BROADCAST engineering

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SPOTLIGHT ON: Automation Systems

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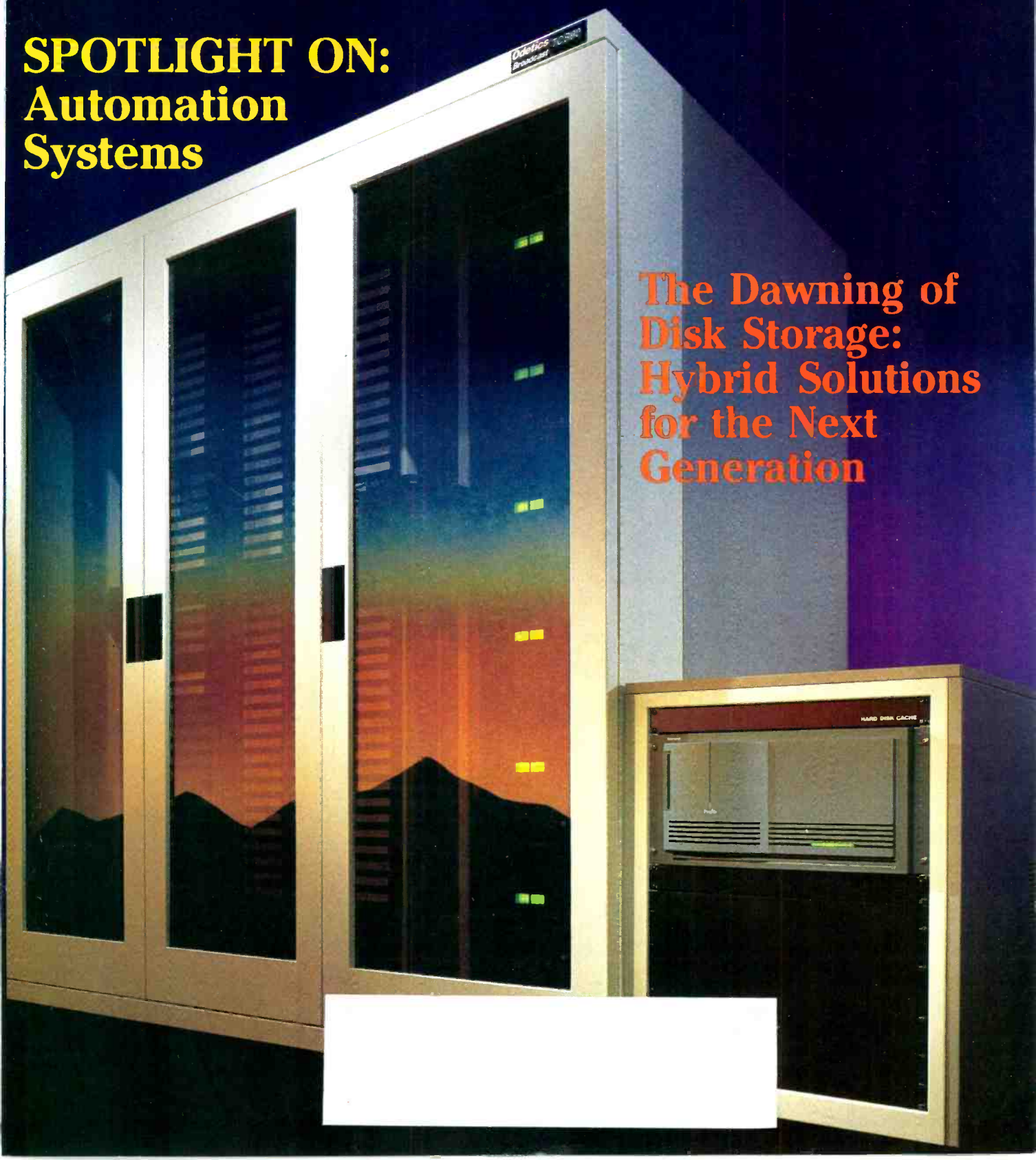

