circle (1163)

TTC/Television Technology **15725**
Radio, TV transmitters, *UHF-30MA* air-cooled IOT transmitter; *XLS series* LPTV transmitters, translators. (*See new products under R1*)
Circle (1164) **See ad index**

27th Dimension Inc. **5222**
Music and sound effects products.
Circle (1165)

TWR Lighting **5124**
Tower lighting products.
Circle (1166)

Ultimatte **12529**
Video compositing systems, the *Ultimatte 300, FORMATTE, SYSTEM 6*; still-stores; memory head camera support products. (*See new products under V3*)
Circle (1167) **See ad index**

Union Connector **17676**
Power distribution equipment, *Polybox* company switches and *CS* connector strips. (*See new products under S3*)
Circle (1168)

Unique Business Systems **16667**
Productivity, business software; *RentTrace* rental equipment availability tracking.
Circle (1169)

United Ad Label **13344**
Custom-printed tape format, tape status labels; *Labels Unlimited* label printing software.
Circle (1170)

United Media **19253**
Editing control systems, *UMI 500, 600* multitasking and *UMI 400* A/B roll controllers; animation products. (*See new products under V2*)
Circle (1171)

UNR-ROHN **4218**
Tower products.
Circle (1040)

UREI **16236**
Audio processsing products. (*See new products under A2*)
Circle (1172)

U.S. Tape & Label **2324**
Labels, promotional products.
Circle (1173)

Ushio America **17579**
Stage, studio lighting products, lamps.
Circle (1174)

Utah Scientific **18046**
Signal distribution switchers, *AVS* analog A-V and *DVS* digital routers; *PVS* production, *MC-500* series master control switchers. (*See new products under S2*)
Circle (1175) **See ad index**

Utility Tower Company **2824**
Tower products and services for AM, FM, TV, microwave and other communications.
Circle (1176)

Valentino Production Music **12208**
Production *Music* and *Sound Effects* library packages.
Circle (1177)

Valmont Industries **1324**
Tower structures, *Monopoles* to 250 feet, also free-standing and guyed *Lattice* towers.
Circle (1178)

Vantage Lighting **16472**
Studio, stage replacement lamps *Ken-Rad* products. (*See new products under V9*)
Circle (1179)

The ULTIMATTE "Choice"

Now the choice is yours. If you want a self-contained video matting device with maximum ease of operation, the choice is **Ultimatte-300.** If you want a peripheral to your switcher which enables your linear keyer to emulate an Ultimatte, the choice is **Foremattе.**

With either device you get the totally realistic composite images possible only with Ultimatte's patented technology. Anything the camera can see will be composited. Transparent objects, reflections, shadows, individual strands of hair can all be reproduced in an Ultimatte foreground. The talent can touch the blue or green backing without creating any fringing or breakup in the composite. Discoloration caused by bounce light from the backing is automatically removed by Ultimatte's patented flare suppression circuits. The result is a composite image so realistic the viewer can not tell it is a special effect.

The **Ultimatte-300** is a completely redesigned update of the Newsmatte, which revolutionized the look of news and weather broadcasts. While it uses an RGB signal from the foreground to generate a fully linear Ultimatte matte signal, all of the processing and mixing is done on encoded foreground and background signals. The result is Ultimatte quality without the need for a free-standing encoder and with only a 35ns delay. The output of the **Ultimatte-300** can easily be timed into a switcher for use in a broadcast or live production environment. With a transcoder for the foreground, the **Ultimatte-300** can be used to composite from Betacam playback in a post-production environment.

The **Formatte** is designed exclusively as a peripheral for switchers with linear keyers, thus allowing the switcher to select and control the background. Now, a linear keyer designed for use with anti-aliased character generators can create amazingly realistic composites from live action foregrounds while the switcher does mix/effects on the background. The **Formatte** generates the same matte signal and processes the foreground in the same manner as the **Ultimatte-300**, but the matte signal output is inverted so that it has the conventional orientation used in a linear keyer. In addition, special operator controls permit the matte signal and processed foreground to be optimized for a particular linear keyer...the result is like having an Ultimatte designed into your switcher.

Whether you want to incorporate dynamic electronic sets into news and information broadcasts or to bring a new dimension of flexibility and creativity to corporate communications, Ultimatte has a product designed to meet your needs. **Foremattе** or **Ultimatte-300.** There are no longer any excuses for compromise.

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Circle (71) on Reply Card

Varian Associates, Microwave Eqpt. 12451
Microwave power devices. (*See new products under R2*)
Circle (1180)

VEAM 16676
Electrical connectors, *CIR series* and *VSC series* multipin products; A-V FO products. (*See new products under S3, S6*)
Circle (1181)

Vega Wireless 19656
Wireless mic, intercom equipment, *600 series* wireless mics, *Q Plus* wireless intercoms. (*See new products under A6*)
Circle (1182) See ad index

VGS California 10549
Studio furnishings, the *Nigel B* furniture line. (*See new products under S5*)
Circle (1183)

VGV Incorporated 17319
Digital composite video production switchers, models *D-2500* and *DX-300*. (*See new products under V8*)
Circle (1184)

Vicon Industries 10045
Camera support, remote positioning products.
Circle (1185)

Video Accessory 16639
Video accessory, utility products, *BBG-2* blackburst generator and *YCDA-1* S-video distribution amp. (*See new products under S2*)
Circle (1186)

Video Associates Labs 13711
Video keying and capture devices, *MicroKey/A* with gen-lock and *DigiView*. (*See new products under A4*)
Circle (1187)

Video Central 12233
Distributor for video products; utility devices, *Optex* mini-image intensifier and camera surface splash bags. (*See new products under V1, V2*)
Circle (1188)

Video Communications 17973
Computer software for broadcasting applications, business systems for *STARS* sales, traffic, accounts receivable system, *Accounts Payable/General Ledger, Payroll*. (*See new products under S1*)
Circle (1189)

Video Data Systems 15684
Character generator, message service products.
Circle (1190)

Video Design Pro 19338
Computer software and hardware packages for computer-aided design, *VidCAD 386*; special features for production facilities.
Circle (1191)

Video International Development 13115
Standards converters.
Circle (1192)

VideoLab Para Technologies 11105
Time-code processors, *LCX-108 Logichron* LTC, VITC generator, reader.
Circle (1194)

Videomagnetics 16733
Refurbishing services for 1" type C video heads; tape degaussers. (*See new products under S7*)
Circle (1195)

Videomedia SED 16354
Editing systems, *SuperMicron* Animation Plus, and transport controllers, *V-LAN* compatible units. (*See new products under V2*)
Circle (1196)

Videoquip Research 4900
Signal routing switchers, distribution products. (*See new products under A4, S3*)
Circle (1197)

Videotek 19919
Video monitors, signal sources; waveform, vector monitors, *TVM-720* CAV/composite combo monitors; frame synchronizers; *Prodigy* video switcher. (*See new products under A6, S3, V8*)
Circle (1198) See ad index

Viking Cases 16374
Equipment transport cases.
Circle (1199)

Vinten Broadcast 19666
Camera support products, *Microswift* robotic systems, *Classic* and *Vision* pedestals, tripods and pan/tilt heads. (*See new products under V1*)
Circle (1200)

Vistek Electronics 18883
Video encoders, decoders, transcoders, *V4130 Varicomb* series; *V2100 Array* routers; video processors; *Autotran* PC-based equipment control system; *GM7500* series color monitors. (*See new products under S2, V3, V4*)
Circle (1201) See ad index

Vortex Communications 13101
Clocks, timers, *Series 400* clock displays showing time/date and *ITC series* time-code-driven FAVAG/MOSER BAER movements; utility video products; signal distribution equipment. (*See new products under S1, V3, V5*)
Circle (1202)

VYVX National Video Network 20082
Switched fiber-optic TV transmission services.
Circle (1203)

Ward-Beck Systems 12501
Audio mixers.
Circle (1205)

WaveFrame 12463
Digital audio workstations, *WaveFrame 1000* and *WaveFrame 400*. (*See new products under A4*)
Circle (1206)

Wavefront Technologies 19641
Videographics software packages.
Circle (1207)

Wegener Communications 5414
Satellite transmission products, *Series 2900* descramblers; *Series 1900 DBS FM²* subcarrier receivers.
Circle (1211)

Wescam 10659
Camera mounting systems for helicopters.
Circle (1204)

Wheatstone Broadcast Group 5000
Audio mixing consoles for on-air *A-series* and stereo production *SP- series*; signal processors, equalizers; distribution products; intercoms, studio furniture. (*See new products under A1*)
Circle (1212)

Wheeler-Rex 17578
Utility tools.
Circle (1208)

Whirlwind 13105
Audio mixers, *MIX5-SB* 4-channel mixer; audio, video cabling, distribution products; transformers.
Circle (1213)

Will-Burt/TMD 16636
Telescoping masts, *TMD-7-42-367* microwave antenna support and *25' Hurray Up*. (*See new products under R1*)
Circle (1214)

Winsted 13122
Special-purpose video, studio furnishings, model E4835 dual pedestal editing desk and K8643 editing console.
Circle (1215) See ad index

Wireworks 14044
Audio, video utility products, *T series* individual transformer isolated mic splitters; *System 502* A-V cabling components.
Circle (1216)

Wohler Technologies 20176
Audio monitor amplifiers, *MSM multisource meters, ARS* routers and *AMP series* monitors. (*See new products under A6, S3*)
Circle (1217) See ad index

Wolf Coach 13936
Mobile production vehicles.
Circle (1218)

World Tower 2226
Tower products, services.
Circle (1219)

WSI 13047
Weather data services, display products, *WEATHERspectrum 9000* workstation. (*See new products under V5*)
Circle (1220)

Yale Electronics 4509
Information not provided.
Circle (1221)

Yamaha Music 3404
Audio mixing consoles, *DMC 1000* digital automated recording console; *YPDR 601* professional compact disc recorder. (*See new products under A1*)
Circle (1222) See ad index

Yamashita Engineering Mfgr./YEM 16409
Video scan converters, *CVS-910* and *CVS-980*; animation/machine control equipment; sync generators. (*See new products under V2, V3*)
Circle (1223)

Zaxcom Video 20013
TBC remote controls; *Taskmaster* automatic TBC adjustment, timing system; *D1 Toolbox* processor for D-1 signals.
Circle (1224)

Zero Stantron 16401
Modular equipment consoles and cabinets. (*See new products under S5*)
Circle (1225) See ad index

Zonal 16223
Audio recording tape and film)
Circle (1226) ■

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Random Access digital audio just got a whole lot easier. The DigiCart™ stores hundreds of cues, and each one is *instantly* available. It's the perfect tool for TV and radio production work, where recording, editing, and playback have to move fast *and* sound great. Today, hundreds of the world's best stations and studios use the DigiCart for everything from sound effects and voice-overs, to sports bumpers and station ID's. Excellent digital editing and playlisting capabilities make the DigiCart a natural for assembling complex sequences. For those with larger plans, optional hard disks expand the storage capacity to over fifty hours, while a fast DSP block[1] gives the speed and power of the most expensive workstations. Best of all, DigiCarts deliver CD quality audio *below* the price of many tape carts. Call us at 360 Systems and request a DigiCart literature pack. Discover why it's becoming the hot production tool for the 90's, in broadcast studios everywhere.

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[1]Motorola's fast Digital Signal Processor, the 27 mHz 56001, performs *real time* fades, level corrections and data compression.

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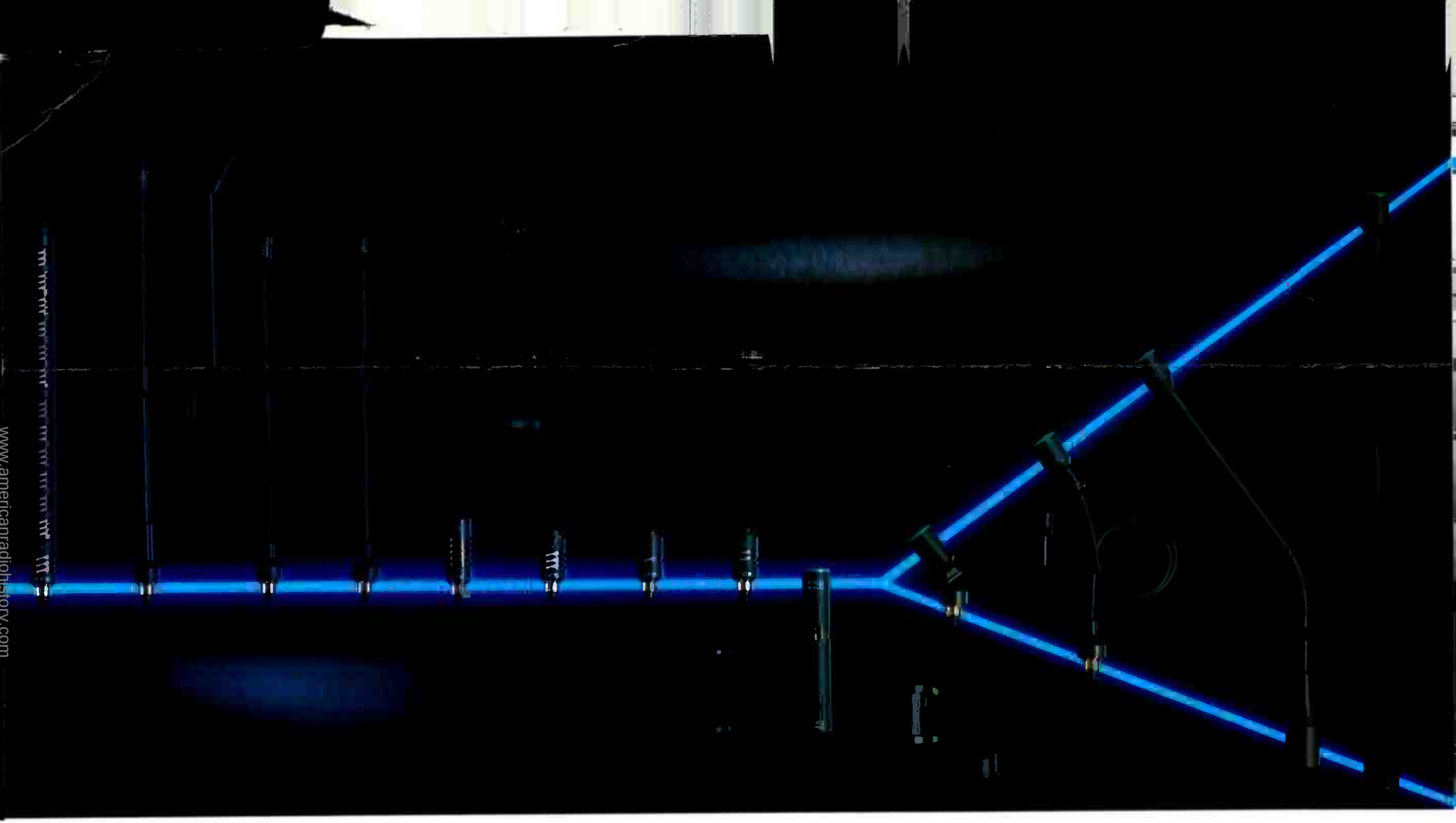

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New at NAB

The following pages indicate model numbers, names and descriptions, when available, of the new products to be introduced at NAB '92. They are categorized according to the list below. Entries for a company in the *Equipment Exhibitors* section include a letter-number reference to where a new product is mentioned in this issue.

Audio Products

A1 Mixers, automation, faders
A2 Processors, dynamics, delays, effects, noise reduction
A3 Analog recorders, all formats
A4 Digital recorders, all formats
A5 CD, phono products
A6 Mics, headphones, speakers, monitor amps
A7 Remote audio equipment; RPUs frequency extenders, telco hybrids
A8 Intercoms, IFBs

Radio Products

R1 Transmitters, remote controls, antennas, transmission line, towers, obstruction lighting and tower services
R2 RF power devices, amplifier cavities (non-satellite)
R3 RF generators, exciters
R4 Demods, receivers, modulation monitors
R5 Terrestrial microwave electronics, antennas
R6 Satellite microwave electronics, antennas

Support Products

S1 Automation equipment, software; data transmission products; machine control; timers, clocks
S2 Signal distribution, routers, DAs
S3 Test, monitor products, signal generators; meters, tools, components; power condiitoners, filters; RF loads, calorimeters
S4 Cases, equipment racks, storage systems
S5 Studio, control room furniture, acoustic material
S6 Wire, cable, connectors, patch panels; fiber optic products
S7 Recording media, all formats, related products; film, film maintenance
S8 Music, effects libraries; programming services; promotional materials; weather services
S9 Production facility, vehicle design, construction; consulting services

Video Products

V1 Cameras, lenses; tripods, P/T heads, pedestals, automation
V2 Recorders (all formats, non-automation); still stores; video edit controllers, software; time code equipment
V3 Processors, encode/decode, A/D-D/A, S/P-P/S converters; keyers, compositors; signal correction
V4 TBCs, synchronizers, standards conversion; VID generators, video/pulse delays
V5 Graphics, titling, effects; weather display systems; integrated production systems; animation
V6 Displays, projectors, video walls; video printers
V7 Cine/film products, telecine equipment
V8 Production, master control switchers
V9 Batteries, chargers, analyzers; lighting instruments, lamps, ballasts, accessories; grip equipment.

Audio Products

A1: Mixers, automation

ADM Systems 18442
Post-Pro: audio-for-video post-production console. Circle (1231)

AMEK Consoles/TAC 13351
EINSTEIN: automated audio mixer; compact packaging with comprehensive metering and monitoring; to 64 inputs with fader, 4-band EQ; 24 balanced group outputs and tape returns; *Steinberg SUPERTRUE* automation; *VIRTUAL DYNAMICS* for gating, autopan, dynamics processing. Circle (1232)
BCIII module options: for broadcast/production mixer; *BC348* facility for four mono mix-minus clean feed outputs; *BC344* 4-into-2 monitor mixer; *BC324* quad group module; TLA input amps designed by Rupert Neve. Circle (1233)

ATI Audio Technologies 12203
BC6DSL/R: 6-channel stereo audio console. Circle (1234)

Audio Services Corporation 5112
Audio mixers: by Mackie Designs and Soundcraft. Circle (1235)

Auditronics 3902
850 series: production consoles with features of 800 series; integrated in-line processing and preselection features. Circle (1236)
800 series: on-air console; 4 stereo, 2 mono output buses; hybrid component technology; multiple user-programmable logic systems. Circle (1237)

Comrex 13101
Talk Console: complete talk studio in small, easy-to-use package. Circle (1239)

Crouse-Kimzey Company 5410
Audio-Technica AT4033. mixer. Circle (1240)
Ramsa WR-54416 mixer. Circle (1241)

Crown International 4818
SMX-6: digital 6× programmable mixer. Circle (1242)

DDA 1214
DDA Interface: production console. Circle (1243)

Fidelipac 1920
MX series: modular audio consoles. Circle (1245)

FOR-A 15870
AM-100: audio mixer. Circle (1246)

GML, Inc. 1406
GML-HT-9100: mixer. Circle (1247)

Graham-Patten Systems 16242
D/ESAM 800 Ver 2.0: software EPROM replacement; includes manual crossfades, auto to/from for enhanced auto-assembly and other features. Circle (1248)
D/ESAM Plus: for D/ESAM 800; adds memory management, storage enhancements; to 200 internal registers; register management function to configure virtual machines and other advanced features; disk drive to store entire system memory. Circle (1249)

Harrison by GLW 13925
Model MPC: Motion Picture Console; total automation of dubbing; to 256 audio channels. Circle (1250)

Henry Engineering 5500
Micromixer: 4-input stereo line utility mixer. Circle (1251)

Image Video 11307
AMS-1000: audio mixing switcher; may be interfaced to any video production switcher. Circle (1252)

MIDAS 1214
MIDAS XL3-16: mixer. Circle (1253)

Neotek 4903
ES-100: high-quality, low-cost production console. Circle (1254)
Esprit: production, on-air, recording console; features high-quality, moderate price. Circle (1255)

Neve/AMS Industries 3400
Neve Flying Fader option: software option for film, video post. Circle (1256)

Otari 2806
Series 54-P: modified 54 series for LCRS film/video mixing; 36 dual-path input modules; 16 group reassign modules; supports 72 individual inputs; 40-channel DiskMix 3 moving facer automation. Circle (1257)

Ramsa Audio/Panasonic 18019
WR-S4400: 4-bus mixer, 12-, 16-, 24-channel configurations; 2-inputs/channel; 3-band EQ; 4 main groups, left/right stereo masters from channels, groups and four aux sends; *D-out* switch reroutes signal path for expanded output capabilities. Circle (1258)

Russco Electronics N.A.
Studio Master 505: audio mixer. Circle (1259)
Telemote 321: remote audio mixer. Circle (1260)

Shure Brothers 11901
FP410: portable automatic mixer; 4-input unit with *Noise-Adaptive Threshold, Max Bus Circuit, Last Mic Lock-On* features. Circle (1261)

Solid State Logic 1302
SL 8000G: multiformat audio production mixer; G-series automation computer. Circle (1262)

Sony Communications/Broadcast 11711
Audio mixer: lower-cost digital audio-for-video system. Circle (1263)

Soundcraft 16236
Vienna, Europa: stage production consoles. Circle (1264)
VBE-100: audio-follow-video console. Circle (1265)

TASCAM 12951
M700-MFA: automated recording console; 24-, 32-channel, 8 group buses, 4 assignable effects return switches, 6 aux sends; dual signal path feature effectively doubles inputs during mixdowns. Circle (1266)
M-1500 series: rack-mount 8+8 or tabletop 16+16 input audio mixers; *Dual Bus* introduces separate stereo signal path to each channel in addition to main fader signal path. Circle (1267)

Wheatstone Broadcast Group 5000
TV-600S: console with bus-minus multi IFB feeds; Event Computer controls channel sources from router or on-console switcher; indicator above fader shows channel sources; optional 8-input preselector overbridge; two stereo output; two mono out for SAP; mono sum. Circle (1268)

Yamaha Music 3404
PM4000: mixing console in 32-, 40-, 48-input frames (24-input special order); inputs to -70dBu nominal; 4-band parametric EQ, variable high-pass filter; eight primary mix buses plus stereo bus. Circle (1269)

A2: Audio processing

Aphex Systems 1906
Modular Aural Exciter: install in one input module space of various audio power amplifiers. Circle (1270)
Model 9901: equalization module fitting 9000 series enclosure; tone shaping accomplished with three overlapping filter bands enable multiple EQ settings within a given bandwidth. Circle (1271)

Dolby Labs 4514
SRP series: 24-track Dolby SR processor. Circle (1272)

Eventide 1421
HS 395: internal sampler board. Circle (1273)

Gentner Communications 1712
Prizm 2.0: 4-band digital preprocessing; wideband AGC circuit. Circle (1274)
Lazer 2.0: digital limiter, stereo generator for FM; 3-band, wideband, composite limiting; 25-, 50-µs pre-emphasis. Circle (1275)

Henry Engineering 5500
Twinmatch: dual stereo impedance and level converter. Circle (1276)

Hotronic 13427
AU202: stereo audio delay system; delay range to 10s. Circle (1277)

Inovonics 1418
DAVID: stereo audio processor; includes

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FM stereo generator. Circle (1278)

JBL Professional 16236
M712: 2-channel gating compressor/limiter Circle (1279)
M644: 4-channel noise gate. Circle (1280)

Neve/AMS Industries 3400
Integrated Audio Processor: customized mobile interface; for any combination of AMS and NEVE digital and analog signal processing devices. Circle (1281)
Neve VR stereo module: controls stereo sources from single module. Circle (1282)

Symetrix 1424
Model 425: dual compressor, limiter, expander; stereo or dual-mono modes; combines downward expansion and compression peak limiting; 112dB dynamic range; 0.04% distortion typical. Circle (1283)
524E multimode crossover: four crossover bands, configure as mono 2-, 3- or 4-way or stereo 2-way; adjustable crossovers, filter slopes; each band individually processing with driver-protection limiter, phase alignment compensation. Circle (1284)

t.c. electronic A/S 12963
M5000: digital audio delay processor; AES/EBU interfacing; DARC digital analog reverb co-processor technology; stereo system includes various delay-based effects programs; requires two rack spaces. Circle (1285)

UREI 16236
LA-10, LA-12: single- and dual-channel compressor limiters. Circle (1286)
LA-22: dual-channel parametric compressor, limiter and expander. Circle (1287)

A3: Analog recording

Audio Kinetics 11633
ES.Lock 1.11 Ver 4: enhanced software for synchronizer modules; *Short Menus* simplify user interface; expanded list of compatible edit controllers, hard disk workstations includes Lightworks editor, Laserdisk, Sony, AMS Logic 2. Circle (1288)
ES.Lock 1.11 option: events card at low cost for small systems applications. Circle (1289)