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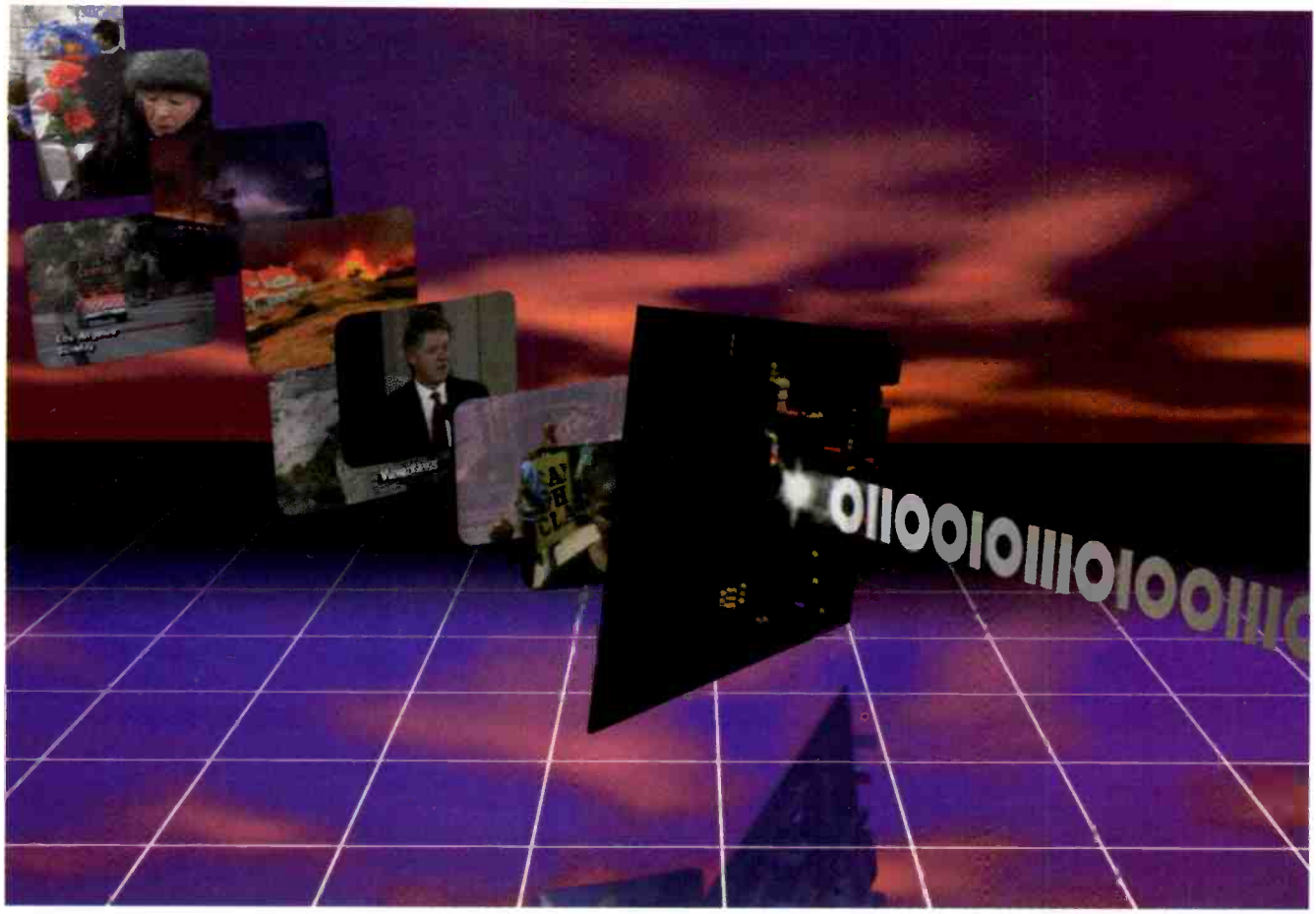