International Tapetronics/ITC 1208
Series 2: audiotape cartridge reproducer and recorder/reproducer; mono, stereo models; Dolby HZ Pro headroom extension, digital tape timer; active balanced I/O on XLR connectors. Circle (1290)

Lester Audio Laboratories 4304
DAS 2000 D series prototype: A/D/D fiber transmission system for audio; passes AES/EBU at output stage without conversion back to analog. Circle (1291)

TASCAM 12951
202 MK II: dual record dubbing deck; permits two copies to be made from external master; twice speed and real time modes; Dolby B, C and HX Pro. Circle (1293)

Telex Communications/Pro A-V 15860
Cassette Duplicator. Circle (1295)
EGM series: miniature gooseneck mic. Circle (1296)
V-series: lightweight professional headset. Circle (1297)

Timewave/Soundmaster 4606
SoundSync: programmable machine synchronizer. Circle (1298)

A4: Digital recording

Alesis 1212
RMB option: 32-channel remote meter bridge for ADAT. Circle (1299)
AI-1 ADAT interface: to AES/EBU and S/PDIF with sample rate converter. Circle (1300)
ADAT: 8-track digital recorder uses S-VHS media; multiple units (to 16 units for 128 tracks) synchronized with SMPTE TC, a proprietary timing reference or BRC optional controller. Circle (1301)
AI-2: ESbus interface; transport control of ADAT with video equipment. Circle (1302)
BRC remote: to ADAT digital recorder; reads, writes SMPTE TC, generates MTC, MIDI clocks to maintain synchronization between multiple transports. Circle (1303)

ASACA ShibaSoku 15746
AAM-200: magneto-optical disk audio file. Circle (1304)

Audio Processing Technology Ltd. 1302
apt-X 100ED IC: ROM-masked device with software selectable mono/stereo encode/decode modes; mono to 48kHz sampling, stereo to 32kHz. Circle (1305)
SCS100, SDS100: encoder and decoder circuit boards as development tools or subassemblies in existing system; analog/digi-

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tal I/O, sampling frequencies between 8kHz and 48kHz; data, clock direct RS-422 interface to modems. Circle (1306)
DSM100 Duplex System: 2-channel unit; *SCS100, SDS100* stereo encoder, decoder boards with RS-449/X21 modem and telecom interfaces. Circle (1307)

Audio Services Corporation 5112
DAT recorders: Stellavox *Stelladat* and Fostex *PD2.* Circle (1309)

AVID Technology 19676
MediaMix: audio editing, sweetening application for Series 200, model 500 Media Composer. Circle (1310)

Barco-EMT 18804
BEDAS MOD recorder EMT 466: minimum of 3.2 hours stereo recording capacity; 5¼" removable, erasable magneto-optical disk media. Circle (1311)

Bec Technologies N.A.
AudioPlex/Pro-Line products:*AD16* 16-channel A/D transmitter; *DA16* 16-channel D/A receiver, repeater; *MP16* 16-channel mic pre-amp, splitter; *FB2* fiber-optic transceiver module; *RPS* redundant power supply module. Circle (1312)

Broadcasters General Store 5426
Rodman/Brown Desk Jockey: PC-based, hard disk commercial storage/satellite automation system; total automation for 14-day walkaway time. Circle (1313)

CCOR/Comlux 13356
3083/3084: 8-channel 16-bit coder/decoder for digital signals. Circle (1314)

Clark & Associates 5114
Digital audio storage: six simultaneous input/output channels; 40-720-minute 15kHz audio; non-compressed; requires 5.25" rack space. Circle (1315)

Crouse-Kimzey Company 5410
360 Systems Digicart: Circle (1316)
BE Audiovault: Circle (1317)
Sony DAT machine. Circle (1318)

Datatek 13914
D-890: digital audio DA module. Circle (1319)
D-891/D-892: digital audio A/D and D/A converter modules. Circle (1320)

Dolby Labs 4514
Model DP90: 2-channel AC-1 digital encoder; for point-to-multipoint and direct-to-consumer broadcast where low-cost decoders will be used. Circle (1321)

Eventide 1421
VR 240: digital audio logger. Circle (1322)

Fidelipac 1920
DCR-1000: digital cartridge recorder. Circle (1323)

FOR-A 15870
AR-200: digital audio recorder with audio list management. Circle (1324)

Fostex 17428
Model PD-2: portable time-code DAT recorder; off-the-tape confidence monitor; internal generator; all four formats; jam sync; time-code loop and output jacks; video sync, work sync I/O. Circle (2248)

Gefen Systems 5224
Filemaster: for AKAI *DD1000,* Panasonic *SV3900;* automatic transfer of sound effects from CDs to the audio/editing system. Circle (1325)
NSM 3101-AC: 100-CD changer. Circle (1326)

Gentner Communications 1712
DAWN: digital audio workstation. Circle (1327)

Henry Engineering 5500
Digistor: digital message storage system; for broadcast *information line* use. Circle (1328)

IMC/International Music Corp. 1002
S1100EX: sampler expansion module. Circle (1329)
Version 2.0 for S1100: direct-to-disk audio recording. Circle (1330)
Version 2.0 for DD1000: time compression, expansion features; RS-422 control. Circle (1331)

International Tapetronics/ITC 1208
DPR-612: digital program repeater. Circle (1332)
DigiCenter: digital audio hard disk recording, playback system. Circle (1333)

Korg USA N.A.
SoundLink: 8-track hard disk recorder, editor; automated digital mixing, EQ, effects processing; 16-track MIDI recorder, sequencer; synchronizes to time code, digital audio. Circle (1334)

Kowa Company/Electronics & Optics 4303
AF220: audio file using M-O disks; two drives with option for four; 4-bit compression; simultaneous record and playback mode possible. Circle (1335)
AF240: compact audio file based on M-O disk; one disk, option for four; 4-bit compression function. Circle (1336)

Lexicon 15708
Opus Software V 3.0: external machine control; *AutoMix* console automation; *CPEX* time compression, expansion, pitch shifting, sample rate conversion. Circle (1337)
GFI-10: digital audio format interface - converts between AES/EBU, S/PDIF, SDIF-2; viewing, editing of data bits. Circle (1338)

Multidyne Electronics 12908
SSR-90: solid-state recorder; 1.5-minute capacity for source identification; playback alternates among messages, tones or external audio source. Circle (1339)

Nagra-Kudelski 12506
Nagra-D: 4-channel digital recorder; open reel ¼" tape with helical rotary heads; 4-channel, flexible editing, mixing; 24-bit sampling for additional headroom for 16-bit dynamics in finished product. Circle (1340)

Neve/AMS Industries 3400
AMS Logic 2: large format workstation with digital recording; total dynamic automation; stand-alone system. Circle (1341)
Mitsubishi X-8620E: master recorder; full use of X-86 20-bit databus with HBC-20 high-resolution converters. Circle (1342)
Mitsubishi X-880EX: multitrack digital audio recorder; 18-bit A/D converter for true 16-bit conversions, expanded dynamic range. Circle (1343)

New England Digital 11629
MultiArc (New Release): Macintosh interface software, includes enhanced ADR capabilities for CMS Autoconform package and for *EditView* and *TrasferMation* modules. Circle (1344)
Version 1.0: LucasArts' SoundDroid software. Circle (1345)
DSP option: for PostPro system. Circle (1346)

nVision 20157
NV1000 terminal equipment: 1020-00 full-duplex AES/EBU codec; *NV1021-00* AES/EBU digital DA; *NV1080-00* AES/EBU reference generator with video gen-lock; *NV1080-10* SDIF-2 reference generator with video gen-lock. Circle (1347)

Otari 2806
R-DAT series: *DTR-7* pro recorder; *DTR-90N* 4-head recorder; *CB149* editor, non-destructive preview editing; quick start memory card option for DTR-90N; *CTR-90T* includes time-code sychronizer card. Circle (1348)

Register Data Systems 2206
DigiCorder: digital audio storage, playback unit for spots, jungles, etcs. Circle (1349)

Roland Corporation 1700
Digital sampling: rate converter/mixer. Circle (1350)

Sonic Solutions 1706
SS-610 A/D-D/A converter: 1-bit stereo converter. Circle (1351)
SS-611 optical converter: bridge between coaxial and optical versions of AES/IEC audio. Circle (1352)
SS-117 Sonic Station: cost-effective digital audio production system. Circle (1353)
SN-100 Sonic Net: optical network to provide multichannel access to all Sonic resources. Circle (1354)

Sony Pro Audio 11711
24-track PCM/DASH: reduced-cost system. Circle (1355)
TCD-D10 PRO II: enhanced DAT recorder with absolute time recording feature. Circle (1356)
A/D-D/A converter: 20-bit system for audio. Circle (1357)

Stellavox/Digital Audio Tech. 4508
STELLAMODE: multistandard professional D/A converter; AES/EBU digital I/O, S/PDIF digital input; adjustable balanced analog output levels; digital domain absolute phase inversion. Circle (1358)

Studer ReVox 3406
D870 R-DAT: free-standing or integrated recorder; spooling to 400 times play; 64x oversampling; bitstream conversion with 8x oversampling; instant start feature; editing possible with shuttle wheel. Circle (1359)
DS-D series: digital modules for *Virtuoso* digital console; *DS M81* 8-to-1 preselector accommodates signals sampled from 28kHz to 54kHz; *DS DA* 1-to-8 dual DA; *DS-MC* master clock with *ARG* reference generator and *DS-D VS* clock generator referenced to video; from Digitec division. Circle (1360)
Dyaxis II: multichannel system with real time crossfading in all edit, record modes; digital mixing; signal processing; software upgrade for integration of Dyaxis with Studer 740 CD recorder, D870 R-DAT recorder; compatible with Macintosh System 7, Apple Quadra computers. Circle (1361)

Symbolics/Graphics Div 12956
S-MIDI: software for S graphics systems; interface for audio to que music, voice, sound effects with animation events. Circle (1362)

TASCAM 12951
ATS-500: synchronizer for TASCAM serial interface ATRs or parallel transports with *IF-500* serial-to-parallel interface. Circle (1363)

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ceiver; IFB and personal communications use. Circle (1402)

Crouse-Kimzey Company 5410
Ramsa WP-1200 monitor. Circle (1403)

Crown International 4818
PCC-170: multifunction supercardioid boundary microphone. Circle (1404)
LM-301, LM-3002: miniature dual gooseneck condenser microphones. Circle (1405)
SASS-P MkII: stereo ambience microphone. Circle (1406)

Electro-Voice 1214
635A/B, RE50/B: optional black finish for ENG/EFP mics. Circle (1407)

Henry Engineering 5500
Twinmic: 2-channel high-performance microphone pre-amp, mixer. Circle (1408)

JBL Professional 16236
Model 4206: 2-way 6-inch console-top studio monitor. Circle (1410)
Model 4208: 2-way 8-inch console-top studio monitor. Circle (1411)

Lectrosonics 15673
DR195: wideband VHF diversity receiver; features dual-band companding. Circle (1412)
T195: hand-held, wideband wireless microphone. Circle (1413)
UHF series: wideband UHF wireless mic systems. Circle (1414)

Lenco 12663
IEC-770: monitor amplifier. Circle (1415)

Nady Systems 2503
1200 VHF: wireless hand-held mic; permits various mic elements to be used; capsules available include Shure SM-58, EV NDYM-757, -357 and others; 120dB dynamic range. Circle (1416)

Neumann USA 18169
TLM-50: transformerless pressure microphone. Circle (1417)
KMS-150: hypercardioid vocalist mic. Circle (1418)
KMS-140: cardioid vocalist microphone. Circle (1419)
GFM-132: boundary layer microphone. Circle (1420)

Neve/AMS Industries 3400
AMS SoundField Mk V: stereo microphone; advanced B-format; coincident and M/S stereo modes. Circle (1421)

R-Columbia Products 13445
RL-100: wireless talent cue hearing aid-type headphone; no battery pack needed. Circle (1422)

Ramsa Audio/Panasonic 18019
WP-1000 series: audio power amp with class H circuit; balanced XLR, TRS phone jacks, 5-way binding posts; also WP-1200, WP-1400 models. Circle (1423)

RTS Systems 15860
V-100: lightweight professional headset. Circle (1424)

Russco Electronics N.A.
MA25, MA75: 25W and 75W audio amplifiers. Circle (1425)
HA10, HA20: headphone amplifiers. Circle (1426)

Sanken/Audio Intervisual Design 11603
COS-11 upgrade: lavalier microphone with ceramic casing; beige flesh tone color for improved camouflage; vertical diaphragm of polyphenylene sulfide; 3-layer windscreen. Circle (1427)

Sennheiser Electric 18169
HMD25 headset: combo headphone, mic unit; headphone earpieces reduce ambient noise by 20dB; pickup mic arm angled for optimum response to speaker's voice; supercardioid mic response reduces external pickup noise. Circle (1428)
HDC450 Mobile Noisegard: noise-canceling headset. Circle (1429)
EK2014: miniature UHF wireless receiver. Circle (1430)

SESCOM 16502
BOOK-1: audio interfacing. Circle (1431)

Shure Brothers 11901
VP64: dynamic omnidirectional hand-held microphone. Circle (1432)
SM99: miniature goosneck-mounted condenser microphone. Circle (1433)

Swintek Enterprises 13401
Mark 90L: diversity receiver. Circle (1434)
Mark 90C: wireless transmitter, converts hand-held mic to wireless. Circle (1435)
Mark 200D/ETS: wireless mic system with security scambling feature. Circle (1436)
Mark Q50: inductive transmitter, receiver for undercover operation. Circle (1437)

Telex Communications/Pro A-V 15860
FMR-100: wireless mic receiver. Circle (1294)
ELM series: miniature label mic. Circle (1438)

Vega Wireless 1214
AX-20: professional studio wireless mic system. Circle (1439)

Videotek 19919
APM-200: stereo audio program monitor. Circle (1442)

Wohler Technologies 20176
DAM-1: desktop audio monitor; stereo power amp for desktop video production; level meter, phase indicator; multiple input switching. Circle (1443)

A7: RPUs, telco hybrids

Broadcasters General Store 5426
Miltronics MCS: multiline coordinating system; cardframe holds 18 auto-coupling phone cards or combination with DAs; yes/no polling tally meter cards; 7-channel digital record/play unit. Circle (1444)

Telos Systems 1024
Telos ONE-plus-ONE: two digital hybrids in one rack enclosure; two operate independently or with mix-minus matrix, as part of multihybrid system; auto-configuring universal power supply. Circle (1445)
Telos 100 DELTA: digital telephone hybrid; full-duplex performance; dynamically controlled AGC and EQ use digital processing; feedback suppression circuit; mic and mic/line inputs; dual ouptuts. Circle (1446)

A8: Intercoms, IFBs

Clear-Com Intercoms 13706
PS-222: 2-channel portable power supply. Circle (1447)
MS-222: 2-channel main station with IFB; rack-mount. Circle (1448)
MTX-3: DTMF Inward Access crosspoint card for Matrix Plus system. Circle (1449)
IF4-B4: 4-channel, 3/4-wire camera interface. Circle (1450)
EFS-1: Enhanced Station Function software for Matrix Plus system. Circle (1451)
CS-222: 2-channel portable main station with IFB feature. Circle (1452)
PS-454: dual power supply; multifunction rack-mount unit. Circle (1453)

Gentner Communications 1712
PeopleLink System One: telephone/intercom system for broadcast, production facilities. Circle (1454)

IRT Electronics Pty Ltd. 17682
AA-332: digital intercom system; low-cost matrix with panels; simple to operate. Circle (1409)

RAM Broadcast 5114
32000C: professional communications system, 32-user; programmable for 8-character alphanumeric destination; separate talk, listen, IFB, mix-minus conferencing; console mount requires a 1.5" module width. Circle (1455)

RTS Systems 15860
IKP950PCS: production control stations. Circle (1456)
TIF 950 series: telephone interface. Circle (1457)
SSA 324: system-to-system interface. Circle (1458)
SAP612: source assignment panel. Circle (1459)

Studio Technologies 13407
IFB Plus Model 2: central controller for interrupted foldback with ENG, SNG, mobile production facilities; associated products include *model 22* access station and *model 32* talent amplifier. Circle (1460)

Systems Wireless 20136
Vega IFB: wireless system for talent cuing. Circle (1461)
HME intercom: UHF wireless system. Circle (1462)

Telex Communications/Pro A-V 15860
PL-2: 2-channel mini bodypack IFB receiver. Circle (1440)
RMT-10: wireless IFB transmitter. Circle (1441)

RF products

R1: Transmitters, antennas, towers, remote control

Acrodyne Industries 15712
TRH/1KS: solid-state VHF transmitter; 1kW output from four slide-out amplifiers using self-contained blowers, dedicated power supplies. Circle (1463)
TRU/30KV: single tetrode UHF transmitter; 30kW visual output with 10% aural from 50kW consumption; Thomson TH-563 tube; use in parallel for 60kW. Circle (1464)

Andrew Corporation 16646
VHF Panel: antenna for HDTV testing. Circle (1465)
AL-8 series: antennas for LPTV facilities. Circle (1466)

C.E.T./H.B. Centennial 15170
ADV-UHF, -VHF series: 15W, 125W UHF and 25W VHF transmitters. Circle (1467)

Cablewave Systems/RF Systems 1924
PAT 8-65: single-polarized, standard truncated design antenna; 6.875-7.125GHz range. Circle (1468)

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Comark Comm./Thomson-CSF 15733
110kW UHF: water-cooled UHF transmitter using two EEV IOT devices; active dual exciter system with Magic Tee combiner. Circle (1469)
High-power amplifier: for international applications; fully meets IEC-215 spec; EEV 40kW IOT device; compatible with klystron or Klystrode devices. Circle (1470)

CTE International 5424
VL/1000: 1kW solid-state FM amplifier; four modules of 250W each; extensive protection diagnostic features; 25-30W RF drive typical. Circle (1471)

Dielectric Communications 1708
UHF FLAGPOLE: low-power UHF TV antenna; designed as flagpole; ready for installation wherever a flagpole can be mounted; CP or HP; 1⅝" EIA input; internally pressure sealed; radome enclosed; patterns on file with FCC for quick application processing. Circle (1472)

Electronics Research 1020
Series 950 combiner: 30kW unit requires no assembly; suited for use with 1010 panel antenna. Circle (1473)
Series 1010: panel and directional antennas; medium power handles 9kW/level and 27kW/system; suitable for multiple Class A facilities or directional antenna. Circle (1474)

Energy-Onix 3604
SSTP line: portable FM transmitters, amps; 100W, 300W, 500W models. Circle (1475)
The Legend series: solid-state FM transmitters; ratings from 1kW to 10kW. Circle (1476)

GE Support/RCA Broadcast 1326
Field service: maintenance and parts support (35,000-line item inventory), technical assistance, manuals, training and 24-hour emergency services. Circle (1477)

Harris Allied Broadcast Eqpt. 2218
High-power DX series: digital solid-state, medium-wave transmitters; 300kW, 600kW, 750kW, 1MW models; *power block* design uses 100kW modules in parallel/redundant configurations; efficiencies 83-86%; size precludes exhibit of systems at NAB but literature, pictures available upon request. (Also see Harris outside) Circle (1478)
TVT Scepter Series: fully solid-state UHF transmitter; 5kW on display; series includes 3kW to 30kW; multiple 1kW modules operate in parallel to replace single points of failure. Circle (1479)

Jampro Antennas 3824
JLST: series of CP translator antennas. Circle (1480)
JLHP: series of HP translator antennas. Circle (1481)
JHD: low-band VHF dipole panel antennas. Circle (1482)
YAGI antennas. Circle (1483)
JUHD: broadband UHF panel antennas. Circle (1484)

Kintronic Laboratories 4824
HF feedthru panel: Circle (1485)
Switch: HF open wire transmission line device. Circle (1486)
Mating network: AM/MW matching system; rapid tuning capability. Circle (1487)
HF Balun. Circle (1488)
HF open-wire feedline. Circle (1489)

LDL Communications/Larcan 19258
TTS16M VHF: 16kW solid-state TV transmitter; available in low, high VHF bands; uses same exciter, PA modules as 30kW system. Circle (1490)

Micro Communications 19043
Model 44100: TV interdigital bandpass filters. Circle (1491)
Model 955000: HDTV all-band panel antennas. Circle (1492)
Model 61000: coaxial transfer switch; 7/8" EIA and 4 1/16" EIA specifications. Circle (1493)
Model 44200: FM interdigital bandpass filter. Circle (1494)
Model 965000: omnidirectional antenna designed by SIRA (Italy); 4-bay design handles four UHF 1kW transmitters; side- or top-mount; VSWR < 1.1 for 470-860MHz; batwing design. Circle (1495)

Nautel 4520
AMPFET FM4: 4kW FM broadcast transmitter; modular solid-state design. Circle (1496)
AMPFET FM10: 10kW solid-state, modular FM transmitter. Circle (1497)

Sira Sistemi Radio s.r.l. 19334
Superturnstile: full-band UHF antenna. Circle (1498)
FM combining filters: high-power systems. Circle (1499)
FMC-03: circularly polarized FM full-band transmitting panel antenna. Circle (1500)
3VTV-02, -04: VHF horizontally polarized full-band panels. Circle (1501)

TTC/Television Technology 15725
XLS-1000D: dual-input 1kW transmitter, translator; solid-state with automatic, manual input switching; operates as 2-input transmitter or translator; permits LPTV, translator programming flexibility. Circle (1502)

Will-Burt/TMD 16636
LPPT-100: antenna positioner; designed for telescoping mast mounting; 12VDC operation; low profile, rugged, but lightweight; electronic control with Az/El readout, auto stow. Circle (1503)
Mast-extension warning kit: produces signals when telescoping mast is not fully retracted. Circle (1504)

R2: Power devices, cavities

BEXT 4320
PJ 501, PJ 1002: solid-state amplifiers rated for 500W and 1kW; both use MOSFET devices; lightweight, low-power consumption; switching power supplies. Circle (1505)

Econco Broadcast Service 4624
Tube line: rebuilt tubes for new generation transmitters, 4CX3500A, 4CX7500A, 4CX1200A, 4CX20000A/B/C (8990), 4CX20000D. Circle (1506)

Keltec Florida 16641
TWT amplifier: 2.5kW X-band system. Circle (1507)

Richardson Electronics 12307
Amperex 3-500Z: power triode for AM transmitters. Circle (1508)
FM modules: from Microwave Modules and Devices; ratings for 50W, 300W and 700W. Circle (1509)

Varian Microwave Equipment 12451
VZC-6967, VZC-6965: 4kW, 2kW TWT HPAs; single-drawer for maximum power in minimum space; 4kW provided in 1:1 power cnmbined or 1:2 redundant rack-mount configurations; 7.5kVA input per 2kW output. Circle (1510)
GEN III Klystron: high-power amplifier for C-, Ku-band satellite use; 3.35kW and 2.2kW powers; microprocessor-controlled, improved reliability. Circle (1511)

R3: RF generators, exciters

Acrodyne Industries 15712
TRU/10X: UHF exciter; stereo/monaural inputs; SAW IF filter; video, IF correction; may be used as retrofit for high-power klystron transmitters without pulsers. Circle (1512)

Aphex Systems 1906
Model 400 Digicoder: FM stereo generator. Circle (1513)

Audio Animation 1624
paragon FM: FM generator option card. Circle (1514)

Circuit Research Labs 4208
Amigo: economy stereo FM-processing system with stereo generator feature. Circle (1515)

CTE International 5424
S/22 exciter: mono or stereo units; meets FCC, CCIR, CIRT specifications; 20W output from modular, redundant design. Circle (1516)
VL/30 exciter: 30W output meets FCC, CCIR specifications; optional programmability via RS-232 port to control transmitter from a remote PC. Circle (1517)

Delta Electronics 2826
ASE-2: low-cost, high-performance AM stereo exciter. Circle (1518)

Energy-Onix 3604
SST-25: 25W FM exciter; frequency agile, solid-state system. Circle (1519)

Inovonics 1418
DAVID: stereo audio processor; includes FM stereo generator. Circle (1520)

Moseley Associates 3424
Digital stereo generator: compatible with DSP 6000 STL system. Circle (1521)

R4: Demods, receivers, modulation monitors

Belar Electronics Lab 3920
AMMA-1 The Wizard: precision digital AM modulation analyzer; offers many measurements, new ways of looking at modulation and processing; full remote control with PC and Wizard software. Circle (1522)

Inovonics 1418
The Sentinel: all-mode broadcast monitor receiver/evaluator. Circle (1523)

Modulation Sciences 5118
PROceiver: PRO aural subcarrier receiver; for ENG, mobile operations anywhere in a TV station grade B signal contour; tunes any channel from 2 through 69; SAW filter avoids video interference; balanced audio and 2,400bs RS-232 data outputs. Circle (1524)

QEI 4518
691 VPTDO: variable peak duration test option for modulation monitor and 695 FM exciter; adjustable response time window from 0.1ms to 1ms; lights peak flasher when

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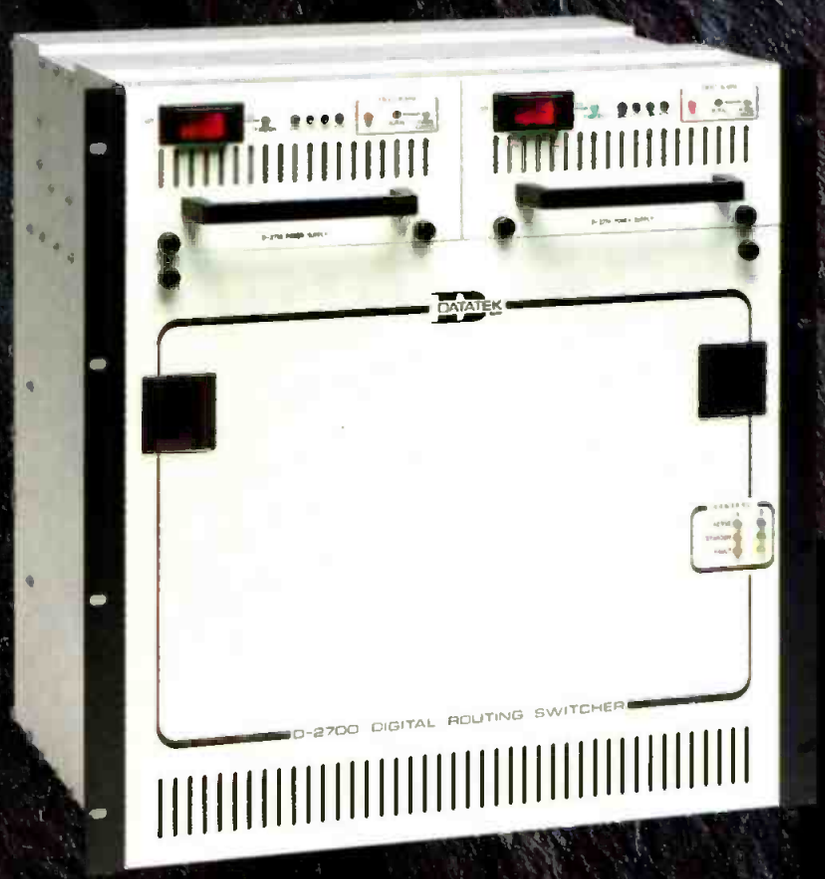

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peaks in 5ms period exceed a programmable threshold, 1-15 peaks. Circle (1525)

TFT Inc. 2508
E-Alert: desktop EBS receiver. Circle (1526)

R5: Terrestrial microwave STL, ITFS/MDS, ICR, ENG

C.E.T./H.B. Centennial 15170
ADV-MX8, ADV-MX12: 8-, 12-channel transmitters for MMDS, ITFS, OFS TV services; solid-state, GaAsFET technology. Circle (1527)

COMWAVE 12447
SB050B: 50W transmitter. Circle (1528)
SB4-10: 4-channel transmitter; 10W/channel. Circle (1529)
A1-S, SBB-M: signal booster. Circle (1530)

Conifer 16107
Mg-3300: lightweight, high-performance MMDS receiving antenna; stacked dipole feed assembly; powder-coated reflector. Circle (1531)
Mg-3308: receiving antenna; broadband block downconverter integrated into antenna feed; compact receive unit with improved aesthetics; 46dB gain with 4.5dB noise figure. Circle (1532)

Dolby Labs 4514
DP5500 STL: production models; 950MHz operation for two audio, two aux channels; 250kHz bandwidth; AC-2 coding, digital RF. Circle (1533)

Mark Antennas/Radiation Systems 11305
Truncated antenna: 8' category A performance with 6' tower windloading; frequency range 2GHz, 7GHz, 13Hz. Circle (1534)

Microwave Networks 10751
MVR-HPA: integrated high-power design based on MVR series. Circle (1535)

Moseley Associates 3424
FT1-3000: digital audio system for fractional T1 applications. Circle (1536)
CDQ 2000: digital audio equipment for video STL. Circle (1537)
PCL 6060 STL: for high RF level environments. Circle (1538)

N Systems 19301
MC5 controller: digital remote with PC/compatible 80286 CPU; operate as slave or master; VGA touchscreen monitor or LCD screen with push-buttons; menu-driven. Circle (1539)
Stiletto ST6, ST8: low windload microwave antenna; asymmetrical reflector and offset feed; performs as 6-, 8-foot parabolic unit with windloading reduced by 2-feet for each. Circle (1540)

NUCOMM 19601
Shadow antennas: designed for ENG van and central receive applications; single- or multiband models; single, dual or quad polarization; *Super-Shadow* for central receive sites. Circle (1541)
20PT3 series: 2.5GHz portable microwave transmitter; gen-locking SMPTE bar generator with self-contained sync source; 4W or 12W; 70MHz input; fiber-optic interface. Circle (1542)

RF Technology 16115
D series: portable microwave systems; RF-1302D 1.5W at 13GHz; RF-23V 23GHz high-performance short-haul video radio; RF-18V 18GHz video radio. Circle (1543)

TFT Inc. 2508
Model 9100S: frequency-synthesized STL with integral stereo generator; field programmable. Circle (1544)
IF interface: STL system. Circle (1545)
Model 9200/9205: monaural frequency-synthesized, field-programmable STL; VLSI design; 70dB SNR at ±22kHz FM deviation. Circle (1546)

Thomson Electron Tubes & Devices 11908
TH 3754 TWT: 2nd generation device for DBS transmission in 12.2-12.7GHz spectrum; >58% efficiency from 120W tube. Circle (1547)

Troll Technology 13901.
TS-1400i: rack-mounted multimaster, multisite touchscreen remote-control system; 14" color monitor. Circle (1548)
TS-250S: rack-mounted slave model remote system product. Circle (1549)

R6: Satellite electronics, antennas

Advent Communications 16233
Trailer-based: systems for all applications. Circle (1550)
Communications packages: flyaway systems with CDMS, TDMA, DAMA, PAMA techniques; flyaway remote control, redundancy systems; flyaway packaged test, monitoring equipment. Circle (1551)
Lynx-MA: SNG trucks for SNG, telephony, data and radio applications. Circle (1552)

Andrew Corporation 16646
Model 1.2M: suitcase antenna for satellite use. Circle (1553)
10M upgrades: package upgrades PBS satellite antenna systems. Circle (1554)
Model 9.3M: antenna for Intelsat "B" facilities. Circle (1555)

Comtech Antenna 12806
1.8m flyaway: portable, transmit-capable Ku-band antenna. Circle (1556)

Norsat International Inc. 17971
System 60 line: satellite-receive system; for private networks; universal power supply; agile transponder, subcarrier frequency and bandwidth adjustment; NTSC/PAL operation; menu-driven operation. Circle (1557)

Radiation Systems Inc. 11305
Model 240KVO: offset-feed SNG antenna system. Circle (1558)

Scientific Atlanta 13929
Model 7555 video exciter: converts audio-video signals to RF for uplink to satellite; sound-in-sync feature permits digital signal to be included in video sync pulse intervals; for data, high-quality audio, multiplexed stereo transmission simultaneous with traditional audio subcarriers. Circle (1559)
7530I International Video Receiver: converts RF to video and audio present at the uplink transmission; global receiver accommodates NTSC, PAL, SECAM and sound-in-sync transmissions. Circle (1560)
Model 8136: 3.6m earth station for various voice, data, video applications; meets C- or Ku-band standards; all-aluminum reflector of three pieces for ease in shipping and set up. Circle (1561)
2.4m antenna: towable mobile vehicle (SA244TMV); self-contained earth terminal; rapid deployment; simultaneous transmission, reception; voice, video, data signals from 19.2kb/s to 8.448Mb/s. Circle (1562)
Model 9708: integrated receiver and decoder; incorporates VQ vector quantization digital video compression; applicable for 525-/625-line, B-MAC. Circle (1563)

Standard Communication 19901
MT-900 Omni International: new generation receiver design; flexible, commercial grade; full compliance with international requirements. Circle (1564)

Support products

S1: Automation, software data transmission

American Broadcast Systems 12804
MicroCart 100: PC-based automation; system runs under MS Windows in multitasking environment; features spot/program playback with programmable record, net delay, traffic system interface and multichannel operation options. Circle (1565)

ASACA ShibaSoku 15746
VB16D2: serial digital interface. Circle (1566)

Audio Processing Technology 1302
ISDN multiplexer: for DSM100; high-quality, full-bandwidth audio transmission on single or multiple 56/64kbps data lines; RS-232 port for 9.6kbaud auxiliary data to be added to data-compressed bitstream. Circle (1567)

Audio Technica U.S. 11906
Model DT100: digital teleconferencing system. Circle (1568)

BASYS 18777
NetStation: networked PC newsroom system workstation. Circle (1569)
Archive II: full-featured text storage and retrieval system; fast response from RISC-based hardware. Circle (1570)
LKT interface: links LKT multichannel system to Sony LMS videocart playback equipment. Circle (1571)
D-Cart: digital audio editing, playback system; interface to newsroom system; hard disk storage; developed by Australian Broadcast Corporation. Circle (1572)
ALEXIS: PC-based election processing system with newsroom interface. Circle (1573)

Broadcasters General Store 5426
CRL event timer: produces timed relay closures for day-parting; operates with Audio Signature unit. Circle (1574)

Canon USA/Broadcast Optics 15719
CANOBEAM: laser beam video transmission system; 16 channels of video, 32 of audio; operates in infrared. Circle (1575)

Carpel Video 16527
ST-3: stopwatch with countdown feature; waterproof. Circle (1576)

CBSI Custom Business Systems 3908
Agency Management System: expanded, improved management of radio stations' business with agencies. Circle (1577)
CustomNet: consolidated traffic/billing system for multiple stations at a single location. Circle (1578)
CBSI Windows: adds multitasking capability to CBSI programs. Circle (1579)

Channelmatic 17430
ADCART Plus: full-featured random access ad insertion system. Circle (1580)

Circuit Research Labs 4208
Real Time Event Sequencer: 200-event

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timer, 8 control outputs. Circle (1581)

Columbine Systems 17019
Master Control Automation: PC-based system for any size TV facility; dual 80386 design automates airing of all scheduled events; returns as-run schedule to traffic for closed-loop reconciliation. Circle (1582)

Comprompter 17969
ENR V2.3 enhanced: full VGA color prompting features. Circle (1583)

Computer Concepts 4814
Editing option: for DCS automation system. Circle (1584)

Computer Engineering Associates 19336
CEA newsroom system enhancements: full-function, wire capture, assignments, scripting, prompting, inventory, personnel management, machine control interfacing; enhancements include spell checking, election reporting, media library management, improved Chinese language script editing, UNIX operating system. Circle (1238)

Corporate Computer Systems 5108
CDQ-2000: 20kHz stereo MUSICAM codec. Circle (1585)

Di-Tech 13107
Model 5880: expandable 128x160 stereo AFV routing switcher; requires 40 rack units of space. Circle (1586)

Dynatech NewStar 18046
NewStar I EDSI drive assembly. Circle (1587)
News Spell Program. Circle (1588)
NewStar II: Version 2.0 software release. Circle (1589)

EDX Engineering 1321
POP-90: PC software for demographic analysis inside station coverage areas based on 1990 census data. Circle (1590)

Fiber Options 17684
Series 190V: sync transmission system; maintains sync levels and phase timing over long cables; eliminates EMI, RFI interference. Circle (1591)

FloriCal Systems 11315
AirBoss: on-air TV automation; unattended operation; detects local breaks by signal analysis of network feed; automatically cues program tapes to beginning of program segments; machine, switcher control; accepts traffic schedule and ShowTimer cue times automatically. Circle (1592)

GTE Spacenet 16976
European SNG: program information uplinked by Deutsche Bundespost Telekom (Germany) from news sites provided the GTE downlink and network. Circle (1594)

Hallikainen & Friends 2224
DRC200: programmable multisite transmitter remote-control systems. Circle (1595)

Image Video 11307
Automation system: for radio or TV applications. Circle (1596)

Intraplex 5206
T1 Smart Mux: for terrestrial, satellite transmission; *TDM-163* multiplexer, *TDM-165* drop/insert terminals. Circle (1597)

J.N.S. Electronics 1418
D-MUX: 16-bit linear digital audio program multiplexing system; support for T1, ISDN, digital STLs. Circle (1598)
LM.8121: LED level meter module; for *8000* rack frame use. Circle (1599)

JEM-FAB 20168
DS-422, SD-422: digital serializer and deserializer. Circle (1600)

Keystone Communications 11933
Transmission service: trans-Pacific service between KDD, Japan and Keystone, Salt Lake. Circle (1601)

Leightronix 20111
LGX-DUB: PC-based duplication control software. Circle (1602)
PRO-16: programmable videotape playback, record controller and switcher. Circle (1603)
C-VOICE: telephone remote video equipment controller. Circle (1604)
TCD-PC: single-channel commercial insertion controller; PC-based, with VHS/S-VHS equipment. Circle (1605)
LGX-PLAYER: videocassette playback control and switching system. Circle (1606)
LGX-REQUEST: classroom videotape controller and distributor system. Circle (1607)

Leitch Video 19924
ADC-5100 series: analog digital clock series Circle (1608)
DAC-5012-24: 24-hour digital analog clock. Circle (1609)
UDT-5701: up-down timer; rack-mounted unit. Circle (1610)

Louth Systems 13350
ADC-10: automation for low-end and cable markets. Circle (1611)
ADC-100: advanced automation system. Circle (1612)

Matco Mfg. & Test 16379
MA-204A: automated playback system; 22x3 stereo audio-follow-video router; loss of video protection: random, sequential event list scans; programmable list per channel; parallel, serial, IR VTR control; 24 control outputs for VTRs, other devices; battery-backed clock, calendar, list memory. Circle (1613)

NewsMaker Systems 16678
Newsroom automation subsystems: Closed-caption encoder, driver; Abekas character generator interface; MS-DOS/Windows 3.0 environment; mouse, touchscreen interface. Circle (1614)

Odetics 18734
ASI: new station automation interface. Circle (2251)
CW 5500/P: cart workstation; permits recording and playback of compiled tapes. Circle (2252)

Pro-Bel Ltd. N.A.
Model 5150: 8x1 AES digital audio switch. Circle (1615)
System 3: router control system. Circle (1616)
5120/21, 5230/31: 20-bit stereo A/D, D/A converters. Circle (1617)
5017/9: 12x4 AES mixer. Circle (1618)

Radio Computing Services 1426
No. 1000 Tracker: digital audio logging to DAT tapes with concurrent playback capability. Circle (1619)
Linker: integrates commercial and music logs on paper or for transfer to a radio automation system. Circle (1620)

Radio Systems 4826
RS Master Clock: analog system with drivers, slaves; designed for broadcast facilities. Circle (1621)

Register Data Systems 2206
R-DAS Register-Digital Automation System: using digital audio with satellite formats or other music sources for radio. Circle (1622)

ScheduALL by VizuAll 10753
Ver 3.20: includes enhanced library system, bidding module and project manager feature. Circle (1623)

Shure Brothers 11901
GR3000: interactive audiographic teleconferencing system; multimedia shares audio, computer graphics on telco lines with digital transmissions. Circle (1624)

Sigma Electronics 18816
ATM-2100, ATB-21: adjustable timing system. Circle (1625)

Sony Communications/Broadcast 11711
LMS/Automation systems. Circle (1626)
FlexiCart: new concept in multicassette machines. Circle (1627)

T.E. Products 20169
AD-V4/4: commercial insertion system. Circle (1628)
TC-801: commercial compiling system. Circle (1629)
MM-16: multimedia learning system. Circle (1630)

Time Logic, Inc. N.A.
APDU-200/E Ver. 5: enhanced software features. Circle (1632)
AIR-WAVE: low-cost radio station automation systems. Circle (1633)

TimeLine 4402
MicroLynx: low-cost machine control; synchronizes audio, video transports and MIDI; incorporates SMPTE, MIDI TC generators, two synchronizer/resolvers, MIDI-to-SMPTE synchronizer; Macintosh interface; VITC, other options. Circle (1634)

TM Century 21 Programming 2525
UDS-92: digital studio computer-controlled juke boxes by Pioneer; 300 CDs, 2 players; spots from DigiCart hard disk; digital audio technology; interfaces to traffic, billing software. Circle (1635)

Toko America 16970
TCD-1000: portable video codec for multimedia teleconferencing systems. Circle (1636)
VAST-P: video, audio storage and transmission system. Circle (1637)

Torpey Controls & Engineering 13413
VLCS-2: triple video alarm and switch. Circle (1638)
STW-5R: rack-mounted digital timer. Circle (1639)
CLK-111: digital time display, operating from ESE, SMPTE, DQS-6 code. Circle (1640)

Video Communications 17973
The Report Generator: software for report generation from Programming System database; multiple sort levels; labels, letters, interface to spreadsheets, computations on database fields. Circle (1641)
Programming System: software to manage movie library, syndicated programs and specials. Circle (1642)

Vortex Communications 13101
P-Timer: production timer; countdown with

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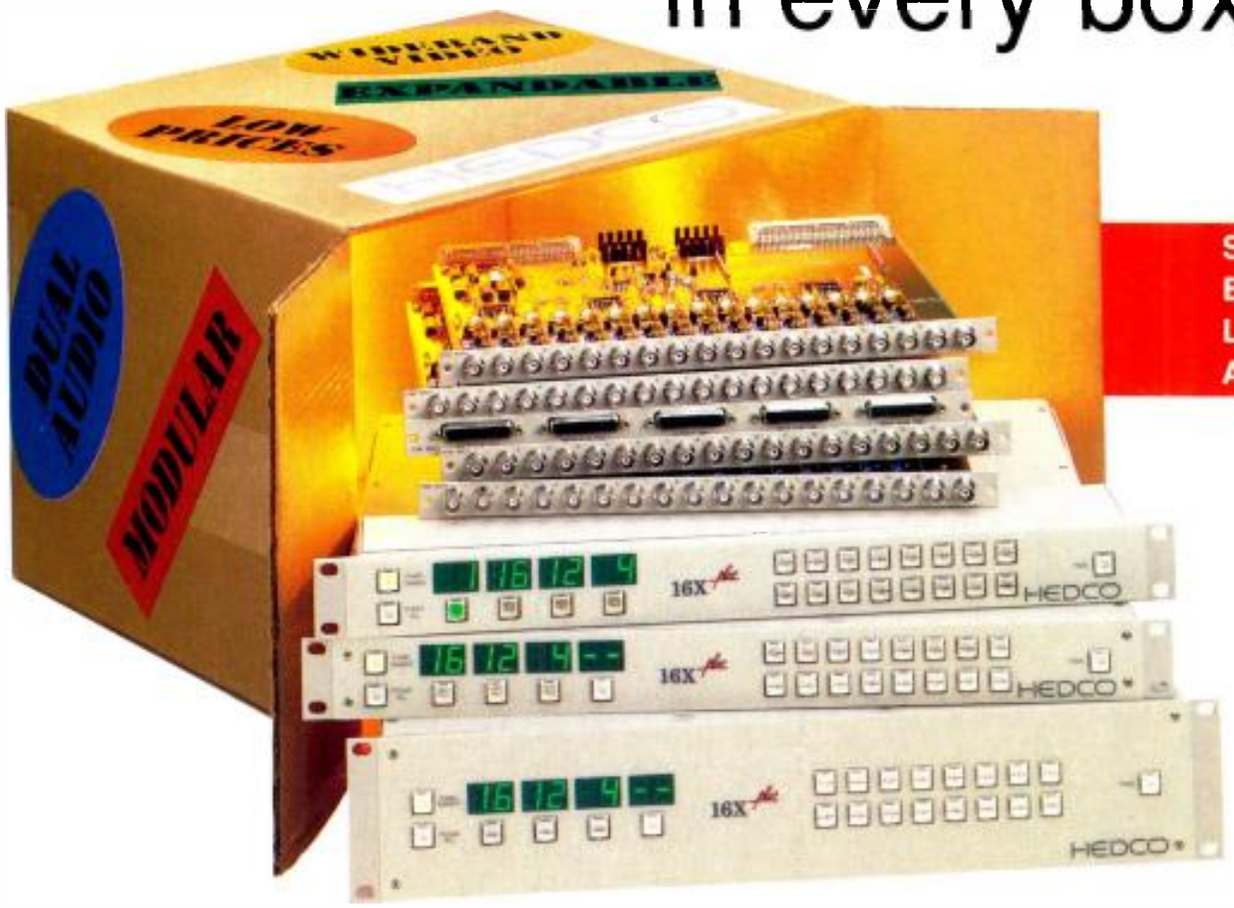

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Circle (77) on Reply Card

time-code comparator. Circle (1643)
482-XR: master clock system; added features as standard. Circle (1644)

S2: Signal distribution & routing equipment

Alpha Image 18046
A232: compact low-cost serial digital router. Circle (1645)
A2128: digital serial router with 128x128 array. Circle (1646)

Avitel Electronics 11058
VDA 3320: serial digital VDA. Circle (1647)
ERF3300: enhanced communication frame. Circle (1648)
VDA 3214: component analog video DA. Circle (1649)
VDF 1026: serial digital video patch panel. Circle (1650)

Broadcast Video Systems/BVS 16742
XY-400: 4x1 video switching matrix; compatible with GVG, Leitch Video DA frames; for composite or component video expandable to 4x4, 8x2 with 3 or 4 layers; remote control with single coax. Circle (1652)

BTS Broadcast Television Systems 18001
400 series: serial digital distribution and signal-conversion products; DAs, format conversions. Circle (1653)
Stand-alone: 24x8 matrix small router; input expandable. Circle (1654)
Venus: routing switcher; compact package with intermixing of different audio and video formats in one frame; medium to large matrices. Circle (1655)

Covid 18700
#650: 30MHz, S-Video, Y-C switch for S-VHS, Hi8, others; 4-pin DIN connectors; wired remote of 8-input system with roll-free VBI switching. Circle (2253)
 # 651: 30MHz, 8-input, composite video switcher with BNC connectors; wired remote; roll-free VBI switching. Circle (2254)
Indicator option: for 650/651; shows selected channel, flashes if video not present. Circle (2255)
 # 913, #915: 200MHz RGB DA; 13W3 or BNC I/O connectors; for HR video from computer workstations; 4-, 8-output; each output has individual EQ control. Circle (2256)

Datatek 13914
D-2535: wideband video routing switcher; 20x10 to 20x20 array; 100MHz bandwidth. Circle (1656)
D-2530: serial digital video routing switcher with 20x10 to 40x40 matrix. Circle (1657)
D-2700: serial digital video routing switcher; 64x64 to 256x256 arrays. Circle (1658)

DYNAIR Electronics 16706
MiniStar control panel: preview option for MiniStar; enables signal preview before take, for error-free switching; applicable to all DYNAIR routers. Circle (1659)
Line Distributor: increases Dynasty router communications line flexibility for multiple home run control line applications; in 1x8 fiber or 1x20 coaxial models. Circle (1660)
MP9230 system control: upgrade; enhanced graphic display, compact design; logical windows-style operator interface; 8-level control, disk storage. Circle (1661)
Series 400: fiber links for video includes stereo audio; carries signals to 15km (9.3mi); RS-250C short-haul video link to 10km; *Series 400 Video* permits 5Vp-p I/O amplitudes for special analog applications. Circle (1662)

ESE 13701
ES-233: digital fade-to-black video interface. Circle (1663)
ES-236: 1x4 digital audio DA. Circle (1664)
ES-219: 4-output RS-170A blackburst generator; PAL options. Circle (1665)
ES-237: 1x4 120MHz video DA. Circle (1666)

Image Video 11307
Control panels: complete array of user interfaces for routing switchers. Circle (1667)
ADA-2000: audio distribution amplifier module. Circle (1668)
VDA-3000: video distribution amplifier module. Circle (1669)
RDU-1000: remote display unit; single display of 30 characters, dual display with 14; red, green or amber for each character. Circle (1670)

Inline 16371
PATHFINDER: matrix switchers to 16 channels; for 120MHz video and audio routing; may be reconfigured. Circle (1671)
IN1222: scan doubler; 4-in, 1-out audio-follow-video switcher; gamma correction, freeze frame, hue, color, contrast adjustments; volume control. Circle (1672)

J.N.S. Electronics 1418
RFM.8180: receiver module for *8000* rack frame installation. Circle (1673)