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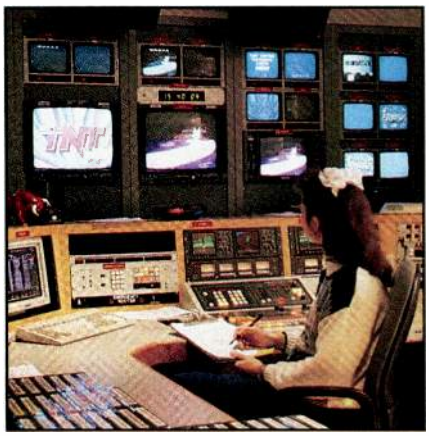

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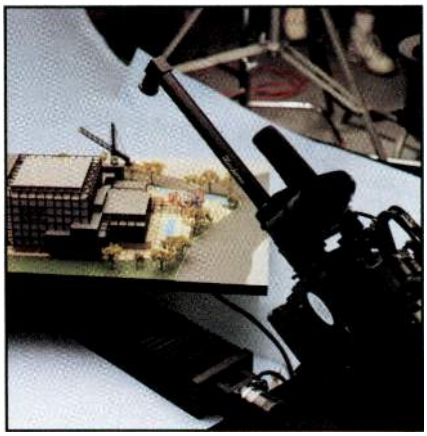

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Facility Automation Special Report:

Broadcast automation has moved well beyond the days of "pegboard" programming, stepping switches and relays to sophisticated computer-based control systems. Today's automation systems provide flexible control and interface capabilities that allow stations to operate more efficiently – and profitably than ever before.

DEPARTMENTS:

COLUMNS:

THIS MONTH...

ON THE COVER:

New era automation systems were exhibited at this year's NAB. Shown on the cover is an Odetics TCS90 library system with a Tektronix Profile disk cache. Photo courtesy of Odetics.

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News

By Dawn Hightower, senior associate editor

Senate Infohighway bill offers spectrum flexibility

New Senate legislation has given radio and TV stations greater spectrum flexibility to offer new broadcast services. Stations also want authorization to provide non-program related services, which will give broadcasters the ability to compete in tomorrow's marketplace with their pay-to-use, wired and wireless competitors.

On behalf of NAB, INTV, ABC, CBS, NBC and Fox, here is additional information relating to broadcasters' flexible use of assigned spectrum:

- Broadcasters are committed to maintaining free, universal, over-the-air service.
- A policy of flexible use of broadcast spectrum follows the policy objectives of H.R. 3636 — the delivery of new services to consumers through the promotion of vigorous competition. No new spectrum would need to be allocated.
- A flexible use policy will not undermine the Federal Communications Commission's (FCC) authority to make determinations concerning the delivery of ATV.
- The FCC should go forward with the process of assigning broadcasters additional spectrum for the purpose of providing ATV service. Broadcasters will use that second channel to further the FCC's goals with respect to ATV.
- Consumers should be able to receive the maximum benefits from the digital broadcasting revolution as quickly as possible.
- The ability to offer these services is consistent with the goal of efficient spectrum use. The authorization of flexible spectrum use for new services is needed to ensure that broadcasters have the ability and incentive to develop the most efficient spectrum use.
- Broadcasters expect to pay an appropriate fee when they offer new types of ancillary and supplemental services in the spectrum assigned to them for ATV.

SBE introduces radio station operator course

The Society of Broadcast Engineers (SBE) has introduced the SBE Radio Operators Certification Course. It is designed for entry-level operators at radio stations. The course is intended to replace the former FCC Radio Telephone Third Class Operator License.

The course will consist of the SBE Radio Operators Handbook and a customized 50 question examination drawn from 150 questions. Candidates will be issued a certificate as a SBE Certified Radio Station Operator after successfully completing the course.

The course may be ordered through the SBE National Office by calling 317-253-1640 or by fax 317-253-0418. The cost of the course is $35, which includes the exam fee. Candidates or their employers need not be a member of the SBE to take the course.

International News

IBC and Montreux ITS conventions scheduled for 1995

Previously, the Montreux International Television Symposium and the International Broadcasting Convention were scheduled in odd and even years respectively, but with IBC's decision to have an annual convention, 10 major manufacturers say they cannot support participation in both conventions taking place in 1995 and have chosen to participate in the Montreux ITS 1995. The 10 companies are: BTS, General Instrument, National Transcommunications Ltd., Panasonic, PESA, Philips, Rank Cintel, Sony, Thomson and Quantel.