Leitch Video 19924
LCP-16x1: local control panel for router; 16 push-buttons. Circle (1674)
VSE-6800: auto-switching serial distribution amp; eight reclocked outputs, automatic cable EQ to 1,000 feet lengths; for D-1, D-2 signals. Circle (1675)
VSM-8X Plus: video switching module; 8x8 matrix; 100MHz bandwidth. Circle (1676)
ADA-885: audio distribution amplifier. Circle (1677)
HEDLINE audio series: distribution *ADA-300*, *ADA-308* and stereo *ADA-301* amplifier modules; *ATG-300* tone generator. Circle (1678)
ASM-8X Plus: stereo audio switching module; 8x8 matrix. Circle (1679)
RCP-32x1: remote-control panel for 16X or 16X Plus series routers. Circle (1680)
UDA-680: utility distribution amplifier. Circle (1681)
VDA-681: video distribution amplifier. Circle (1682)
PDA-308: HEDLINE pulse distribution amp. Circle (1683)
HEDLINE video series: distribution *VDA-301*, equalizing *VEA-302*, clamp *VCA-304* and switchable delay *SVD-307* modules. Circle (1684)

Lenco 12663
#3550: 8-output video DA. Circle (1685)
IEC-740: audio DA. Circle (1686)
No. 6550: stereo audio DA. Circle (1687)
IEC-752: equalizing and clamp video DA. Circle (1688)

Multidyne Electronics 12908
AD-8550: audio adapter converts GVG8550 audio DA tray to XLR connectors; terminal, ribbon cable adapters. Circle (1689)
VDA-100: field video DA; 4,000 foot cable EQ; GVG compatible. Circle (1690)
VDA-101: video DA; card fully compatible with GVG systems; AC/DC operation; sampling clamp; 1-in, 6-out. Circle (1691)
VEQ-200: portable equalizing video DA; dual 8,000 foot EQ; AC/DC powered. Circle (1692)

Omicron Video 13441
Model 887: HDTV distribution amplifier. Circle (1693)

OpAmp Labs 18180
TCB-10K: dual 10k:10k audio transformer in enclosure. Circle (1694)
RSP-4S: stereo audio-video 4-in, 1-out routing switcher. Circle (1695)
VA-8, VA-32: 1x8 and 1x32 mic/line video-audio press boxes. Circle (1696)
A4/2L: 2-channel 1-in, 4-out audio DA. Circle (1697)
A24-2ML: 2-input, 24-output audio press box; 50Hz-15kHz range at -2dB; XLR, phone jack, RCA and 3.5mm jack; 18dBm output; inputs are balanced and switchable to 10kΩ. Circle (1698)
MS/8x8/VSA: 8x8 stereo audio-video matrix switcher. Circle (1699)
TCB-10K: dual 10k:10k audio transformer in enclosure. Circle (1700)

OptoDigital Design 20012
Fiber Power Cable: combines mains power and FO data conductors in single cable for ease of setup. Circle (1701)
RDN system: Rapid Deployment News ENG system, uses single FO cable van-to-site interconnection. Circle (1702)
LSV-801: FO connectivity system meeting CCIR-801 HDTV specs. Circle (1703)
LSV-601: digital video FO link compliant with CCIR-601, 4:2:2 specs. Circle (1704)
LSV-RGB: routing, switching features in digital RGB FO connectivity system. Circle (1705)
LSV-1: digital composite video FO connectivity system; routing, switching. Circle (1706)
LSA-12: 2nd generation, multichannel digital FO audio link; remote control, intercom, routing, switching; for studio and OB vans. Circle (1707)
Fiber-Optic Extension: additional lengths with fool-proof interconnects. Circle (1708)

PESA Switching Systems 19306
RM4000: 100MHz bandwidth routing switcher; 6600 EX self-contained controller board. Circle (1709)

Russco Electronics N.A.
DA 2816: audio distribution amplifiers. Circle (1710)

Sierra Video Systems 10742
Model 32V/A: 32x1 video and audio router. Circle (1711)
Model 20: 20x10, 20x20 video and audio routers. Circle (1712)
Control program: DOS software control for all SVS routing switchers. Circle (1713)
Model Sixteen-Sixteen: 16x16 router for video and audio. Circle (1714)

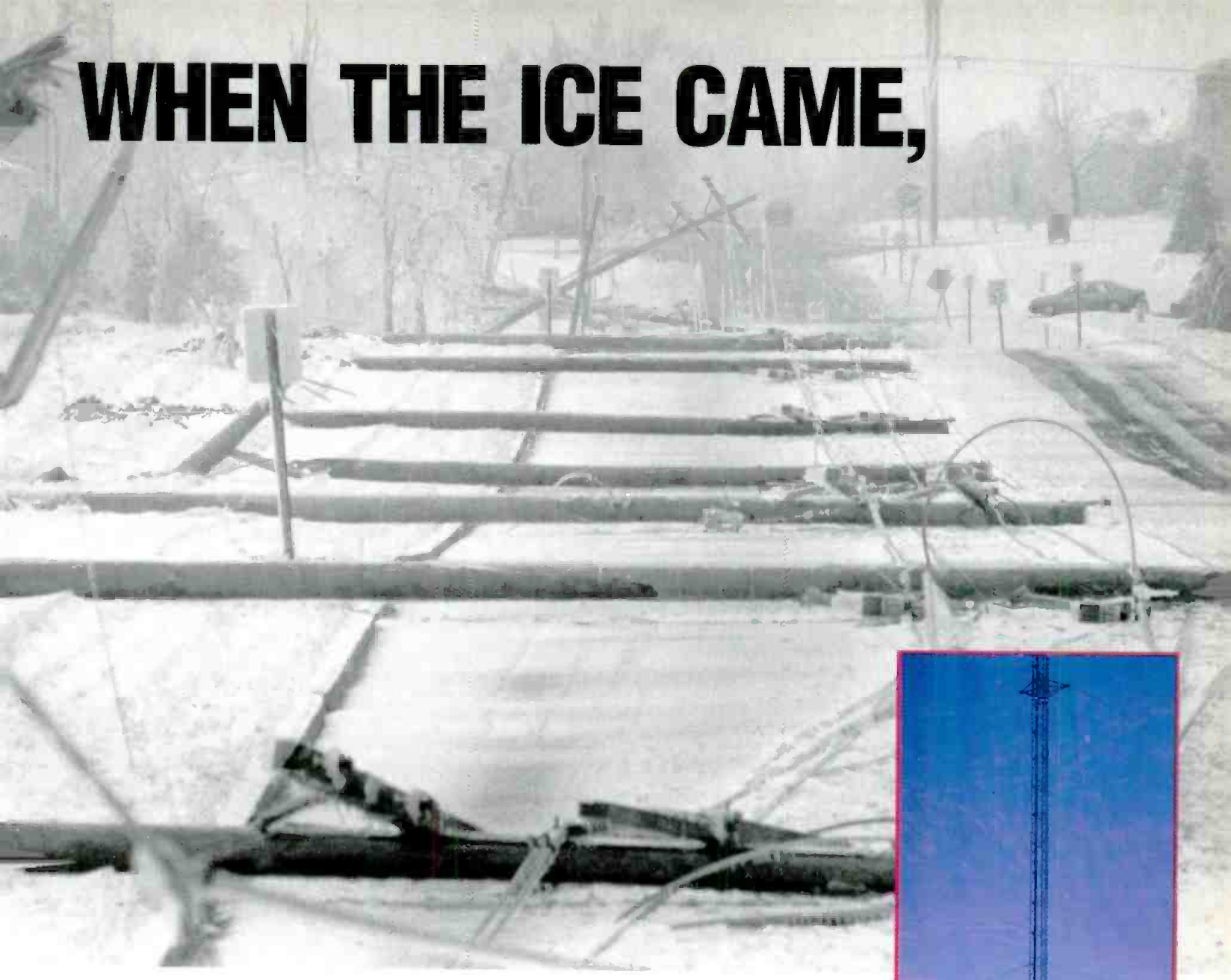
Sigma Electronics 18816
VDA-21: stand-alone VDA. Circle (1715)

Thomson Video Equipement 15733
TTV 5790, 5791, 5775: serial digital routing switchers. Circle (1716)
TTV 7400 DIGIPHASE: serial digital signal phasing device. Circle (1717)

Utah Scientific 18046
Enhancements, upgrades: for existing switcher lines. Circle (1718)

Video Accessory 16639
VDA-HN: 6-output wideband video distribution amp; hum null adjustment. Circle (1719)
VB/VDA: 4-output VDA; ultracompact design; 100MHz bandwidth. Circle (1720)

WHEN THE ICE CAME,



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Circle (78) on Reply Card

Vistek Electronics 18883
V2000 series: Array router control system: additions to series include multiple controller interface for direct control from GVG Kaleidoscope; video display of router status; tally interface, undermonitor displays for routing indications. Circle (1721)

S3: Test, measurement

Altronic Research 11129
Air-cooled loads: expanded line. Circle (1722)

Amher Electro Design 4806
Amber 7000: analog, digital audio generator, analyzer; integral 386/40MHz computer; Windows-based GUI; digital signal processing with FFT analysis; AES/EBU generator analysis; offers two simultaneous measurement channels. Circle (1723)

Audio Precision 3900
Portable One Plus: audio system test set; portable package includes sweeps and graphs. Circle (1724)

AVCOM of VA 12903
NASA 1000A: integrated network, spectrum analyzer; provides signal from 1MHz to 1GHz; for sweeping line duplexers, other microwave components. Circle (1725)
MSG 1000A: microwave sweep generator; covers 100kHz-1GHz range for testing of microwave components, systems. Circle (1726)

Beck Associates 10949
Semi-custom consoles: welded tubular steel frames, hardwood trim, custom countertop configurations. Circle (1727)

Canare Cable/Cables & Connectors 11121
BCJ-XJ-TR, BCJ-XP-TR: impedance transformer for AES/EBU digital audio lines; 110Ω XLA female and male to 75Ω BNC receptacle connections. Circle (1728)
The Stripper: 15-second quick coax cable strippers; *TS-4C* for LV-61s, RG-59B/U; *TS-5C* for LV-77S, No. 8281. Circle (1729)

Consultronics Limited N.A.
AQC Audio Quick Check: performs a complete stereo program channel test routine in less than 5s. Circle (1730)

Control Concept 16641
LF, LCG series: surge and power protection systems. Circle (1731)

Gennum/Video Broadcast 18278
GT4123: 2-input video mixer IC. Circle (1732)
GT4124: 2-input video mixer with overall DC restore feature. Circle (1733)
GS9000: serial digital video IC family meeting SMPTE/EBU specifications. Circle (1734)
GB4551: video buffer IC with precision backporch clamp. Circle (1735)
GB4600: unity gain video buffer IC. Circle (1736)
GB4550: video buffer IC with sync tip clamp. Circle (1737)

Guicar Television 18480
Videorecorder Video Test: 30-minute videocassette for checking TV/monitor and videotape equipment. Circle (1738)

Hamlet Video International 16406
HVI 502 Stereo Scope: dual stereo input device for on-screen, in-picture displays; left/right, sum/difference as VU or PPM and polar plot showing information not available in a linear plot; operates in NTSC, PAL composite, component YUV/RGB. Circle (1739)
HVI 301: budget videoscope; 4-input, on-screen, in-picture single or combined waveform, vector displays; operates in composite with SC/H phase monitoring; compatible with component YUV, RGB, S-VHS, PAL, NTSC with stereo audio as polar display; remote options. Circle (1740)
HVI 303: precision composite multistandard videoscope; in-picture waveform, vector displays; high accuracy measurement of timing, phase, SC/H; full-field line select with cursors, readaouts; chop mode; 3-H combined 3-input display or filter parade. Circle (1741)
HVI 401: fully digital video scope; component, composite displays in standard format with digital output; data transfer information; does not require A/D-D/A conversion to monitor outputs from digital systems. Circle (1742)
HVI 608: out-of-gamut indicator. Circle (1743)
HVI 304: precision multistandard videoscope; component, composite waveform, vector displays on standard monitor; all features of HVI303 composite unit with component mode. Bow tie, overlay, parade, individual Y/U/V, component vectors. Circle (1744)
MatchCam: camera alignment system; used in conjunction with video scope units to speed camera alignment duties; data

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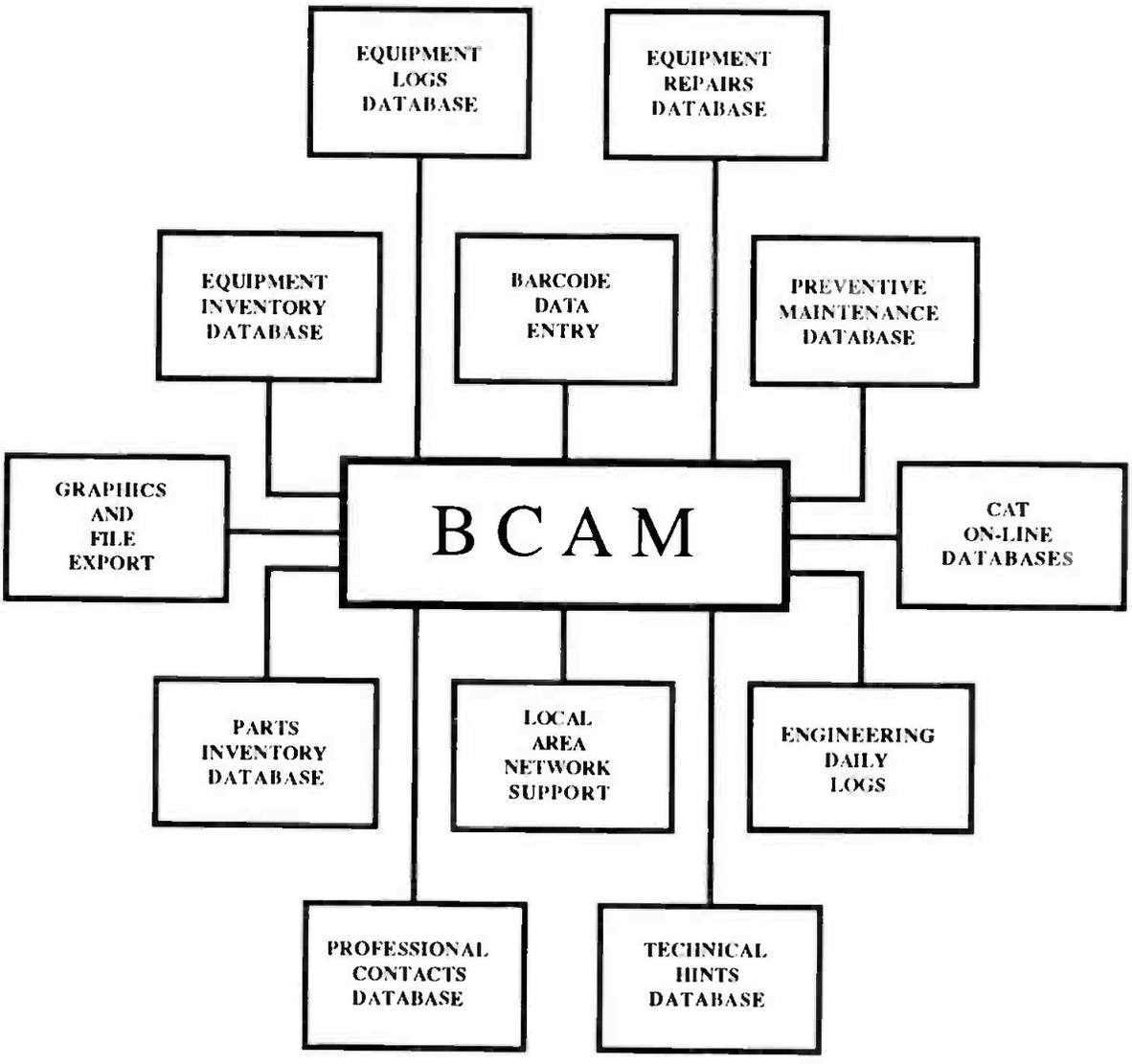
Version 2.0

SEE IT AT BOOTH 13705



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Circle (85) on Reply Card

transfer facilities available if used with computer software for measurement and maintenance guidance. Circle (1745)

Jensen Tools 13426
Fluke Model 97 scopemeter. Circle (1747)

Leader Instruments 11701
951: auto-ranging RF level meter; covers broadcast and cable channels. Circle (1748)
1605: RGB video generator; dot-clock operates at 300MHz maximum. Circle (1749)
5835: stereo amplitude and phase monitor. Circle (1750)
5860D: digital/composite video waveform monitor. Circle (1751)
3221: 2.7GHz synthesized RF signal generator. Circle (1752)
326 oscilloscope: 100MHz, dual-channel unit with alternate time base; attaché size. Circle (1753)

Leitch Video 19924
TSG-1302N: NTSC/D-2 test signal generator. Circle (1754)

Lenco 12663
No. 3690: multiburst and sweep generator. Circle (1755)

Lightning Master Corp. 11062
TVSS line: transient voltage surge suppression for power, telco, data lines. Circle (1756)

Logitek 4820
Bright-VU LED: audio level meter, redesigned with larger display range, peak-hold indicator; desktop, rack-mount, panel meter models. Circle (1757)

Magni Systems 19246
MM-W/V: Magni Monitor waveform/vector version. Circle (1758)

Minolta 11705
CC-100: CRT convergence meter; provides numerical measurement of CRT phosphor convergence. Circle (1759)
CM-2002: hand-held spectrophotomer; battery operation; 8 viewing angle with diffuse illumination. Circle (1897)

Multidyne Electronics 12908
TS-4: SMPTE color bar generator with black-burst; gen-lock, video ID and spoken ID features. Circle (1760)
TS-12: hand-held test set with 12 video test signals; character ID, stereo tone source. Circle (1761)

Philips TV Test Equipment A/S 16523
PM 5639: color analyzer. Circle (1762)
PM5635: HDTV sync generator with pattern generator. Circle (1763)
PM 5644: Indian Head test pattern generator. Circle (1764)
PM 5636: 4:2:2 test signal generator. Circle (1765)
PM 5639: color analyzer. Circle (1766)

Rohde & Schwarz 13918
VNA video noise meter: for all TV standards; also for 1,050-, 1,125-, 1,250-line HDTV, CCVS, analog component 525-/625-line systems and several non-broadcast standards. Circle (1767)
SAF generator: multistandard video source for CCVS signals; PAL, NTSC 525-/625-line, analog component and digital component signals. Circle (1768)

Tektronix 18032
VM 700A Option 21: package for video test system adds automated camera measurement; CCD defects, fixed-pattern noise, color imagery, frequency response functions. Circle (1769)
Service agreement: extended service option; extends product support to five years, commencing immediately after standard warranty expires. Circle (1770)

Television Equipment Associates 13411
Boxed delay lines: low-cost units ideal for Video Toaster applications. Circle (1771)
Racked delays: high commercial specifications; to 7µs. Circle (1772)
Extended bandwidth: delay for signals to 11MHz. Circle (1773)
D2-NTSC: video filters for various applications. Circle (1774)
Racked filter system: fits in same rack as new delay line series; solves studio filtering problems. Circle (1775)

Tentel 12808
New gauges: designed for maintenance of D-3, D-2, Hi8, Betacam, MII and U-matic transports. Circle (1776)

Union Connector 17676
DistroBox: complete range of portable power distribution boxes; four sizes from 2-circuit 100A to 3φ 48-breaker power center; carrying handles adapt with C-clamp for pipe mounting; shippable by UPS. Circle (1777)

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VEAM 16676
B-LOK: 400A 5-pole sequential power distribution system. Circle (1778)
CIR-GRH: 60A and 100A 5-pole power distribution connectors. Circle (1779)

Videoquip Research 4900
VU, PPM meter. Circle (1780)
BG-2 generator. Circle (1781)
Silence detector. Circle (1782)

Videotek 19919
TVM-730: composite video analyzer; *AutoMeasure* feature. Circle (1783)

Wohler Technologies 20176
TDM-1: time delay meter module; MSM series product; displays delay or phase shift for a given frequency between two audio channels of stereo pair; two delay range selections. Circle (1784)

S4: Cases, equipment racks, storage systems

Calzone Case 17567
Studio series: rack cases; full protection of 8 or 12 rack spaces of equipment; upper rails slanted; all rack rails of tapped steel. Circle (1785)
Introduction: corrugated plastic, synthetic material for variety of equipment cases. Circle (1786)

K&H Products 16466
AR-D10: audio recorder case for Sony TCD-D10. Circle (1787)
AO-2 audio organizer: all-purpose audio production case. Circle (1788)
FC1 filter case: for 4" square and 4½Æ round optical filters. Circle (1789)
RS 537/5 rain slicker: for Sony DXC-537 with BVV5. Circle (1790)
AR-222: audio recorder case; accommodates Marantz PMD-222, -201, -021, -430 and other models. Circle (1791)
CAR-2 cargo case: general-purpose production case. Circle (1792)

Nalpak Video Sales 20015
TK-400T Travel Kart Plus: 300 pound capacity; foldout rear wheels; soft bicycle grips on T-type handle. Circle (1793)
Magline Kart enhancements: *Quick mount* shelf support brackets, with Allen Wrench included; *Mag-Bag* of Dupont cordura-plus, slips over hand grips of Magline Jr., includes numerous pockets for small items. Circle (1794)

Peerless Sales 18576
CVM 010: mount for VCR; attaches to TV/monitor cabinet for compact combination mount. Circle (1795)

Star Case 11113
Revised CRG: Custom Regerence Guide to custom case design; new literature, training aids for dealers and end-users. Circle (1796)
The Exhibitor: convertible shipping container, organizer, table set; efficient, expeditious for trade show use. Circle (1797)
Enhancements: to entire Star Case line. Circle (1798)

Storeel 17424
SM/D3: double-entry system for maximum storage of D-3 media. Circle (1799)
RS/D2: high-impact styrene storage units for D-2 media. Circle (1800)

S5: Furniture, acoustic materials

Acoustical Solutions/Alpha Audio 12901
Alphasorb: Fiberglas panel. Circle (1801)
Sound Barrier: materials by Audio Seal. Circle (1802)
Acoustical forms: Alpha Pyramid and Sonex products. Circle (1803)
Soundtex: acoustical fabric. Circle (1804)
Audio Seal: acoustical blankets. Circle (1805)

AMCO Engineering 16412
Instant AMCO: quick-ship enclosure program. Circle (1806)
Monitoring consoles: single, multibay styles for broadcast, security ccenter; standard accessories; low silhouette pedestal bases, sloped front, vertical frames; standard, custom colors. Circle (1807)

Atlas/Soundolier 11055
Series V equipment: revised line of racks, cabinets, pedestal desks; various heights, widths and depths; 14-ga MIG-welded steel; 11-ga corner caster gussets; 14-ga mounting rails. Circle (1808)

Bretford Manufacturing 18276
TVCY35T-BK: ceiling yoke TV mount; for monitors to 35". Circle (1809)
TVWY20BK: wall/yoke TV mount for 20" monitor. Circle (1810)
TVMP, TVUM: ceiling/wall plate and mounting brackets for TV mounts. Circle (1811)
TVPW27R-BK: platform/wall TV mount with VCR bracket. Circle (1813)

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Model 5870 Vector/Waveform/SCH Monitor

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- Digital SCH Readout • R-Y for DG/DP Measurements
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- Universal Power Supply with DC Operation Standard

Model 411 Precision Sync/Test Generator

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Circle (111) on reply card
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For product information and demonstration

illbruck/SONEX 1657
SONEX: ceiling tiles and materials in painted colors. Circle (1814)
ProSPEC: pyramid acoustical foam and new composite barriers. Circle (1815)

Industrial Acoustic/IAC 5126
STC 49 door: acoustical door; *Noise-Lock* design. Circle (1816)

RTS Systems 15860
Model 2550: quad galvanic isolated buffer amplifiers. Circle (1817)

VGS California 10549
Perfect Editors Chair: provides Quadracontrol with correct back support in any work position. Circle (1818)
Worklighting: low-voltage diffused lighting for A/V applications; fits on/under worktop or shelf. Circle (1819)

Zero Stantron 16401
Enclosure options: modular, wood trim, all steel cabinets; 22 colors available; pre-assembled; free tapped rails. Circle (1820)
Pre-assembled racks, consoles. Circle (1821)

S6: Cable, fiber, connectors

ADC Telecommunications 19652
FN series: multichannel broadcast-quality video fiber transmitter. Circle (1822)
LC series: single-channel broadcast-quality video fiber transmitter. Circle (1823)

Canare Cable 11121
BCP-C51: 75ΩBNC crimp plug for No. 8281 cable. Circle (1824)
241U-VJ22W-C: video patchbay; 24 dual video 75Ω jacks; also baseband audio to serial digital; 1 RU height. Circle (1825)
V*-5C: 75Ω mult cable; 3-, 4-, 5-channel; LV-77 (#8281) type low-loss. Circle (1826)

Clark Wire & Cable 11763
590 series: low-loss RGB cables with 3, 4, 5 conductors. Circle (1827)
TV7559 SuperFlex: TG-59 style cable; triax, stranded center conductor; five colors available. Circle (1828)
700 series: audio snakes; color-coded and numbered conductors. Circle (1829)
Composite cables: for remotes; three video, four audio circuits; options with or without power cable. Circle (1830)
690 series: subminiature RGB cables with 3, 4, 5 conductors. Circle (1831)