Montreux ITS will take place June 8-13, 1995. For more information contact: Montreux International Television Symposium and Technical Exhibition, P.O. Box 1451, Rue du Théâtre 5, 1820 Montreux/Switzerland; telephone 021 963 32 20 (national) and +41 21 963 32 20 (international); fax 021 963 88 51 (national) and +41 21 963 88 51 (international).

The IBC 1995 will take place Sept. 8-12, 1995. The 1994 IBC will take place Sept. 16-20, 1994 in Amsterdam. For more information contact the IBC Convention Office; telephone 44 (0)71 240 3839; fax 44 (0)71 497 3633.

■

BROADCAST engineering

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CORRESPONDENCE
Editorial and Advertising: 9800 Metcalf, Overland Park, KS 66212-2215. Telephone: 913-341-1300; Editorial fax: 913-967-1905. Advt. fax: 913-967-1904.

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Editorial

One size doesn't fit all

Consumers are already becoming deaf to the thundering din of new announcements about the super highway, National Information Infrastructure (NII) or whatever you want to call the conglomeration of new media technologies. It seems not a day goes by without another company announcing some nifty, new or fantastic solution-to-everything, box or gizmo that no TV user in his right mind could live without. At times I think the pronouncements resemble more a circus than a high-tech revolution.

Although some of us rightly remain skeptical about many of these high-tech claims, the press and news crews echo their hype while being blindly led down a techno-path to nowhere. Hasn't anyone thought of asking the consumer (the guy and gal who's going to have to pay for this) what they really want?

Finally someone has done just that. Odyssey, a research firm specializing in consumers' attitudes about technology, recently issued a report that provides some useful insight into what the new media users really want. The results suggest that much of the ballyhoo about what consumers really want, and will pay for, is just that — bunk.

In a study involving more than 4,000 consumers, Odyssey found that the market for new media is not homogeneous, but actually comprised of six quite different market segments. Each market segment, or user category, represents a different attitude toward new media offerings including cable and interactive television. These attitudes suggest how and when each group will embrace or adopt new offerings. Let's look at these six groups of consumers.

New Enthusiast, represent those on the cutting edge of technology. These consumers have a strong desire to learn new things and master new technologies. They are demanding consumers who insist on high performance.

The *Hopeful* consumers are similar to the New Enthusiasts, but they lack the economic and educational means of the above group. As a result, they are concerned about anything that sounds expensive or seems difficult to use.

The *Faithful* households are neutral. They are not opposed to new technologies, but not turned on to them either. They are satisfied with current television. Although they are willing to pay more for new products, they see no real need for change.

Oldliner households don't care. They are not interested in learning new technologies and express an above average degree of dissatisfaction with current TV programming. Although they are the heaviest users of television, they also are concerned about cost and are unlikely to be motivated by any new products that appear to be cutting-edge technology.

Independent households lead lives where technology and television don't play an important role. They watch less television than any other group and have a below average cable TV subscription rate. For them, television is already good enough.

Surfer households are ambivalent about technology. This group watches more television than most and is generally satisfied with the offerings. However, although they have an above average cable subscription rate, they are the most dissatisfied with their cable TV companies. They are quite cynical about big business and concerned about privacy issues.

So there you have it. Despite what many pundits have told us, the media-buying public is not of a single mind. Like everything else we buy, there are always other options. The adage, "One size fits all," doesn't work with media any more than it does with underwear.

Brad Dick

Brad Dick, editor

Editor's note: For more information on the research, contact Odyssey in San Francisco.

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FCC Update

Grand Alliance chooses Zenith transmission subsystem

By Harry C. Martin

On Feb. 16, the Grand Alliance of U.S.-sponsored all-digital advanced TV (ATV) systems selected the 8VSB (vestigial sideband scheme) transmission subsystem developed by Zenith Electronics Corporation as its standard. According to NAB, this decision is the final major technical step in the process of developing a system that will be submitted for FCC approval. The decision followed tests at the ATV test center, which showed that the Zenith system affords a more interference-free service and one with less impact on the existing NTSC system than does the competing 32 QAM system.