Cooper Industries/Belden Div. 16225
No. 9180: digital audio cable. Circle (1832)
No. 9292: serial digital cable. Circle (1833)
No. 8281: serial digital cable. Circle (1834)

Covid 18700
10-03-xx: low loss multi conductor RGB cable. Circle (2257)
10-04P-xx: multi coax; RGB+S with plenum rating; high visibility orange jacket withstands vigors of rentals. Circle (2258)

GEPCO International 12747
GEP-VFM807 series: miniature 75Ω coax for RGB signals. Circle (1835)
GEP-5524 series: low capacity, 100Ω cable for digital audio applications. Circle (1836)
GEP-5524 series: low capacity, 100Ω cable for digital audio. Circle (1837)
RGB 2000 series: 59/U coax; low-loss cable for RGB applications. Circle (1838)

Mohawk Wire & Cable 17681
Boot: and waterproof cable-connector system. Circle (1839)

Nemal Electronics International 11643
MC424P: flexible mic cable. Circle (1840)

Neutrik USA 4300
NC3FDH6 series: ¼" jack sockets; direct mount to PC boards; compatible with existing mono, stereo plugs; *double jack* vertical array of two jacks with single-jack footprint. Circle (1841)

Switchcraft 5215
Video patching: expanded line of patch panels and cords. Circle (1842)

Telecast Fiber Systems 20011
Sidewinder: storage reel with electronics to convert program video and audio between electrical and light signals; basic system has 600-foot FO cable. Circle (1843)

VEAM 16676
FOMS: fiber-optic mic snake; 52-channel analog and digital to analog over optical fiber link. Circle (1844)

S7: Recording tape, degaussers, film maintenance

Ampex Recording Media 17101
499 Grand Master Gold: analog mastering tape; low noise, low print-through formulation handles operating levels of +9dB or greater; in ¼" to 2". Circle (1845)
Calibration tapes: multifrequency analog audio reference material; in ¼", ½", 1", 2". Circle (1846)

audiopak 2326
Compact cassette components: leader tape, graphite liners in 95 styles, configurations. Circle (1847)

Carpel Video 16527
T-120: VHS videotape cassettes. Circle (1848)

DIC Digital 16371
MO-128MB: 128MByte magneto-optical disk with 3.5" form factor. Circle (1849)

Garner Industries 13722
Model 682 series: upgrade of 680 series degaussers; open top design; erases 850Oe media in one pass; multiple passes ensure erasure of 1,000Oe media. Circle (1850)

Research Technology Int'l/RTI 13746
TapeChek XCL: cleaner, conditioner, rewinder for VHS. Circle (1851)
Proline 4100: Betacam SP tape recycler. Circle (1852)
Proline 490M: MII tape recycler. Circle (1853)
CF3000-MK V: Lipsner-Smith ultrasonic film cleaner; optional submerged buffing, to 200 feet per minute. Circle (1854)
DX-11: dropout counter for digital tape. Circle (1855)

Sanix Corporation N.A.
SANIX 5500: compact tabletop unit for metal and oxide D-1, D-2 and D-3 large cassettes; tape selector sets erasure parameters for special types. Circle (1856)

Sony Recording Media 11711
Shipping cases: for large-size S1, S2 cassettes. Circle (1857)
MDU series: digital audio U-matic material. Circle (1858)
Enhanced D-2: for composite digital; improved lubrication; Super Cross Linked Binder; less dropout; 208-mins. Circle (1859)
HMEX series: Hi8 metal media; vacuum evporation bonds cobalt alloy directly to base film; 3,700 gauss retentivity; new surface treatment. Circle (1860)
MQST series: pro S-VHS medium. Circle (1861)
PDP series: pro DAT Plus medium Circle (1862)
MCT-MA series: metal Betacam SP medium. Circle (1863)

3M Pro A-V Products 18012
HXP Hi8: videocassettes for Hi8 format applications; greater than 400-line resolution, low noise; 30- to 120-minute. Circle (1864)

Videomagnetics 16733
CDS-2500: belt-driven high-volume videotape degausser system. Circle (1865)

S8: Music/effects libraries; program, weather services

Accu-Weather 13727
FeatureFone: enhanced turnkey voice information system. Circle (1866)
RadSat: combination radar and satellite image service. Circle (1867)
Accu-Call 900: 900 telco service offering significant profit opportunity. Circle (1868)
UG386AT: enhanced high-resolution graphics access, paint and display system. Circle (1869)

Associated Production Music 16422
APM package: more than 150 new CDs from KPM, Bruton, Sonoton production music libraries. Circle (1870)
SFX package: sound effects library from KPM; includes 8 CDs. Circle (1871)

Audio Action 10651
FEX 01-10 Sound Effects Library: digitally mastered audio material. Circle (1872)

Carpel Video 16527
CA-1 Carpel-o-peel: label remover; odorless solution. Circle (1873)

Focal Press 16768
Industry books: *Global Telecommunications* by R. Akwuk; *TV and Video Engineer's Reference Book* by Townsend & Jackson; *The Broadcast Century* by R. Hilliard, M. Keith; *Broadcast Technology Worktext* by S. Ebersole; *The Art of Digital Audio* 2nd ed. by J. Watkinson; *Creative Radio Production* by B. Siegel Circle (1875)

Gefen Systems 5224
SFX libraries: various collections including *Sonic Boon, BBC, DigiFFelts,* Circle (1876)
"Touch the Music": touchscreen background music system Circle (1593)

Guicar Television 18480
Fantastic Videolibrary: two subject groups; 80 1-minute sequences; special event cuts in 1-minute lengths. Circle (1877)
3-D & normal effects: two subject groups include more than 50 1-minute broadcast-quality special effects for reel. Circle (1878)

MicroNet 18478
International service: program uplink and downlink via earth stations. Circle (1879)

Production Garden Library 11608
Sales Energy/PG CD 114: bright, pretty broadcast commercial beds. Circle (1880)
Air Assault/PG CD 301: 240 production elements. Circle (1881)
Energy Tracks/PG CD 113: high-energy broadcast commercial beds. Circle (1882)
Off the Wall/PG CD 213: high-energy music themes. Circle (1883)
Motivation/PG CD 214: corporate industrial theme music. Circle (1884)

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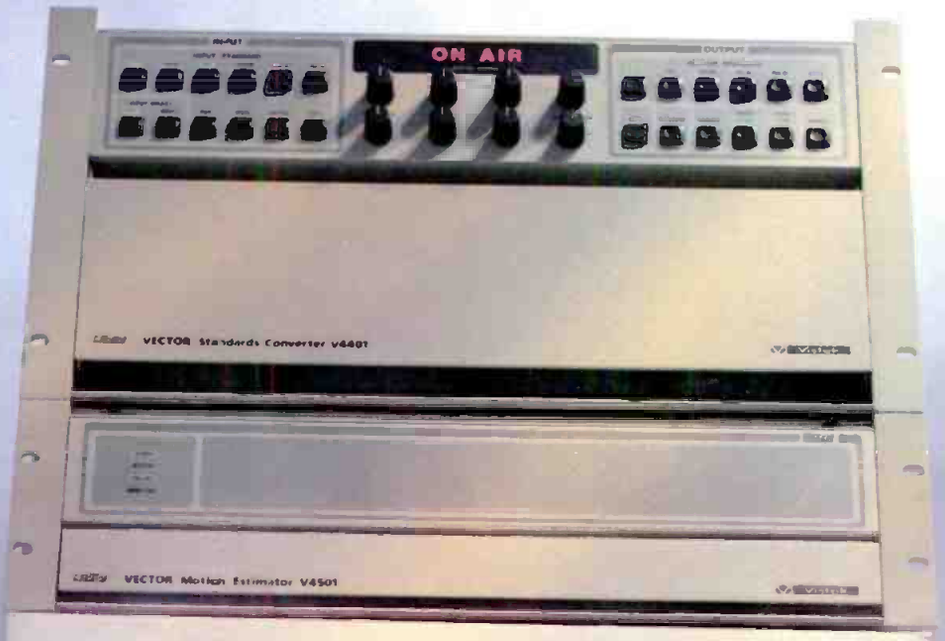

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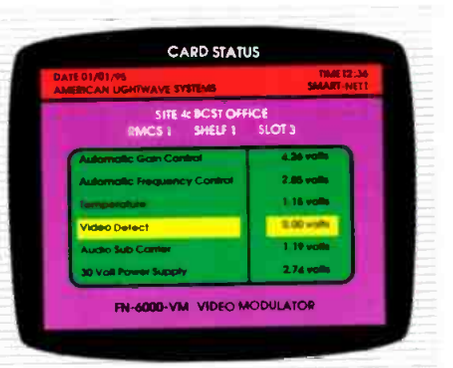

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Circle (160) on Reply Card

Promusic 2601
Regular series on CD: 7 new releases. Circle (1885)
Music libraries: UBM and Modiophone series. Circle (1886)
Producers: sound effects. Circle (1888)

Thomson Video Equipement 15733
TTV 5651 SYNONYM: 4:2:2 component digital video production switcher. Circle (1889)

TRF Production Music Libraries 20156
CD Digital: more than 100 new releases; digitally recorded. Circle (1890)
New Image music library Circle (1891)

S9: Facility design, consulting

Rees Associates 16738
Facility: business planning service. Circle (1892)

Shook Electronics USA Outside
Model 29-36: 6-8 camera mobile TV production trucks; air-ride suspension; premium oak trim, stainless steel belly box; Circle (1893)

Television Engineering 13117
New ENG Design system: new dimensions, features and layout. Circle (1894)
IFB-19A: audio controller. Circle (1895)

Sigma Electronics 18816
No. 21168, 21616: small matrix routers; high performance, control flexibility; low cost. Circle (1896)

Video products

V1: Cameras, lenses; camera support

A.F. Associates 19634
RP2: robotic pedestal for ENG/EFP cameras and lenses; full manual operation optional; by Radamec. Circle (1898)

Angenieux Corporation 18037
14x6.6: ENG lens for ½" cameras. Circle (1899)
14x anamorphic: lens converts any 3:4 aspect ratio camera to 16:9 HD format. Circle (1900)
20x8.5: broadcast lens; 20x zoom using fluophosphate material, multilayer coatings to reduce chromatic aberration; 0m MOD; *Multirange extender* for on-air selection of five extenders; *Teleshot* focus feature; for ⅔" CCD cameras. Circle (1901)
14x8.5: ergonomic, rugged design for ⅔" cameras. Circle (1902)
14x FPL series: lightweight lens for ENG/EFP; available with f/1.6 for ⅔" and f/1.4 for ½" cameras offering lower-light capability; CCD optimized; integrated UV filter. Circle (1903)

Bencher 11118
VP400 tabletop, Illumina: copy stand system for heavier cameras to 40 pounds; available in tabletop or floor (Illumina) models; four 300W quartz sidelights; 25x25" copy area includes 16x16" illuminated area. Circle (1904)

BTS Broadcast Television Systems 18001
LDK 9 enhancements: CCIR digital output option; control panel access to numerous functions; serial remote to *Series 9000* control to robotic and station automation systems. Circle (1905)

Canon USA/Broadcast Optics 15719
LX 100: Hi8 camcorder; special features include interchangeable lens system. Circle (1906)

Concept W Systems 15766
PP-40 Plus Port Adapter: option interfaces Panasonic CCUs and digital hand controllers to Camplex systems. Circle (1907)
PowerPlex: intelligent remote power systems for cameras operating with coax; *PDC-240* 20W, *PCD-240HP* 31W; powers camera with single coax simultaneously with other bidirectional signals. Circle (1908)
PP-100 Plus Port Adapter: option interfaces camera control units and hand controllers to Camplex systems; may be used with PowerPlex; for Sony, Ampex, Ikegami, Hitachi, JVC equipment. Circle (1909)

CSI Camera Support Int'l. 15568
Full line: camera support products for broadcast, industrial, educational; System 2, 3, 15, 20, 25, 30, 35; professional quality with reduced cost. Circle (1910)

Fujinon Optics 15854
A14x8.5EVM: well-balanced, hand-held lens for ⅔" cameras; f/1.7 to 103mm f/2 to 119mm; MOD 2.6 feet; designed for more comfortable hand grip and control; 2x extender. Circle (1911)

Hitachi Denshi 17046
SK-H5: portable camera using high-sensitiv-

ity Harpicon tube. Circle (1912)
Z-ONE-B: portable CCD camera. Circle (1913)

Ikegami Electronics (USA) 18558
HK-343: field, studio camera using 3 ⅔" IT CCDs. Circle (1914)
HC-340: portable camera using 3 ⅔" IT CCDs. Circle (1915)
HL-43: portable companion to HK-343 camera. Circle (1916)

Innovision Optics 15660
Series 6000: high-resolution lens for unique closeups; 15"x½" tubular unit; self-illuminating lens with direct, 90° and 45° angles of view. Circle (1917)

Right angle Probe: features 90° angle of view for video cameras; permits camera to shoot tabletop products with camera mounted over product. Circle (1918)

J-Lab 12436
CCD-3: hand-held camera control unit; for Betacam: smooth operation, equalized video, gen-lock to 100m. Circle (1919)

JVC 16756
KY-90U: camera using three FIT CCDs; outstanding resolution, signal-to-noise; docks with various JVC S-VHS and other major formats; advanced memory system. Circle (1920)
KY-17B, KY-17FIT: CCD cameras; -17B uses IT MicroLens devices for high sensitivity, low vertical smear; -17FIT uses FIT devices to for high resolution, negligible vertical smear. Circle (1921)

Karl Heitz 13730
No. 380 fluid head 3: 5½" high, 3¾lb; 90° front, 45° rear tilts; 360° pan; adjustable drag; all-metal quick release, shift plate for centering, balancing of cameras to 15 pounds; with *Inter Pro Studex* tripod and levelling ball 3. Circle (1922)
No. 180 fluid head 1: 3½" high, ½lb with quick release; 90° front-rear tilts; 360° pan; adjustable drag; for cameras to 7 pounds; with *Sport Eco* tripod. Circle (1923)
No. 280 fluid head 2: 4", ¼ lb; quick release with 90° front-rear tilts; 360° pan; adjustable drag; 90° side tilt for tripods without levelling ball; for cameras to 10 pounds; with *Reporter Eco* tripod. Circle (1924)

Miller Fluid Heads (USA) Inc. 16101
Lightweight range: single, 2-stage tripods; spreaderless with leg angle lock capability. Circle (1925)
Air lift assist: geared elevator column of No. 700 pedestal; permits air pressure-assisted vertical positioning. Circle (1926)

Nikon Photo/Electronic Imaging 18172
S15x8.5B II: enhanced version of previous S15× for ⅔" cameras; 0.8m MOD; removable servo housing for serviceability; wide zoom ratio. Circle (1927)
FW-ENG, G-ENG: cost-effective means to expanded special effects; permit Nikkor SLR lenses to be used with ENG cameras. Circle (1928)

O'Connor Engineering Labs 17029
35 series: tripods with rigid spreader; air-assisted column. Circle (1929)
55C series: tripods with air-assisted columns. Circle (1930)

Panasonic 18019
Camera products: expanded line of cameras for use with D-3, and analog recorder products. Circle (1931)

Panther 17884
Pegasus: modular, 2-person camera crane; elevation to 6.2m. Circle (1932)

Philips Components 16723
XQ-5002: camera tube for high-resolution imaging. Circle (1933)

Quickset 12508
QPT-15: electromechanical pan/tilt system. Circle (1934)
QYTH Mercury: fluid head system. Circle (1935)

Radamec EPO Ltd. 19634
RP2: 2nd-generation robotic pedestal; designed for ENG/EFP cameras and lenses; full manual operation of all pedestal functions. Circle (1936)
SAS See and Select: cue computer facility; frame grab function for key frames, stores information at 1/16 full size; replay of shots initiated by selecting the required frame on the monitor. Circle (1937)

Sachtler 18512
7080/Dolly XL: maximum stability, but weight-conscious design. Circle (1938)
1800L/Video 18 III: lighter ENG fluid head. Circle (1939)
6400/OB1: studio support system, outstanding stability, weight savings. Circle (1940)
6286/Tripod DA 150 HD 2: robust design;

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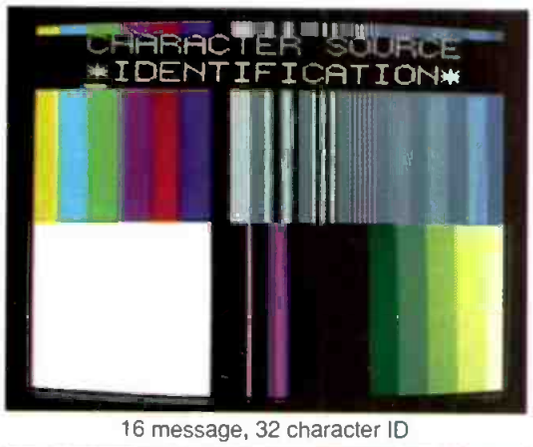
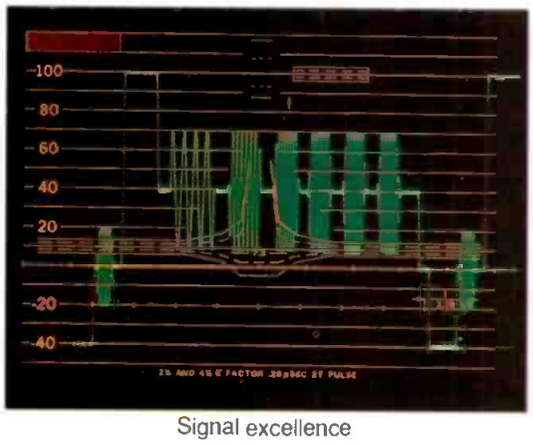


16 message, 32 character ID



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Circle (93) on Reply Card

greater stability than previous products. Circle (1941)
2000L/Video 20 III: lighter ENG, EFP fluid head. Circle (1942)

Sony Communications/Broadcast 11711
HDTV CCD camera: in HDTV display area. Circle (1943)
Camera enhancement: includes serial digital output. Circle (1944)

Telemetrics 19673
TM66095: pan/tilt control by RS-232. Circle (1945)
TM8650/AQ-20: triax adapter for Panasonic AQ-20 camera. Circle (1946)

Toshiba Prof. Video Systems 19646
TSC-100: 3-CCD Hi8 camcorder; resolution 700 lines from 768×494-pixel array; six shutter speeds; 12.54 pounds operating weight; linear matrix color-correction circuitry; records SMPTE VITC TC, PCM and AFM audio. Circle (1947)

Video Central 15682
DXC-537/PVV-1: Sony dockable CCD camera; professional Betacam VCR; PAL standard. Circle (1948)

Vinten Broadcast 19666
Pro-Ped: portable, 2-stage self-pumping pedestal and dolly. Circle (1949)
Classic HD-2: heavy-duty, 2-stage tripod; torque-safe leg locks. Circle (1950)
Classic HD-1: heavy-duty, single-stage tripod; torque-safe leg locks Circle (1951)
Microswift series: additions and system enhancements announced. Circle (1952)

V2: Recording, editing

Abekas Video Systems 11251
A66 recorder: new features and options. Circle (1953)
A82-cache: composite digital cache for A82 system; enhances operational speed. Circle (1954)

Adrienne Electronics 18580
AEC-Box-95: video sampler/compressor for Sony protocol VTRs. Circle (1955)
AEC-Box-20PR: LTC/VITC bar code label printing system. Circle (1956)
AEC-Box-32: LTC/VITC serial data inserter for Sony protocol VTRs. Circle (1957)
PC-LVTC/RG-1: LTC/VITC reader/generator board for IBM/PCs. Circle (1958)

ALTA Group 18046
Centaurus SSR: still-store; 179-field/85-frame storage, removable hard drive; 4-input video switcher with effects; access stills by number or create list of files with effects to be applied; composite or Y/C switcher; optional 4-input audio switching, tally accessories. Circle (1959)

Amtel Systems 11317
E-Pix upgrade: on-line, non-linear editing system; video component configuration with Betacam-quality output. Circle (1960)

ASACA ShibaSoku 15746
AMD-1340: MO HDTV HD still-store; 200 images per disk; random access at 0.7s access time typical. Circle (1961)
ADS-330: NTSC magneto-optical disk still-store; *RC33* remote-control unit. Circle (1962)
ADR-6000: NTSC magneto-optical disk recorder. Circle (1963)

AT&T Graphics Software Labs 18483
StudioMaster: video editor for Macintosh. Circle (1964)

AVID Technology 19663
Media Composer Rel. 4.0: upgrade enhances JPEG video compression; adds wipes, graphic positioning; internal color vectorscope; audio scrub; 4-channel output. Circle (1965)
MediaMatch: film matchback application. Circle (1966)

BTS Broadcast Television Systems 18001
DCR 500: new-generation D-1 VTR; for post-production facilities. Circle (1967)

Calaway Editing 18046
CE-400: comprehensive on-line, off-line edit controller. Circle (1968)

CMAX Editing Systems N.A.
CMAX-PRO: full-featured, on-line capability; programmed motion control; multiple GPIs, record; real time mode. Circle (1969)

CMC Technology 11708
Refurbishing: upper drum service for Betacam-SP VTRs. Circle (1970)

CMX 19306
OMNI 1000 options:interface allows control of titler from editor; *List Magic* EDL utilities include *Rinse*, *Clean* and *Lookback*; *TBC interface* for setting of levels on editor graphic

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Video recorders: expanded line of D-3, MII, S-VHS and VHS video platforms. Circle (2001)

Pioneer 10145
PLUS system: Pioneer LaserDisc Universal System; *LD-V8000* player; *LC-V330* autochanger; *PLUS* IBM AT/compatible controller; operates pay-per-view channel automation. Circle (2002)
VDR-V1000: rewritable videodisc recorder; simultaneous erase, record feature; random access time at 0.2s. Circle (2003)

Sony Communications/Broadcast 11711
SuperMotion: based on Betacam products. Circle (2004)
8mm recorder: still-frame for industrial use. Circle (2005)
D-2 series: low-cost player. Circle (2006)
BVE-9100 edit control: 32-bit CPU at 20MHz increases editing efficiency by factor of 5; dedicated CPUs on interface cards; control from Sony, other manufacturers' switchers, effects systems; BZE-1901 software for time-track, slow motion; BZE9102 list management, simultaneous EDL use. Circle (2007)
BVW series additions. Circle (2008)
Betacam enhancement: 4:2:2 or 4Fsc serial digital output. Circle (2009)

Sundance Technology Group 11563
Sundance Version 2.0: editing system enhanced with Trace, Dynamic Motion Control; CMX EDL export/import; multilog editing; Video Toaster interface. Circle (2010)

Thomson Video Equipement 15733
PIXTORE: still-store; 386-based; operates with DIANA server for any type of picture, 525/625, 4x3, 16x9; Bellevue interface card; Ethernet LAN may tie in with ISDN; uses ISO/IPEG compression to reduce disk space. Circle (2011)

Time Logic, Inc. 15669
FLEX Kit: edit list output for TLC editor. Circle (2012)

TouchVision Systems 18740
D/Vision V2.0: non-linear editing software with "B" series DVI chips by Intel; near U-matic picture quality. Circle (2013)

United Media 19253
VAC-100 series: video animation controller board; plug-in for PC; controls numerous RS-422 VTRs for animation and multiframe recording. Circle (2014)
EZ PC series: easy-to-use PC-based editing controllers; for familiarity of a PC with features of advanced editing equipment. Circle (2015)

Video Central 15682
PVW-2800P: Sony 2000 series professional Betacam, PAL standard. Circle (2016)

Videomedia SED 16354
Auto-Pict QT: animation and digitizing software; Truevision NuVista+ board, V-Lan compatible controller, incorporates QuickTime movies into edit lists for input and output to videotape. Circle (2017)

Yamashita Engineering Mfgr/YEM 16409
AC7000: animation & VTR controller. Circle (2018)

V3: Processing, correction; pulse, video delays

Abekas Video Systems 11251
A20 series: system components, including encoders, decoders, converters. Circle (2019)

Allen Avionics 16207
Serial digital products: serializer/deserializer; serial digital DA. Circle (2020)
Interface: 10-bit A/D interface in 2-RU tray. Circle (2021)

Alpha Image 18046
A370: NTSC to serial digital composite converter. Circle (2022)
Alpha 380: digital serial composite to NTSC converter. Circle (2023)

Bio-Electronics 16669
NR-2: NTSC-RGB 2-channel video decoder. Circle (2024)

Broadcast Video Systems/BVS 16742
CP-600: video processing amplifier; fits GVG, Leitch VDA frames. Circle (2025)
CARDKEY: linear keyer, fits GVG, Leitch Video DA frames. Circle (2026)

CEL Electronics 10257
P171: digital video encoder. Circle (2027)

daVinci 18046
Renaissance 8:8:8: color corrector meets CCIR-601 spec; 16-bit processing with 27MHz video path; real time programmable processing; software-driven for future upgradability. Circle (2029)

Digital Vision 18883
Model ASC: for dust, scratch and tape drop-out concealment; upgrade to DVNR 1000 range or available as stand-alone unit; con-

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ceals negative and positive film dust; can replace chemical and electrostatic treatment or as companion to such methods. Circle (2030)

DVIS 1000: digital image stabilizer; corrects undesirable 2-D motion in video from camera or telecine sources; detects 2:3 sequence; advanced variable movement filters used in motion estimation technology. Circle (2031)

Echolab 13733
PC-1: two levels of linear key, mix, wipe on a PC board. Circle (2032)

Faroudja Laboratories 13422
LD100 line doubler: accepts NTSC, S-video inputs; produces high-resolution images by doubling the number of lines of resolution; also available for PAL. Circle (2033)

FOR-A 15870
MVP-2200: multivideo processor; scan conversion of computer images to NTSC. Circle (2034)

UDP-1000: universal digital processor; 3-D noise reduction. Circle (2035)

Intelvideo 20009
SG1 generator: NTSC blackburst source with sync; variable H, V, SC phase lock. Circle (2036)

FLASHER II: video gating device; permits pictures to be taken off TV screen without visible vertical interval bars. Circle (2037)

IV-9: combined comb filter color decoder with complementary encoder unit. Circle (2038)

IV-9R: color corrector; remote-control feature with independent adjustment of R, G, B, chroma level and chroma phase. Circle (2039)

Leitch Video 19924
DigiBus: conversion products for digital/analog video and audio; user-configurable format. Circle (2040)

Magni Systems 19246
VGA-Pro: VGA Producer Pro, VGA-to-NTSC or PAL encoder. Circle (2041)

Nova Systems 13943
NOVA Dcoder: composite and Y/C decoder. Circle (2042)

NOVA Xcoder: RGB and component transcoder. Circle (2043)

Ncoder: RGB, component video inputs produce composite NTSC, Y/C-3.58, Y-688 outputs; converts among RGB, Betacam, MII formats. Circle (2044)

Omicron Video 13441
Model 360: chroma-keyer. Circle (2046)

Model 721: gen-lock system for Amiga computers. Circle (2047)

Philips TV Test Equipment A/S 16523
PM 5629: 4:2:2-CAV format converter. Circle (2048)

PM 5628: CAV-4:2:2 format converter. Circle (2049)

Sony Communications/Broadcast 11711
DFX1201, DFX2101: bit rate converters between 4:2:2 and 4Fsc; convert digital audio and video in one process. Circle (2050)

Sprocket Video Technologies 10142
DST-1000: single-channel, multistandard serializer, deserializer; converts between parallel component or composite video to serial data; operates as component 4:2:2, composite 4Fsc NTSC or 4Fsc PAL. Circle (2051)

DST-4:2:2: single-channel unit for 4:2:2 signals; converts between parallel video and serial data. Circle (2052)

Thomson Video Equipement 15733
TTV 7760 HD: Hi-Doubler image converter. Circle (2053)

Ultimatte 12529
System 6 Transcoder 4:4: bidirectional transcoder; 2 complete channels; permits System 6 to be used with any component recorder. Circle (2054)

Ultimatte 45: for mid-sized production, post-production; compositing system with *Matte Shading* feature to overcome inconsistencies of blue screens; integral transcoders, flare suppression circuitry; menu driven. Circle (2055)

Vistek Electronics 18883
V4229 decoder: digital system for analog or digital composite (D-2, D-3) to analog component format as RGB or YP_RP_B; operates with NTSC, PAL, PAL-M inputs. Circle (2056)

Vortex Communications 13101
Q-Channel: quad-split unit for broadcast video; low-cost. Circle (2057)

CK-100: linear component, multichannel keyer. Circle (2058)

SCG-120: sync generator, encoder; NTSC/PAL switchable. Circle (2059)

NEW

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The RVS 630 combines the power of 30 video inputs, the flexibility of two 4-bus Multi-Level Effects Systems (MLE), totally integrated DVE control, the Ross Downstream Multi-Keyer, and complete switcher set-up storage, with the convenience of uncomplicated operation provided by the PGM/PST busses.

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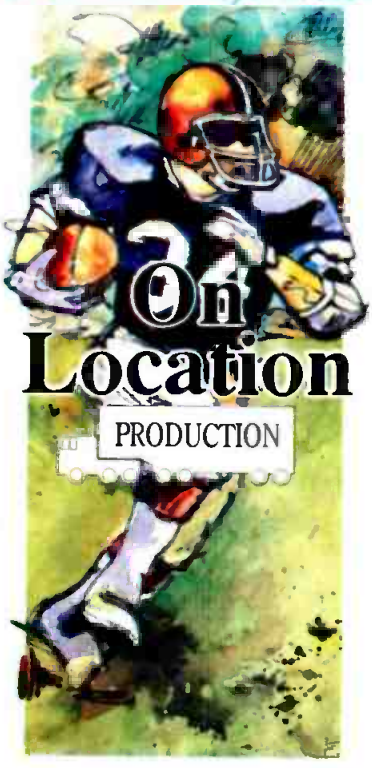

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Ross Video Limited, P.O. Box 220, 8 John St., Iroquois, Ont., Canada K0E 1K0

Circle (103) on Reply Card

Yamashita Engineering Mfgr/YEM 16409
CVS-970A: high-resolution, HDTV downconverter. Circle (2060)
CVS-985X: advanced, wideband scan converter including HDTV format. Circle (2061)
EDEC-2000: digital EDTV decoder - H&V enhancement, noise reduction. Circle (2062)
RB-1701C: ultrastable rubidium clock-controlled dual sync generator. Circle (2063)

V4: TBCs, synchronizers, standards converters, delays

A.F. Associates 19634
TDFI: digital serial framestore, synchronizer. Circle (2064)
TCFI: component framestore, synchronizer. Circle (2065)
ADAC 2000: 10-bit TV standards converter from AVS. Circle (2066)

Allen Avionics 16207
TDL-487: video delay lines providing timing control for Video Toaster. Circle (2067)
AVS filters: miniature package low-pass video filters for video OEM applications. Circle (2068)

AVS Applied Video Systems 19634
Adac 2000: standards converter: upgradability to full motion-compensated interpolation; 10-bit processing; integrated encoding, decoding; D-1, D-2 interfaces standard with analog composite NTSC, PAL, SECAM and component/YC-525, 625. Circle (2069)

CEL Electronics 10257
Worldmaster/P256: standards converter. Circle (2070)

Digital Processing Systems 10654
Desktop Video Products: series includes - Personal TBC II, Personal VDA and Personal V-Scope waveform and vector monitor. Circle (2071)
DPS-230: component transcoding TBC. Circle (2072)

FOR-A 15870
FA-320: full-frame TBC; noise reduction and color-corrector options. Circle (2073)
FA-310: TBC with noise reduction. Circle (2074)
FA-810: 4-field synchronizer; median noise-reduction filter option. Circle (2075)

Hotronic 13427
AP41-SP: broadcast-quality TBC/frame synchronizer. Circle (2076)
AP41: TBC/frame synchronizer with Y-C and composite input/output facilities; frame-freeze/field-feature; strobe; DOC; low cost. Circle (2077)

James Grunder & Associates 16406
C-100: time base corrector and frame synchronizer; by Feral Industries; NTSC and PAL; transcodes between composite, S-VHS; fade to black; freeze field 1, field 2; RS-422 serial control; full proc amp control. Circle (2078)

Leitch Video 19924
SPG-1500P: PAL standard master sync generator. Circle (2079)
SPC-1302N: NTSC/D2 master sync generator. Circle (2080)

Nova Systems 13943
4-field option: produce accurate color framing with NOVASync systems; reduce horizontal shifts in pictures caused by out-of-phase conditions. Circle (2081)
Y/C dub option: output feature for 920SP wideband Y/C TBC; produces Y-688 signal for use with U-matic(SP) VCRs. Circle (2082)
NOVAMate: TBC on PC plug-in card; stand-alone or NOVAFrame. Circle (2083)
Y/C dub option: feature for 920SP wideband Y/C TBC; Y-688 output for use with U-matic(SP) VCRs. Circle (2084)

Prime Image 10442
TBC-PCB: plug-in TBC board; single-channel, 525-line window; compatible with Betacam (SP), M-II, U-matic (SP), Hi8, S-VHS, VHS and ED-Beta formats. Circle (2085)
Model 2X: dual-channel time base corrector. Circle (2086)
Power Pack 6: option for TBC systems develops Y-688 dub signals for use with ¾" VCRs; variable chroma noise reduction, chroma/detail enhancement; Y/C in/out transcoding. Circle (2087)
Model 1010: wideband direct synchronizer. Circle (2088)

QSI Systems 16633
Model 800 image inserter: places stored images in video with 760×480-pixel resolution; CMOS EPROM devices easily changed; output is RS-170A; two non-volatile chips store logos, call letters or other graphics. Circle (2089)
No. 8000 image generator: graphics editor; creates image EPROMS for image inserter; mouse-controlled editing, 2×-8× magnification; cut-and-paste and pixel-by-pixel fea-

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tures; 512-color; color shading, fills; integral EPROM programmer. Circle (2090)

Tektronix 18032
VS210 synchronizer: NTSC unit; transparent operation with four times the accuracy and resolution of 8-bit systems; analog, composite digital I/O for mixed format systems. Circle (2091)

Vistek Electronics 18883
Vector VMC V4401: standards converter with vector motion compensation; removes nearly all artifacts caused by motion in standards conversion; additions to VMC vector motion compensation algorithm with 3-D prediction. Circle (2092)

V5: Graphics, titling, effects production systems; weather displays

Abekas Video Systems 11251
A51 effects: new 4-channel operation. Circle (2093)
A57: 10-bit frame-based digital effects system; new control system. Circle (2094)
A72 titler: expanded graphic effects, shading, light sources, animation enhancements. Circle (2095)

Ampex Corporation 17101
ADO 500: software enhancements. Circle (2096)

ASACA ShibaSoku 15746
VG922B: closed-caption encoder. Circle (2097)

AT&T Graphics Software Labs 18483
Panorama: image-sequencing, multimedia desktop presentation software. Circle (2098)
MacTOPAS: 3-D modeling, rendering, animation software for Macintosh. Circle (2099)
Comet/CG: character generator for Macintosh. Circle (2100)
TOPAS 4.0: upgraded 3-D modeling, rendering, animation for DOS PCs. Circle (2101)

Aurora Paint Systems 19306
Liberty: painting, drawing, compositing, animation and typography package, resolution and hardware independent software; for NTSC, PAL, HDTV, Pre-press applications; available for numerous hardware platforms. Circle (2102)
MAC interface: software option for AU/200 series permits digital file transfer to and from Macintosh PCs. Circle (2103)
AU/280 Commander: 32-bit 4:4:4:4 paint system with multiplane animation; switcher effects, color cycling; controls multiple recording devices; 2-D, 3-D tools; 40MHz SUN SPARCengine2 processor; 16Mbyte RAM, integral SCSI port, Ethernet. Circle (2104)

AVS Applied Video Systems 19634
601 Floating Point: free-form titler with real time manipulation in 3-D space; composite, component, 601; RISC 32-bit parallel processing; on-air page update for sports, news, election coverage; off-line page composition; animated elements imported from paint; logo feature. Circle (2105)

Blue Feather 10149
Prompt Box Jr. cost-effective teleprompter; includes all necessary features without frills. Circle (2106)

CEL Electronics 10257
Myriad-fx: image manipulation system; 525-line version. Circle (2107)

Chyron 19306
CODI: compact titler for use with external RS-232 sources; anti-aliased characters; 16.7 million color selections, automatic shading; 1,500 master bitstream typeface library; for message systems, cable companies, small production facilities. Circle (2108)
iNFiNiT! networking: permits numerous systems to share disc resources. Circle (2109)
Fonts-by-Wire: access 1,500 master bitstream faces by modem for iNFiNiT!, SuperScribe, MAX! titling systems. Circle (2110)

ColorGraphics Systems 18046
DPenhancements: vector-based cel animation scripter *Morph Cel* software; advanced cel *Ink and Paint* software; *Mosaic 25s, 100s* digital disc caches. Circle (2111)
LiveLine 5 enhancements: based on Motorola 68040 microprocessor; 16Mbyte system memory for expanded animation, graphics creation; doubles overlay animation capability; preload animation for instantaneous on-air access; SCSI disk control. Circle (2112)
DP/Painter: paint system meeting demands of high-quality graphics production; rotoscope, matte creation; extensive typography facilities; upgradable. Circle (2113)
DP/Animator: use as central device in graphics suite; extensive image manipulation features with 2-D, 3-D scripting tools. Circle (2114)
DP/MAX: designed for D-1 video post-pro-

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DYNATECH Broadcast Group

duction; processes moving video with compositing, real time color correction, effects, audio scratch track, warp scripter and other features. Circle (2115)
Real Time features: compositing, editing, layering and audio capabilities for DP/MAX video workstations; permits recording of mattes, image warp effects, chroma-key, color-correction features. Circle (2116)

Computer Prompting 16424
CPC-1000D: flat-screen teleprompter display; 9 pounds. Circle (2117)
CPC-2000: Smart Prompter with closed-captioning feature. Circle (2118)

Digital Arts 19040
Render Manager: for Iris Indigo graphics computer; rendering, drawing, animation, font management, geometry database features; 3-D environment. Circle (2119)

Digital F/X 12941
Verson 2.1: enhancement software; adds video database integration, extended transport support; compatible with Macintosh System 7, Quadra 68040 computers; Adobe Photoshop filters; *work print* feature; CMX 340, 3600 support. Circle (2120)

Echolab 13733
Transparent drop shadows: horizontal, vertical splits; mosaic dissolves and other features for Tempest effects system. Circle (2121)

Enterprise Electronics 13414
DWSR-90CTV enhancements: incorporating EEC *RADSYS 2000* display/control with 486 PC, DOS 5.0; 8MByte RAM, 40MByte hard drive; AT&T Vista graphics PCA, 14″ VGA monitor; 19″ RGB monitor for display; NTSC encoder; map builder, movie-loop playback; programmable sequencer. Circle (2122)

FOR-A 15870
MF-4000: Multifex digital effects generator; full 3-D features, page-turn and wraps. Circle (2123)
MF-3000S: Multifex effects generator; page-turn option. Circle (2124)
VPS-500S: video production system; includes TBC, switcher, effects features with variable compression. Circle (2125)

Getris Images 19685
ARAMIS 202: combines Sequencer software with two Venice Silicon Recorders (VSR); rotoscope, effects, animation features; 10-80s sequences in 4:4:4:4 digital domain architecture; one VSR plays a sequence mixed with real time animation, while second records it in real time. Circle (2126)
VENICE Version 2. paint, multilayer animation to 11 layers; digital effects, rotoscope, compositing; multimachine control, networking; interface to 3-D software; *MACRO* generate a sequence of functions into one command; Cell tool creates cel-by-cel automation automatically. Circle (2127)

Grass Valley Group 16933
Video Desk: range of PC-based video production tools. Circle (2128)

Grass Valley Group/Graphics 16933
RGB Grapher: color digitizer for Dubner K-series graphics systems. Circle (2129)
Video Designer: PC-based design, retouch and layout system. Circle (2130)

I•DEN Videotronics 19282
IDM-Z2: switcher with video effects; dual channel TBC function; composite, Y/C, Y/R-Y/B-Y I/O; color backgrounds, wipes, keys, compression, variable transitions; mosaic, paint functions. Circle (2131)
IVT-20: dual-channel TBC, frame synthesizer; infinite window; field/frame freeze; composite, Y/C, Y/R-Y/B-Y I/O; RGB in; DOC; presettable proc amp; blackburst out; remote-control feature. Circle (2132)
TBCard: plug-in TBC for Amiga, IBM computers; Y/C, composite 5.5MHz bandwidth; integrates computers, video. Circle (2133)
IVT-60: one to six channel transcoding TBC/synchronizer; builds on IVT-20 concept with additional modules to meet requirements. Circle (2134)
JAZZ effects: enhanced system; many cosmetic and ergonomic improvements. Circle (2135)
IVT-7/RGB: enhanced IVT-7 with RGB I/O. Circle (2136)

Image Logic Corp. 15574
Autocaption: low-cost, in-house closed-captioning system; for use during or following post-production; works with most existing word processors. Circle (2137)
Caption Producer: hardware and software package; type in closed captions or import material from word processor; schedule times for captions to appear; place captions into line 21 of the vertical interval; user supplies playback and record decks. Circle (2138)

Image North Technologies 16367
2-Room: Inscriber option; controls titling system from two control rooms separated up to 400 feet. Circle (2139)

Finally — a routing switcher that's no space hog. The new Venus® switcher provides BTS's famed routing power, yet is packaged in the industry's most compact housing to help save valuable facility real estate. You can also mix video and audio, both analog and serial digital, in the same frame. Big things *do* come in small packages!

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HCVGA: off-line Inscriber preparation system. Circle (2140)
Subtitle: multilingual subtitling with time-code feature. Circle (2141)

Intelligent Resources 18483
Demonstration: 16:9 HDTV images from Video Explorer. Circle (2142)
Video Explorer D1: serial CCIR-601 digital video card. Circle (2143)

Kavouras 12227
RADAC DBS: real time national composite, regional composite, single-site weather radar network. Circle (2144)
RADAC DBS: real time national composite, regional composite, single-site weather radar network. Circle (2145)
TRITON i7: advanced graphics, weather workstation; 386/486 base with multitasking i960/i860 RISC pipeline processing; 8-, 16-, 24-bit animation planes; high-resolution 24-bit backgrounds; intuitive icon prompting; fly-through perspective; 12 36-bit real time animation buffers; 256Mbyte animation memory. Circle (2146)

L. Greenberg Electronic Prompting 20171
Telescroll International: enhanced software version with Spanish, French, Japanese character sets. Circle (2147)

Listec Video 16719
A-6000/100 software: stand-alone editor for preparation of scripts in PC network; direct import/export with A-6000 prompter software system. Circle (2148)
A-4000 display: VGA resolution on-camera prompter unit. Circle (2149)

Magni Systems 19246
SC-CSD: Signal Creator with serial digital output facility. Circle (2150)

Matrox Electronic Systems Ltd. 10252
ILLUMINATOR PRO: video graphics controller; 32-bit frame buffer; all-digital encoder/decoder; 2-D video and graphics processor; alpha channel with blender. Circle (2151)
Matrox Studio: complete desktop editing, post-production; five boards for EISA-type PC; 8-input switcher, multilayer mix/effects unit; 3-channel digital effects; three TBCs; audio mixer; titling generator; VTR machine control; true color graphics. Circle (2152)
Virituoso: audio card for full-function, 6-channel mixer; analog stereo with 32-bit DSP-based digital processor. Circle (2153)

Media Computing 11107
pcTV-r: full-motion color video with stereo on computer monitor; remote control of video source from the computer keyboard. Circle (2154)

Microtime 18801
IMPACT ONE: variable image tranformer; 3-D shape manipulation in real time; maps live video onto those surfaces; includes conventional effects features; shapes stored in a library for quick access. Circle (2155)
2XP, 3XP series: Xtra Patches for series 2, series 3 IMPACT variable image transformer; more patches for additional 3-D shapes; LSI devices condense hardware into smaller system; upgrade for series 2, series 3 available. Circle (2156)

NDG Phoenix 18579
Mac Graphics, Mac Graphics 3D: integrated paint software packages for 2-D and 3-D. Circle (2157)

NewTek 11547
Video Toaster 2.0: 4-input switcher, effects, titler, still-store, animation, paint, color processor; D-2 internal processing; enhanced with more soft-edge transitions, real time sphere and cube mapping; *OrganicFX*, *ActionFX*, *KikiFX*. Circle (2158)

Paltex 19267
EDDi: video production system; desktop configuration; includes switcher, editor, audio mixing, titling, *vision* video overlay and *SceneManager* key-frame database; uses Windows environment. Circle (2159)

PESA Electronica 18777
CG4733: graphic titler. Circle (2160)

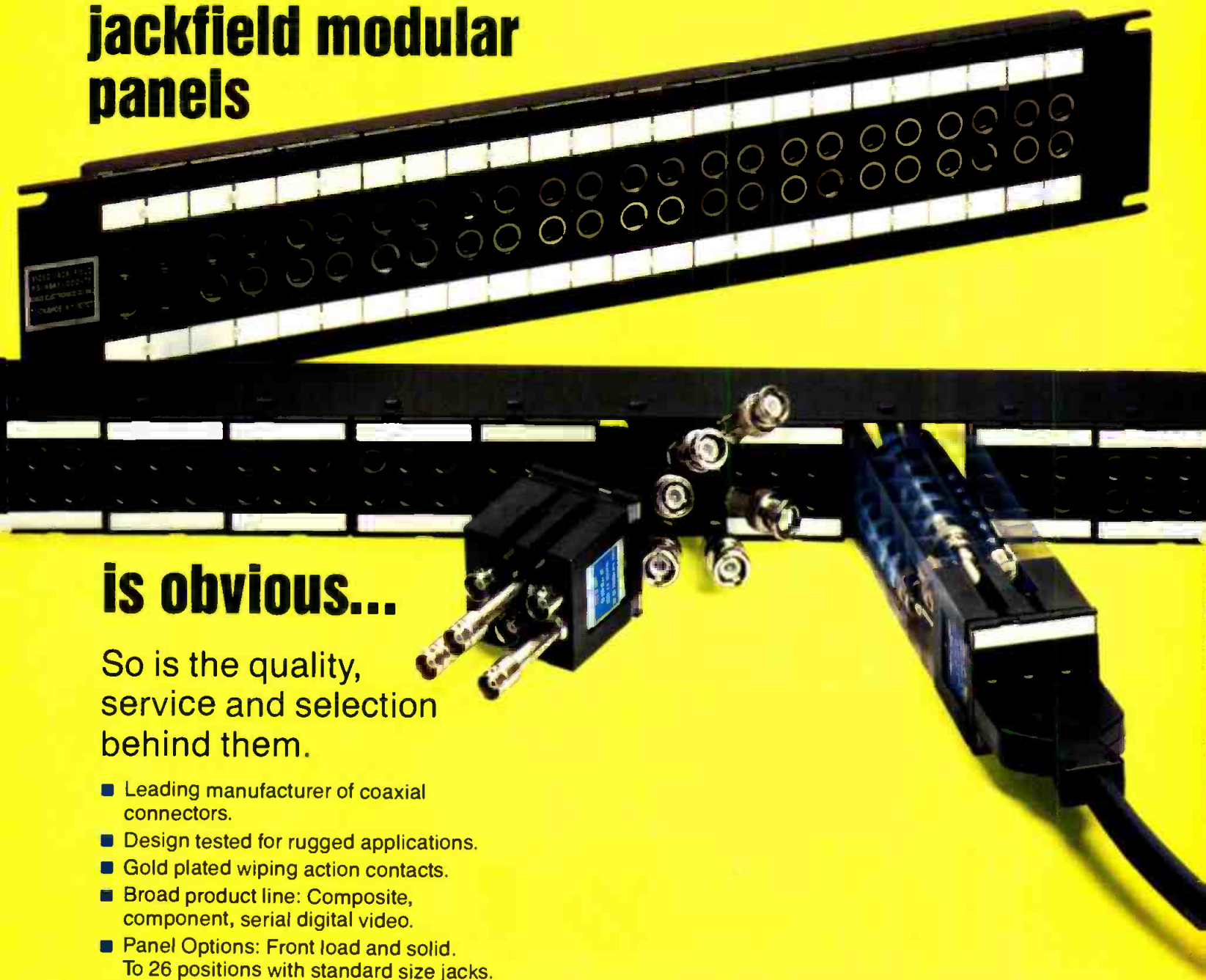
Pinnacle Systems 18808
Prizm enhancements: grab montage, autocube, edit control and additional 3-D effects features. Circle (2161)

Q-TV 17029
Components: for ComputerPrompTer systems. Circle (2162)
Super lightweight: on-camera prompter. Circle (2163)

Quanta 18046
Delta family: enhancements for D-1 character generators. Circle (2164)

Shereff Systems 15662
Pro Video CG II: real time titling software for Amiga. Circle (2165)

The advantage of KINGS front load video jackfield modular panels



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- Leading manufacturer of coaxial connectors.
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Sony Communications/Broadcast 11711
DME 550: digital effects demonstations. Circle (2166)

Symbolics/Graphics Div 12956
RenderServer 2.0: for off-loading of rendered images to Silicon Graphics Indigo, Personal Iris workstations; includes new rendering effects. Circle (2167)
Release 6.2: upgrades unified paint, 2-D, 2-D graphics software; DXF converter for CAD; networking software; direct SCSI to Solitaire film recorder; RS-232 control of Abekas A66; multiple machine control. Circle (2168)
HD XL animation:*Unified Graphics* system with paint, 2-D/3-D animation tools; supports multiformat I/O with NTSC, PAL, multiple HDTV types. Circle (2169)

Telescript 16823
Electronic Computing: for the newsroom; featuring noiseless computers, edit capability while prompting function in progress. Circle (2170)

Thomson Digital Image/TDI 15733
Explore Indigo: extends Explore system with additional rendering power; can be used as modeling subsystem. Circle (2171)
Explore V3.0: interactive 3-D modeling, material ediitng, animation, rendering, output to film and video; interactive photorealistic rendering/IPR feature. Circle (2172)

Time Arts 18285
Creative License: videographics and design software; for Silicon Graphics 4-D series workstations and IRIS Indigo; Motif interface; VideoFramer option. Circle (2173)

TrueVision 19284
Bravado: multimedia engine; on-board VGA for ISA platforms; full-color video-in-a-window, audio pass-through; Windows 3.0 compatible; 8-bit entry level and 16-bit full-featured versions. Circle (2174)

Vortex Communications 13101
Logo 3: logo/identification generator; keyed output; low-cost, high resolution. Circle (2175)

WSI/ESD 13047
PRECIP: precipitation estimations for levels of rainfall at essentially any geographic location east of the Rockies; uses NOWrad reflectivity data to produce 2km resolution images. Circle (2176)
NOWrad Plus: high-definition radar composites; preparatory step toward NEXRAD program currently in development by National Weather Service. Circle (2177)
LIGHTNINGplus: lightning information, imagery; real time lightning plot summmaries, weather fusion graphics; cumulative climatological summaries. Circle (2178)
Polar Orbiter Satellite Imagery: from POES satellites; 14 orbits per 24 hours; high-resolution infrared images of entire earth every 6 hours. Circle (2179)

V6: Monitors, displays projectors, printers

ASACA ShibaSoku 15746
VP1207: 12" HD monitor. Circle (2195)
CM203: 20" high-resolution auto setup monitor; 900-line resolution. Circle (2196)

BARCO Industries 18804
HDM 2081: 32" HD multistandard monitor; follows CVS philosophy; offers all standard broadcast features; includes auto setup. Circle (2180)
CVM 2500 series: grade 2 14" high-resolution, 20" medium-resolution CRT; menu-driven; composite inputs; quad decoder; component RGB/S-VHS input. Circle (2181)
CPM 2000 series: grade 3 monitors; 21" or 28" flat square CRT; menu-driven; composite inputs; quad decoder; component RGB/S-VHS input, optional RF input. Circle (2182)
Digital inputs: for CVS/CVM 2000; series of D-1, D-2 digital input boards for serial and parallel signals. Circle (2183)
CVM 2137: 14" monitor; similar characteristics as CVM 2000 series; minimum outside dimensions to fit in OB vans; monitor walls; small keyboard with limited functions integrated in bezel; all other functions available with remote control. Circle (2184)

Electrosonic Systems 20041
Philips video display products: Procube II *ESI5055* remote control; ImageMag 2 *ESI 5554* 2x2 processer; ImageMag 3 *ESI 5559* 3x3 video processing unit. Circle (2185)

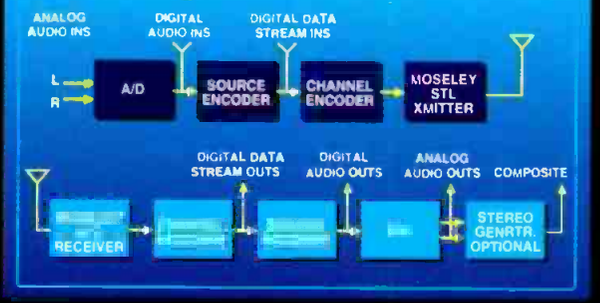
FOR-A 15870
Multi-Viewer Series: display enhancement products; split screen presentations of 4-, 9- and 16-image displays. Circle (2186)
HMC-1060: Multicam high-resolution still picture projection system. Circle (2187)

Ikegami Electronics (USA) 18558
30 series: color monitor with high-resolution CRT and auto setup feature; 20" diagonal. Circle (2188)

The Digital STL Advantage

- CD-Quality Audio
- Higher System Gain
- Constant SNR
- No Crosstalk
- No Background Noise
- No Phase Distortion
- Degradation-Free Multiple Hops

Open Architecture



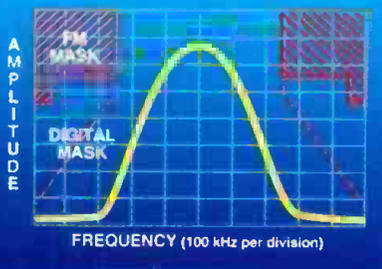
Open and optimal partition of source and channel coder. AES/EBU allows for end-to-end digital connectivity.

25 dB higher system gain translates into significant savings on antenna and transmission line costs.

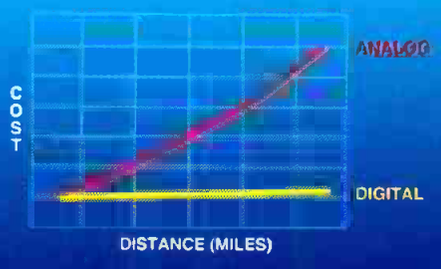
A new transmission technology that has the power to deliver CD-quality audio and solve your STL problems.

The DSP 6000 can operate in existing FCC channel allocations from 100 kHz to 500 kHz with existing analog radios.

FCC Spectrum Compliant



Instant Payback



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Introducing the first spectrum efficient CD-quality digital STL system. The DSP 6000 Digital Transmission System consists of the DSP 6000E source and channel encoder and the DSP 6000D source and channel decoder, and any Moseley digital-ready transmitter and receiver. The encoder and decoder can also be easily interfaced with any existing Moseley PCL 606/C or PCL 6000 series STL. The system can convey up to four 15 kHz CD-quality audio channels and two data channels, and has a built-in V.35 modem interface for fractional T1 applications! The DSP 6000 source coder is characterized by peak level preservation, low coding delay (3.8 ms), excellent bit-error immunity, and multiple encode/ decode capability. The channel coder offers spectral efficiency, constant envelope, error detection capability and perturbation tolerance.

The DSP 6000 System offers broadcasters the digital transmission advantage, continuing the Moseley traditions of innovation, reliability, and most of all, *value*. Call us for a color brochure with all the facts.

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Telex 658448
a GRC International Company

Circle (117) on Reply Card

20 series: color monitor with auto setup feature ;14", 20" models. Circle (2189)

Image North Technologies 16367
NRCD: Multichannel information display system. Circle (2190)

NEC Technologies 12456
DM2710: 15-38kHz multisync monitor; RGB inputs. Circle (2191)

V7: Telecine, film products

Management Graphics 20138
Film camera modules: custom units for 35mm; Vistavision; Cine/Academy; Cine/Sude. Circle (2192)

Nytone Electronics 16119
Slide-to-Print: transfer system with fade between. Circle (2193)

Options Int'l 11158
Quattroscan 4:4:4: framestore. Circle (2259)
Meta-Speed: digital servo Circle (2260)
Noise reducer with image stabilizer; by Digital Vision. Circle (2261)
Telecine utility: Autoshading; white clip prom; gate hand, focus knob, CRT access, instant frame alignment kits; transport rollers. Circle (2262)

Rank Cintel 17024
Turbo 2 telecine. Circle (2194)

V8: Production, master control switchers

Echolab 13733
DiAlog: interface for video DV-7, DV-7C 8-input switcher operation from Tempest effects system user control. Circle (2197)

FOR-A 15870
VM-100: video mixer. Circle (2198)
DVM-400: digital video switcher; D-1 interfacing. Circle (2199)

VGV Incorporated 17319
DX120: composite digital production switcher with single mix/effects system. Circle (2201)

Videotek 19919
PDG-418: 18-input production switcher; includes multilevel effects. Circle (2202)

V9: Batteries, chargers lighting products

Alexander Batteries 13738
BP1B: 12V 2.3Ah replacement unit for Sony NP1 and NP1A. Circle (2203)
MZ3100: self-contained maintenance system for professional NiCad video batteries. Circle (2204)
Amart Pak-14: directly replaces Anton/Bauer Snap-On batteries; power gauge displays capacity that has been used on mAh scale. Circle (2205)

Anton/Bauer 13418
Gold Mount: quick-release battery-mounting system. Circle (2206)
Logic Series chargers: multiposition fast charging with µP control. Circle (2207)
UltraLight 2: on-camera accessory light; low-voltage requirement; compact size. Circle (2208)
Magnum and Compac Magnum 13/14: standard and lightweight, high-capacity NiCad batteries. Circle (2209)

Arriflex 17276
ArriSoft/Fresnel kit. Circle (2210)
Electronic Ballasts: for 575/1.2kW, 400W, 600W, 12kW ratings. Circle (2211)
ArriSoft 1000, 2000: softlights, interchangeable reflectors. Circle (2212)
ArriSun HMI: fixtures for 2.5kW, 400W ratings. Circle (2213)
Compact HMI fixtures: 575W, 1.2kW, 2.5kW ratings. Circle (2214)

Chimera 17586
Quartz, Daylite Rings: for multiple ARRI, Desisti lights to 4kW open face; second model to 10-12kW. Circle (2215)
CronieCone: collapsible unit for VideoPro and Daylite Jr. single lights. Circle (2216)

DN Labs 16478
DURAPAR 4000: 4kW HMI PAR system; light output equivalent to 12kW. Circle (2217)
SPECTRA-FLUX 1200: 21" broad; soft daylight output at 5600°K; 1.2kW fixture. Circle (2218)
DURAPAR 6000: 6kW HMI PAR system. Circle (2219)
SPECTRA-FLUX 200T: 100W or 200W soft light; mounts on camera; uses halogen lamp; powered from DC battery pack. Circle (2220)

F J Westcott 15571
Light reflective umbrellas: soft white, metalized silver, gold, blue. Circle (2221)
Illuminator backgrounds: collapsible systems; available in many styles, colors. Circle (2222)
Halo, Apollo: light modifiers; silver, gold,

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Airbank: air-inflated light bank for large formats. Circle (2225)

Frezzolini Electronics 13408
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Solar Charger: ENG battery, supercompact solar charger. Circle (2227)
HMNP, HMNP1/2: NP-1 camera battery conversions brackets. Circle (2228)
AR-30: microcomputer-controlled fast-charger; 12-30V, single-channel; *AR-30/4* is 4-channel system with integral sequencer. Circle (2229)
FNP-1SB: Frezzi highest-energy output NP-1 type battery. Circle (2230)

G&M Power 16427
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Lithium batteries: in BP90 sizes. Circle (2264)
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1500PAR64: 1.5kW tungsten-halogen PAR64 lamp. Circle (2232)
ACL series: Thorn aircraft landing lamps for production effects. Circle (2233)
CMC GEL: gel filter and spun diffusion materials. Circle (2234)

Leonetti Company 20134
Sunray 2500W: HMI PAR. Circle (2235)
Electronic ballasts: model *EB 1200* 120Vac; *EB 2500, EB 4000* 240Vac. Circle (2236)
Sunray 18,000: HMI Fresnel. Circle (2237)

Lowel-Light 17569
Tota-shades: light control. barn door system for Tota-lights. Circle (2238)
L-Light: second generation of Lowel-Light first product line. Circle (2239)

LTM Corp. of America 17878
Superlite 18k: HMI Fresnel; 18kW rating; 60% more output in flood, 25% spot than 12k system; accessories. Circle (2240)
Cinepar 1200W S/E: single-ended PAR HMI lighting fixture. Circle (2241)
Cinepar 4000W S/E: single-ended PAR HMI lighting unit. Circle (2242)

PAG Ltd. 13408
PAG Belt IC2: battery belt, integral switched-mode charger; 12-14.4V 4-10Ah, 24V or 30V 4-7Ah; dual output on XLR4 connectors; over discharge protection; charger input range 100-250Vac. Circle (2243)
PAG AR30: auto-ranging single-channel fast charger; for 12-30VDC NiCad batteries; companion product *PAG AR304* includes four sequential channels. Circle (2244)

Sachtler 18512
575D1/Set 575D1: lightweight, compact daylight for location use. Circle (2245)

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PAR64 lamps: 1kW 120VAC units; *FFR* medium flood; *FFN* narrow spot; *FFP* narrow spot; *FFS* wide flood. Circle (2247)

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HDTV Proponent Executive Panel
3:45 - 5:00 p.m.
- Executives from ATRC, ATVA, NHK and Zenith/AT&T discuss the current state of HDTV and look toward the future.

Wednesday, April 15 (EBU Day)

Analog Systems
9:00 - 10:30 a.m.
- A report on various European experiences with advanced analog TV systems.

Digital Systems
11:00 a.m. - 12:30 p.m.
- Issues and updates on digital HDTV's progress in Europe.

HDTV Program Production
2:00 - 3:30 p.m.
- New directions in European TV production techniques brought about by HDTV will be discussed.

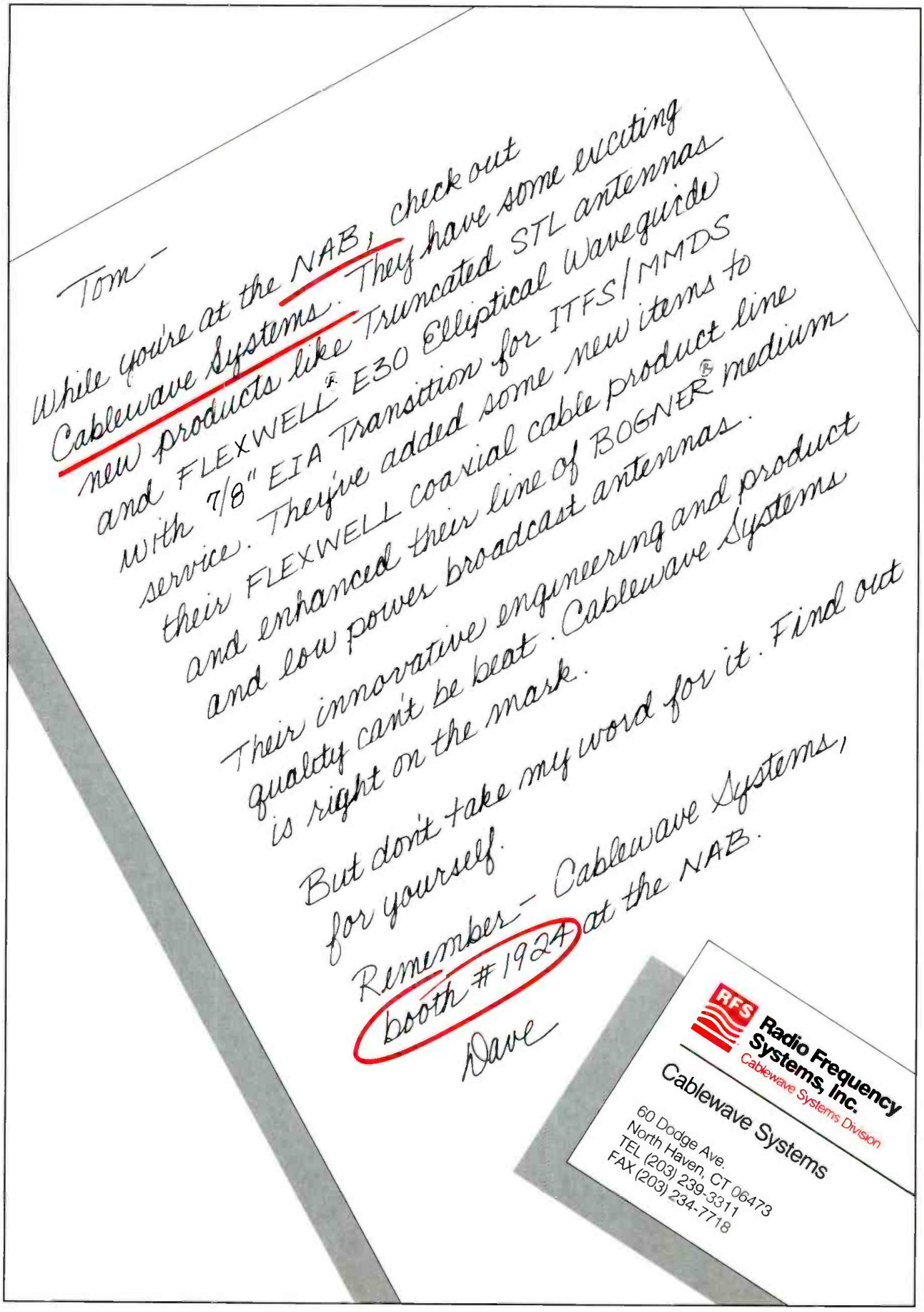
The European vs. the American Way: A Panel Discussion
4:00 - 5:00 p.m.
- American and European HDTV experts compare notes and examine future prospects.

Thursday, April 16

HDTV Systems Selection Process
9:00 a.m. - 12:30 p.m.
- A number of HDTV studies, testing procedures and test results are detailed, including several presentations by the ATTC.

HDTV Alternative Delivery Methods
9:00 a.m. - 12:30 p.m.
- Cable, satellite and optical HDTV delivery is discussed, along with theatrical and other non-traditional TV applications.

■



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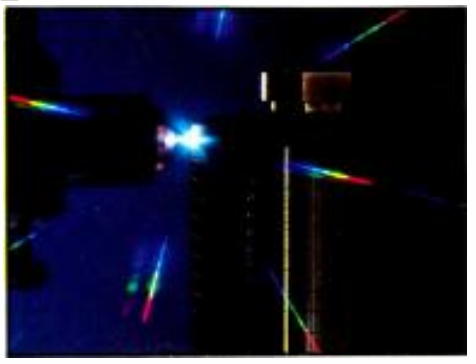
Applied Technology

UHF efficiency improvements — a review



By Roy Heppinstall, Heinz Bohlen and Geoff T. Clayworth

The technology of UHF TV broadcasting is passing through a period of rapid change brought about by the arrival of a new generation of highly efficient, high-power amplifier tubes. Three different families of transmitting tubes are now in use as the final amplifiers in UHF TV transmitters. The oldest of these families is represented by modern tetrodes, which now achieve output power levels to 20kW under reliable, safe operating conditions. However, the broadcast market is presently dominated by the klystron family, featuring output power levels to 70kW and outstanding performance with regard to reliability and life expectancy.

During recent years, the combination of beam control device (BCD) modulation and multistage depressed collector operation has increased klystron efficiency to, or even beyond, values previously only achieved by tetrodes. The driving force behind these improvements — the quest for saving energy — has resulted in the introduction of the inductive output tube (IOT) as the third family of transmitting tubes. The IOT combines the simplicity of the tetrode with the ruggedness of the klystron. This article describes the IOT in some detail, but in order to assess its position and prospects in the marketplace, it is first necessary to outline the characteristics and performance of the other two families of tubes.

The natural choice

When UHF television was in its infancy, tetrodes were the natural choice for the final amplifier. They were available, and their properties at high frequencies were well known from their use as VHF amplifiers. With some improvements, tetrodes soon realized an output power level of 10kW at frequencies to 860MHz. Their gain was low, and they had to be driven by other thermionic tubes — semiconductors could provide little power in those days. Since then, numerous improvements

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have made the UHF tetrode into a UHF power amplifier with remarkable amplitude and phase characteristics. Tubes are available with air cooling (usually to 10kW) as well as water- and vapor-phase cooling (to 20kW or even more). Tubes for 50kW and higher levels have been designed. However, good results with regard to reliability and life are restricted so far to output powers to 20kW, for which average lifetimes of approximately 8,000 hours have been reported.

UHF power tetrodes have to cope with high specific power densities because of the frequency-related small dimensions of their electrodes. The best results so far have been achieved with tubes featuring mesh-type cathodes made from thoriated tungsten wire and grids manufactured from pyrolytic graphite. Typically, a 10kW tetrode, such as the CR2382, operating at 600MHz, has a gain of 13dB and figure of merit of 0.9.

The advantages of klystrons

Klystrons have been used as the final amplifier in UHF TV transmitters for many years. The main reason was their excellent reputation for high stability and reliability and the fact that they have a high gain. This was an important factor at a time when IF modulation had not been introduced and there was a need to increase the power level of UHF TV transmitters. The first generation of klystrons was entirely water-cooled. They had external cavities and homogeneous focusing provided by coils. Although three different subtypes were needed to cover the 470-860MHz range, the main disadvantage of these rugged high-gain tubes was a lack of efficiency, because they only had figures in the region of 0.34. This consideration gave birth to a second-generation klystron — an entirely air-cooled external cavity 10kW tube. The klystron covered the entire frequency range with a single set of tubes and cavities. It had periodic magnetic focusing with permanent magnets and a single-stage depressed collector — a bold step forward at the time. However, limited signal precorrection capability restricted the figure of merit of this tube to 0.45.

The following two decades saw general improvements in klystron performance. In particular, power levels were increased to 60kW. The use of the depressed collector principle and periodic focusing, were abandoned to avoid complexity. Spiraling energy costs in the early 1980s led to users re-emphasizing the need for improved electrical efficiency.

The inductive output tube (IOT) is another step in the search for higher efficiency in UHF TV power amplifiers. Although the current devices are rated at 40kW in water-cooled and air-cooled versions, a step toward 70kW can be expected in the near future.

Initially, some improvement was achieved by pulsing the klystron modulating anode, but this technique did not yield *completely reliable* results until the introduction of klystrons equipped with a low-voltage beam control electrode. Pulsing the beam through this electrode current during the synchronizing pulse resulted in a figure of merit of 0.65 for

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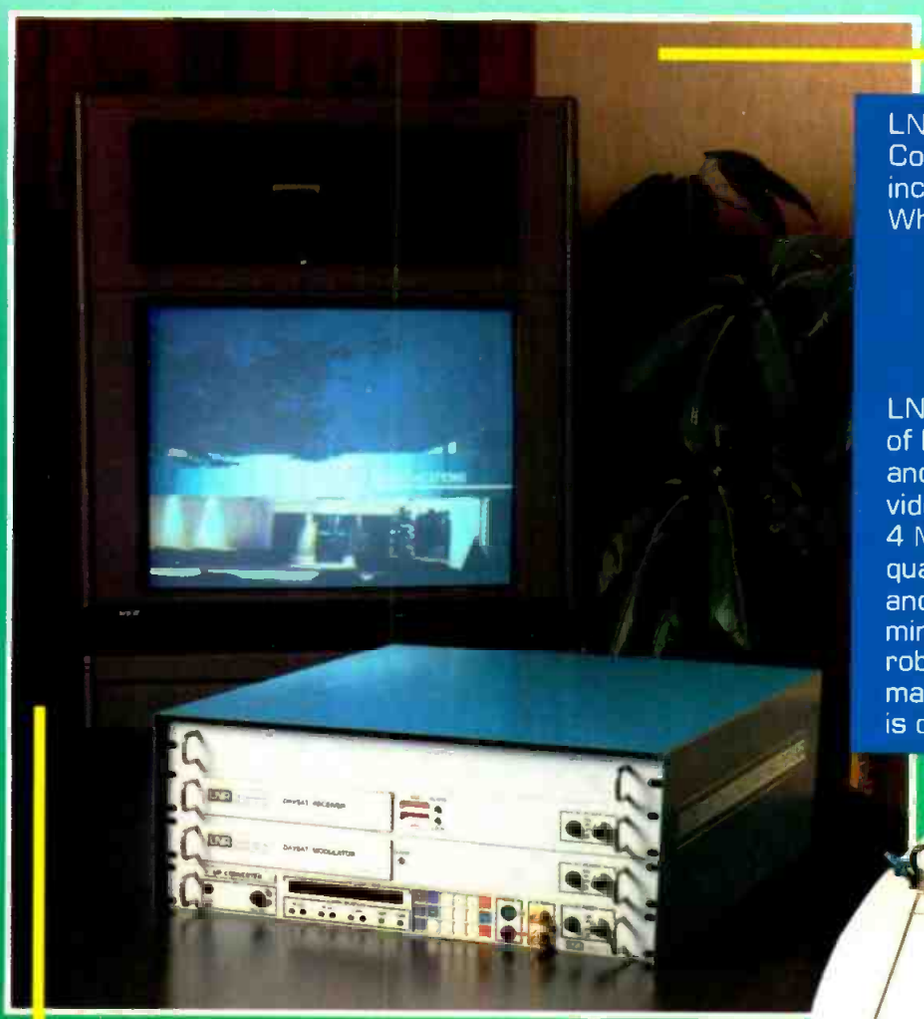

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A more dramatic improvement in klystron figure of merit has been achieved by the re-introduction of the depressed collector principle. The standard collector has now been replaced by a 5-stage collector, with each stage consisting of a specially shaped water-cooled copper electrode separated from adjacent stages by ceramic insulators. The electrodes are maintained at successive voltages between earth and full-beam voltage. The result causes beam electrons to be decelerated before impacting on the electrode surfaces, thus saving energy. Such tubes operate at a figure of merit of 0.9 without BCD modulation and 1.3 with BCD modulation. A possible major problem with such collectors is that secondary electrons originate at the conductor electrode surfaces and these can affect the figure of merit obtained. They can also re-enter the RF region of the tube, creating a kind of electronic feedback resulting in severe signal disturbances. Such effects can be minimized by coating the electrode surfaces with materials to suppress secondary electron emission. This can, however, cause technological problems, such as gas generation. An alternative technique is to employ a varying magnetic field between the output cavity and the collector entrance to deflect slow electrons onto the wall of the tube.

IOT, the latest UHF TV tube amplifier

The past decade has seen the development of the latest UHF TV tube amplifier — the *inductive output tube*. This tube is based on an idea first described by Andrew Haeff back in 1938-39. It essentially combines various aspects of tetrode and klystron technology to produce a compact, highly efficient UHF amplifier and can actually be regarded as a special tetrode, its specialty being the inductive output cavity.

An IOT operates on a different principle from a klystron. The electron beam is density-modulated in the gun region by applying the input RF signal between the impregnated tungsten cathode and a grid positioned close to, and in front of, the cathode. The grid is manufactured from pyrolytic graphite, a material chosen for its excellent mechanical and thermal properties. A negative bias voltage, approximately −80VDC, is applied to the grid to produce a low quiescent beam current (approximately 200mA) without RF drive. The density-modulated beam is then accelerated by a voltage near 30kV to the output region, where power is extracted through the alumina output ceramic.

The conversion efficiency of the IOT is relatively high (nearly 55%), and because the beam current varies directly with the applied RF power, the collector needs to

PROPERTIES OF DIFFERENT TUBE FAMILIES				
	TETRODE	KLYSTRON BCD	IOT	KLYSTRON ESC+BCD
Reliability	Very good to 10kW. Good to 20kW	Very Good +	Unknown, expectations to be good ≈	Unknown, expectations to be good ≈
Life expectancy (Hours)	8,000 —	>30,000 +	>20,000 (expected) ≈	>20,000 (expected) ≈
Tube price	Low +	Medium ≈	Medium ≈	High —
Amplifier complexity	Low +	Medium ≈	Low +	High —
Gain (dB)	13-16 —	30-38 +	20-23 ≈	30-38 +
Figure of merit	0.9-1 ≈	0.65-0.75 —	1.1-1.3 +	1.1-1.4 +

Table 1. *Properties of different tube families.*

TUBE FAMILIES SUITABLE FOR VARIOUS OUTPUT POWER LEVELS				
Amplifier output power	Tetrode	Klystron	IOT	Klystron
50kW-70kW	...	≈	+	+
30kW-40kW	...	≈	+	≈
20kW	≈	≈	+	...
10kW	+	...	...	...

Table 2. *Tube families suitable for various output power levels.*

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have only a relatively low-power dissipation capability. This enables the tube to be compact (less than half the size of a standard klystron). Therefore, it can be handled by one person.

An essential requirement for TV operation is the achievement of the required bandwidth. The circuit assembly has been designed to achieve this while being tunable over the 470-860MHz spectrum, as is the case with modern wideband klystrons. The input circuit at the top of the assembly is a patented coaxial type cavity, featuring a large basic bandwidth. Special precautions are taken to ensure that the necessary DC supplies (beam voltage, heater power and grid bias) and the RF drive can be applied to the various electrodes without causing RF oscillation, while at the same time maintaining the required DC isolation characteristics. The output system consists of a pair of interconnected waveguide cavities, providing the bandwidth required for the stable transmission of TV signals, including combined vision and sound operation.

Two versions of IOT tubes are presently in operation — water-cooled and air-cooled. Both are rated for power levels to 40kW. The air-cooled tube is particularly attractive where water cooling is not a practical proposition. Figures of merit in excess of 1.25 have been obtained, and the gain of the tubes (20dB or more) is considerably higher than that of the tetrode, enabling the tubes to be driven by modern solid-state drive amplifiers.

The initial reaction of the broadcast market to these new tubes has been encouraging, and the demand for them is high. Development activities are continuing, and it is anticipated that 60kW water-cooled IOTs will be placed in service soon. This will ensure that the IOT family of tubes is suitable as amplifiers for a wide range of UHF transmitters, particularly those using combined vision and sound amplification (multiplexing). It will, of course, be only one of three different tube families (tetrode, klystron and IOT). With regard to the klystron, two subgroups can be considered — klystrons with BCD modulation and klystrons with BCD modulation and a multistage depressed collector.

Increasing the choices

In an effort to simplify assessment of the relative merits of the various families of tubes, two tables have been prepared. In Table 1, a number of properties of the different tube types are compared and valued (+ corresponds to advantageous, ≈ to acceptable, – to disadvantageous). With regard to reliability, it should be noted that the IOT and the multistage depressed collector technology are new and there is insufficient life data to draw meaningful life expectancy conclusions. The life expectancies for the new types reflect the fact that klystron technology is involved — complicated by either a grid (IOT) or a complex multistage depressed collector. The amplifier complexity is weighted in accordance to the requirement for special equipment, such as BCD modulators and MSDC power supplies. Tube prices are assessed in fairly coarse categories, the relationship high to medium to low being roughly 3 to 2 to 1. Based on these results and on the power capability of the tubes, Table 2 assesses the suitability of each of the groups for different power levels, naturally under the assumption that these new devices live up to expectations.

The arrival of these new tubes has significantly extended the choice of thermionic devices available to UHF TV broadcasters, and this will present quite a challenge to the ambitions of semiconductor transmitter manufacturers at power levels exceeding 5kW.

Roy Heppinstall, PhD, is senior engineer, power tube division; Heinz Bohlen is engineering manager, power tube division; Geoff T. Clayworth is head of klystron projects, engineering department for EEV, Ltd., England.

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Audio EQ module
By Aphex Systems

• **Model 9901:** parametric equalizer fits Aphex 9000 processor rack; overlapping frequencies of three filter bands allow multiple EQ settings with same bandwidth.

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By Crouse-Hinds Airport Lighting

• **Red/white obstruction beacons:** combination of red and white warning lights using EG&G FG-2000 white strobes; for installations where white beacons are objectionable at night.

Circle (376) on Reply Card

Synchronizer system
By Digidesign

• **Video slave driver:** uses house sync or blackburst signal as reference to synchronize tape and disk equipment with Pro Tools multitrack audio production system.

Circle (377) on Reply Card

Audio-mixer option
By Harrison by GLW

• **Graphic interface:** interactive video display for Series Ten-B automated consoles; GLW NuBus video processor in Macintosh and PC-controlling automation; for display and adjustment of controls and parameter settings.

Circle (390) on Reply Card

Roland introduces the Digital Audio Workstation for everyone.

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Circle (139) on Reply Card

Radio, audio products

By EELA Audio

• **S-120:** broadcast version of audio mixer; includes facility modules in the top rack; suitable for production work.

• **EELA music-play automation:** interactive for live-assist or automated continuous-play system; central machine room with VDU terminals in the studio; can be linked with audio consoles to be a music source.

• **EA 915 hybrid:** incorporates digital echo cancellation to reduce hybrid crosstalk; 19-inch package requires 1-rack unit.

Circle (380) on Reply Card

Blackburst, DA units

By ESE

• **ES-219:** blackburst source; integral generator produces four outputs with SC/H-phased output of sync, blanking, reference black setup and color burst; internal adjustment of subcarrier frequency and SC/H phase controls.

• **ES-237:** high-resolution video DA; rated for 120MHz bandwidth; 1×4 unit suitable for graphics, HDTV or composite video.

Circle (383) on Reply Card

Audio distribution

By Image Video

• **ADA-2001:** audio DA with jumper selection for 3-output/channel stereo, 6-output mono modes; balanced stereo input with six summed outputs; +16dB gain with maximum output of +24dBm.

Circle (394) on Reply Card

Modulation measurements

By Rohde & Schwarz

• **FMB modulation analyzer:** wide dynamic range, high measurement speed to 5.2GHz; suitable for microwave, broadcast frequencies; useful as RF counter, power meter, voltmeter, psophometer and distortion meter.

Circle (421) on Reply Card

TBC/synchronizer

By Hotronic

• **Model AP41:** combination TBC, synchronizer for composite and Y/C inputs; full proc-amp control with gen-lock; strobe, optional pixel-by-pixel dropout compensation; serves VHS, S-VHS, U-matic (SP) and satellite-feed synchronizer requirements.

Circle (393) on Reply Card

Power-protection devices

By Falcon Electric

• **UVS Plus L series:** uninterruptible voltage sources for engineering, computer equipment in mobile vehicles; UVS1k-1L 1kVA, UVS1.25k-1L 1.25kVA, UVS1.5k-1L 1.5kVA systems; configurations for frequency converters, dedicated DC-to-AC inverters or use with generators.

Circle (384) on Reply Card

Video transcoding

By Vistek Electronics

• **V4001 transcoder:** converts PAL to SECAM with V4021 Varicomb PAL decoder, V4136 SECAM encoder in 2RU enclosure; PAL subcarrier suppression, adaptive chrominance notch for reduced color interference; encoder includes color difference, RGB components inputs; five encoded outputs.

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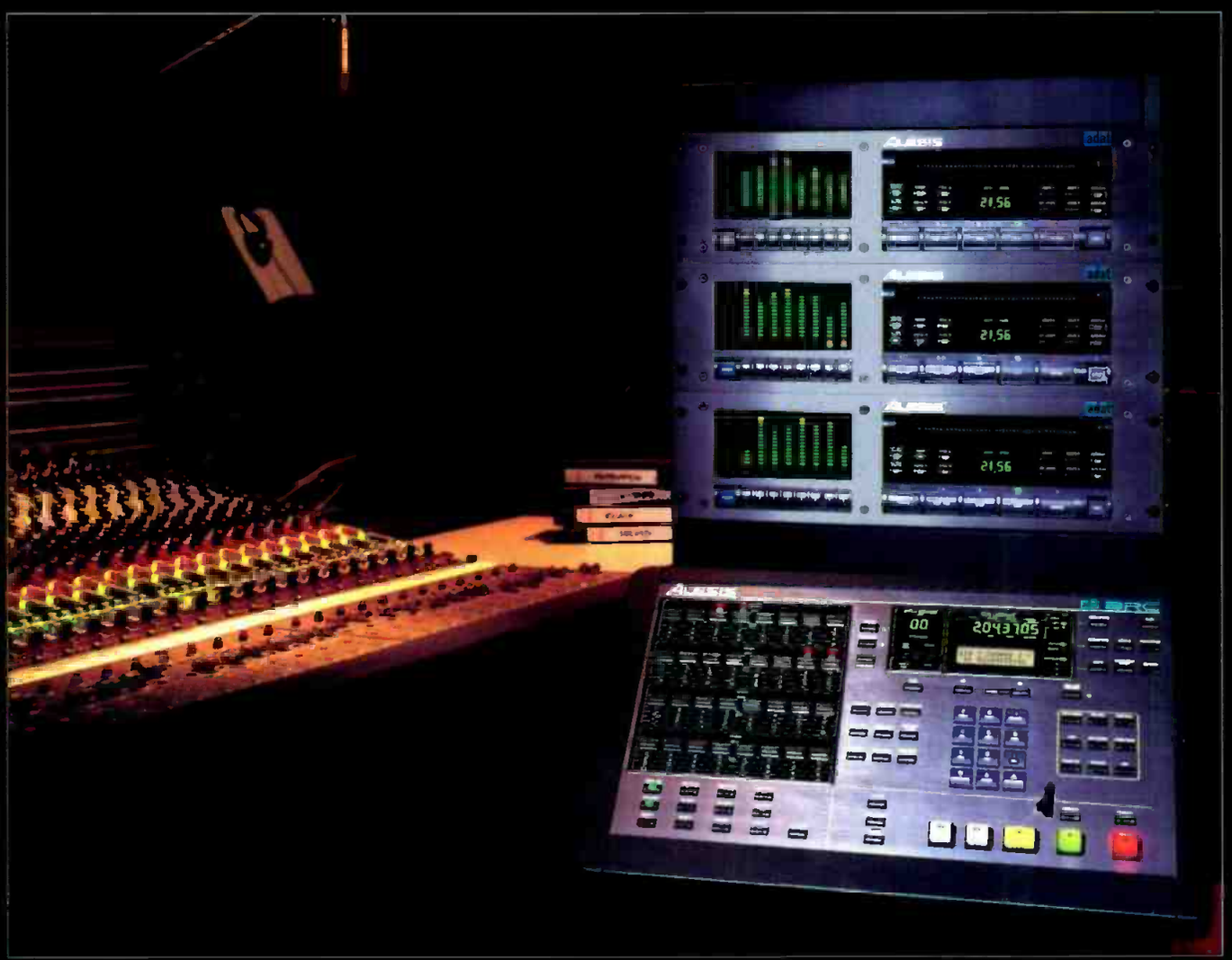

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Enhanced camera

By JVC Professional Products

• **KY-17FITU:** upgrade camera uses 3-frame interline transfer CCDs; improved resolution, reduced vertical smear; correlated double sampling noise reduction; 700-line resolution.

Circle (399) on Reply Card

Microwave transmitter

By RF Technology

• **RF-223GL:** portable transmitter for 1.7-3.5GHz (2GHz and 2.5GHz bands in United States); frequency agile; 10W minimum output; 12VDC or 115VAC operation.

Circle (420) on Reply Card

Weather service

By SeaSpace

• **TeraScan:** directly accesses 1km-resolution images from polar-orbit NOAA weather satellites; HRPT antenna server receives, processes, archives and displays data with 10× the resolution of other weather services.

Circle (422) on Reply Card

Video encoder, color framing

By Nova Systems

• **4-field option:** for NOVASync frame synchronizers; proper color framing reduces horizontal picture shifts; removes artifacts in frozen images.

• **Ncoder:** RGB, component video-encoding system accepts interlaced RGB, RGB/S, Y/R–Y/B–Y producing NTSC composite, Hi8, S-VHS and U-matic dub formats.

Circle (411) on Reply Card

Time-code conversion

By ESE

• **ES-2695, ES-2743A:** units convert between time code in SMPTE, ESE formats; for operation of master clock systems; ES-2695 drives 100 ESE clock slave units one pair of wires.

Circle (382) on Reply Card

Multichannel monitoring

By For A

• **MV-40D:** signal-processing device displays four signals on screen; all may be non-synchronous; expand any picture to full screen; freeze function for each channel; character generator for source ID.

Circle (385) on Reply Card

Auxiliary power

By Frezzolini Electronics

• **Sun Panel:** 9×12×1/2-inch unit (closed) weighs 1.5 pounds; 15W output in continuous sunlight; 2-hour charge for NP-1 battery; adapter cables for all standard batteries.

Circle (386) on Reply Card

Graphics software

By Great Valley Products

• **Scala 500:** titling, presentation graphics package for Amiga A500 by Digital Vision of Norway; includes many transition features in full color; 3-D effects.

Circle (387) on Reply Card

Fiber transmission

By Harmonic Lightwaves

• **YAGLink:** for CATV operation; AM-video transmission system uses optical transmitter, externally modulated laser and predistortion to carry 80 channels on 30km fiber circuit.

Circle (389) on Reply Card ■

Preview

April...

FACILITY AUTOMATION

- **The Dollars and Sense of Master Control Operation**

Station engineers and managers struggle for ways to cut costs. One way is to automate mundane and repetitive tasks.

- **Integrating Newsroom Automation**

Newsroom automation is a growing area. Stations, caught in the squeeze caused by smaller staffs, find that newsroom automation can save time and allow a limited staff to do a better job of covering the news.

- **Closing the Loop**

Connecting it all together. That's the goal for TV stations as they attempt to interconnect a wide range of islands of computerization.

- **The Digital Radio Station**

It is now possible for a radio station to integrate many of the production and on-air functions into a single system.

- **High-Performance Recording Tape**

The article will look at the performance characteristics of today's high-performance tapes.

May...

RF TRANSMISSION SYSTEMS UPDATE

- **Multichannel TV Antennas**

As tower space becomes more difficult to obtain and more expensive, stations are increasingly looking toward sharing facilities.

- **Considerations in building a 1,000-Foot Tower**

Building a "tall" tower requires special considerations.

- **Lightning-Protection Systems**

There's an old engineering axiom, "The probability of any antenna or tower being struck by lightning is directly proportional to its value.

- **Solving RPU Intermod Problems**

Remote pick-up systems are critical to many radio and TV stations' operations.

Industry Briefs

BUSINESS SCENE

Paramount Television, Los Angeles, has added two AJ-D350 D-3 digital studio VTRs from Panasonic Broadcast & Television Systems to the technical plant that produces *Entertainment Tonight.*

Chyron's iNFINiT! was interfaced with the Dynatech Newstar newsroom automation system, which allowed for better control of the copy at KTLA-TV, Melville, NY. Canadian Broadcasting Corporation (CBC) recently purchased 12 Chyron MAXI! and four Chyron iNFiNiT! systems.

Canon, Los Angeles, has delivered a lens package to be used on an Ikegami HL-53s to KUSA-TV, Denver, a member of Gannet Broadcasting Group.

TGI North America Incorporated, Ontario, Canada, has sold 12 pairs of Tannoy System 8 DMT studio reference monitors to HBO Communications for its Long Island facilities.

A.F. Associates, Northvale, NJ, has sold two AVS ADAC standard converters to California companies. All Post in Burbank, CA, purchased its first ADAC, and VDI of Hollywood added a second ADAC to its facility.

Abekas Video Systems, Redwood City, CA, has sold an A72 SPORT interface to Texas Video & Post. The character generator is helping to produce a 12-volume set videotape of the New Testament.

Trident Audio USA, Torrance, CA, has sold its latest console, the Vector 432, to CBS Television City in Los Angeles. CBS will use the console for its new teleproduction studios.

Television Technology Corporation (TTC), Louisville, CO, received a half-million dollar contract to build and install a 20kW UHF TV transmitter for Malaysian TV (MTV) in Sri Lanka. Last December, TTC installed in Sri Lanka an older version of the same transmitter.

Sony Broadcast and Communications, United Kingdom, has announced that its D-2 has been chosen by Swedish Televison (STV) as the composite digital format to replace its existing 1-inch VTRs.

Neve, England, has sold eight of its 66 Series broadcast mixing consoles to replace the consoles at RAI Radio, Italy's national broadcasting station. Neve delivered its first 66 Series console to RAI in mid-1991.

A.F. Associates, Northvale, NJ, has sold an AVS manuscript character generator to BetaBay, Portland, OR.

Ultimatte, Chatsworth, CA, has sold an Ultimatte System-6 production system to In-Sync in Dallas and to RGB Post.

TIW Systems, Sunnyvale, CA, has been awarded a contract by the Societe Europeenne des Satellites S.A. to provide a combined TT&C and communications earth station to be installed at SES's Satellite Control Facility in Betzdorf.

PEOPLE

Bill Sturcke has been named product manager for Broadcast Cameras for the Panasonic Broadcast & Television Systems Group, Secaucus, NJ.

Frederick A. Schaefer has joined Varian Associates as marketing manager of the Microwave Tube Products unit.

Kenneth F. Wiedeman and **Joseph E. Tibensky** have been appointed to positions with Sony Professional Tape Division, Boulder, CO. Wiedeman, former director of sales, has been promoted to vice president of sales and marketing. Tibensky has been named director of marketing.

John Burrell has been appointed district sales manager for Tektronix Television Division's sales force, Beaverton, OR. He covers the Colorado, Wyoming, New Mexico and Utah areas.

Dave Sanders has joined Grass Valley Group, Grass Valley, CA, as general manager of its production systems division.

Richard Bauarschi has been named marketing manager of Pioneer Communication's VideoDisc Recorder Products, Multimedia Systems Division, in Upper Saddle River, NJ.

Steve Metzger has been promoted to assistant sales manager of Audio Animation's sales and marketing division, Knoxville, TN.

Edwin Karl has been promoted to director of engineering for Northstar Television, Rehobath, MA.

Donald R. Lockett has been named vice president of Video Engineering for NPR, Washington, DC.

John Missale has been promoted to vice president of Video Engineering and Broadcast Operations, Flushing, NY.

Charles D. Coyle and **Dick Lawrence** have been appointed to positions with C-COR/COMLUX, Mountain View, CA. Coyle is the Eastern regional sales manager. He is responsible for all non-CATV sales of the company's digital fiber-optic products east of the Mississippi. Lawrence is Western regional sales manager and is responsible for such sales west of the Mississippi.

David Stafford has been named video product manager at the manufacturing facility of Ampex Recording Media, Opelika, AL.

C.J. Weij has been appointed European sales manager of HM Electronics, The Netherlands. He covers Belgium, Denmark, Finland, France, Germany, Greece, Italy, Luxembourg, The Netherlands, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Sidney Rivenbark has joined JVC, Elmwood Park, NJ, as district sales representative for its Professional Products Company. He is responsible for sales in North Carolina, South Carolina and Georgia.

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CHIEF ENGINEER: KSTS Channel 48/Telemundo in San Jose seeks applicants for the position of Chief Engineer. Extensive UHF transmitter experience required. Competitive compensation and benefits. Send resume to: Human Resources, KSTS TV 48, 2349 Bering Drive, San Jose, CA 95131. 3-92-1t

TELEVISION MAINTENANCE TECHNICIAN: Applicant should have 3-5 years of television studio maintenance experience. Operational experience is also helpful. Successful applicant will have expertise in construction, VTR repair and system maintenance. FCC General Class license and a valid drivers license are required. Resumes to CE, KCPQ-TV, P.O. Box 98828, Tacoma, WA 98499. EOE. No phone inquires. 3-92-1t

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ELECTRONIC ENGINEER SHOP/FIELD SERVICE. Swiderski Electronics, Inc. located in the Chicagoland Area, is looking for a Video Service Engineer with a minimum of 2 years experience. Person to work with Industrial/Broadcast ½", 1" & ¾" VTR's and related equipment. Full Time Position. Mon. thru Fri. 8-4:30 pm. Full Company Benefits. Send resume and salary history to: Human Resources Department, 1200 Greenleaf Ave., Elk Grove Village, Illinois 60007. Fax resume to: (708) 364-5019. EOE M/F t-92-3t

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CNN HEADLINE NEWS

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CHIEF TELEVISION & RADIO ENGINEER: Experienced engineer needed for San Jose State University's Radio TV & Film program. Repair 1KW FM radio station, TV studio industrial video cameras, VTRs, audio boards & accessories. Requires 3 yrs. experience in TV & Radio broadcast maintenance (prefer 5 yrs.); FCC 1st Class or general license. SBE certificate desireable. Full state benefits. SALARY: $44,148-$53,280. SJSU Human Resources, One Washington Sq., San Jose, CA 95192-0046. Call (408) 924-2265 for REQUIRED APPLICATION. EOE 3-92-1t

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SCA Data Systems, Inc.	184	120	213-576-0655
Schmid Telecommunication	157	80	800-955-9570
Sennheiser Electronics Corp.	70,186	42,132	203-434-9190
Shure Brothers, Inc.	1,MAP	3	800-25SHURE
Sierra Automated Systems	202	151	818-840-6749
Sierra Video Systems	158	145	916-273-9331
Sigma Electronics Inc.	201	148	717-569-2681
Sony Business & Professional Group	MAP,22-23,124-125		800-635-SONY
Sony Pro Video Tape	117,119,121,123		800-635-SONY
Sprague Magnetics	174	107	818-994-6602
Star Case	196	137	213-985-3390
SS7 Summit	99	38	
Synergistic Technologies	188	129	412-928-0448
Tascam	120	67	213-726-0303
Tektronix, Inc.	IBC	2	800-TEK-WIDE
Telemetrics, Inc.	3	4	201-423-0347
Thomson Broadcast	50,169	28,100	201-569-1650
Thomson Tubes Electroniques	53	30	331-604-8175
Toshiba Corporation	127	69	
Total Spectrum Mfg., Inc.	21	13	914-268-0100
Trompeter Electronics	174	106,161	818-707-2020
Television Technology Corp.	87	50	303-665-8000
Ultimatte	131	71	818-993-8007
United Ropeworks (USA) Inc.	172	104	215-368-6611
Utah Scientific	43	23	800-453-8782
Vega, A Mark IV Company	62	34	818-442-0782
Videotek, Inc.	77	46	215-327-2292
Vision Fund	34	19	212-806-0077
Vistek	160C	159	
The Winsted Corporation	203	127	800-447-2257
Wohler Technologies, Inc.	204	158	415-285-5462
Yamaha International Corp.	129	70	714-522-9011
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