On Feb. 16, the Grand Alliance selected the 8VSB transmission subsystem as its standard.

The Grand Alliance of HDTV proponents was formed in 1993 to avoid duplication of effort, expense and delay in the development of ATV. Also, it was believed that combining the competing technologies would prove beneficial in developing the best possible single system.

The FCC Advisory Committee must approve and test the 8VSB subsystem before an overall ATV proposal is submitted to the agency for final approval. The target date for final approval is early 1995.

FCC sets tougher EEO sanctions

On Feb. 1, the FCC adopted guidelines that greatly increase the amounts of fines and the likelihood of short-term renewal or hearing designation for violation of the EEO rules. The FCC applied those guidelines to assess fines ranging from $18,500 to $37,500 against more than a dozen licensees that made inadequate recruitment efforts. Nearly all of these stations were given short-term renewals with reporting conditions.

Martin is an attorney with Reddy, Begley & Martin, Washington, DC.

Applicant "pool" requirements

The guidelines set a base fine of $12,500 plus imposition of reporting conditions when a licensee fails to recruit in order to attract a pool of minority/female applicants for at least 66% of its vacancies during the license term. Inadequate record-keeping and/or lack of self-assessment throughout the license term is evidence of such failure. Where the percentage drops to 33%, the fine rises to $18,750.

Assessing the penalty

The guidelines include a complex system of criteria for upward or downward adjustment of the $12,500 base fine. It is based on the percentage of minorities/women in the labor force, the number of hiring opportunities and the station's employment profile. Where a rule is violated, short-term renewals will be assessed under many circumstances. Also, if a licensee had previously been assessed a sanction for an EEO violation, the stakes go higher rising to designation for a hearing and a possible fine of $250,000 if the licensee's prior EEO sanctions included a short-term renewal.

Record-keeping and self-assessment

Licensees must keep records of the race and sex of all applicants for each position filled and the referral source for each applicant. Licensees also must assess their EEO programs on a regular basis, and at least annually, determine whether their recruitment efforts require modification. Where minority/female recruitment sources are not referring adequate numbers of applicants, additional sources must be used.

Political programming rule violations

The FCC has admonished three broadcast stations and a cable operator for the following violations:

• *Failure to maintain complete political file.* A cable system was admonished for failing to include the following in its political file: information concerning requests for time and their disposition, scheduling and classes of time purchased, when the spots aired, and the specific rates charged. The FCC rejected the operator's reliance upon separate files to provide required information. The political file must include all required information, with the exception of the actual broadcast (or cablecast) schedule, which may differ from the contracted schedule. That schedule doesn't need to be placed in the political file immediately if a notation is placed in the file that schedule information will be provided upon request.

• *Lowest unit charge/package plan rate.* A station was admonished for failing to include all of its package rates in the calculation of its lowest unit charge (LUC). The LUC calculation must include individually negotiated packages, as well as those offered to all advertisers. The rules require disclosure of all rates and value-enhancing discount privileges offered to commercial advertisers, so the station was obligated to inform candidates that the rates in the package plans were available to them on a per-spot basis without the candidate having to buy the entire package. The station was ordered to rebate any overcharges.

• *Reasonable access: No flat limit on number of spots.* Two licensees were admonished for imposing a flat limit on the number of spots that could be purchased by federal candidates. A station may not decide, in advance, how much time it will sell to a federal candidate, but must consider each request individually.

• *Political rate cards/incomplete information.* Two stations were cited for not describing and defining classes of time available to commercial advertisers. ■

Date line

May 31, 1994 is the filing deadline for the FCC's 1994 Annual Employment Report. June 1, 1994 is the deadline for annual ownership reports or certifications for commercial broadcast stations in the following states and federal district: Michigan, Arizona, Idaho, New Mexico, Nevada, Utah, Wyoming, Virginia, West Virginia, Maryland, Ohio and Washington, DC.

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Strictly TV

Compression basics

By Curtis Chan

In industry news, it was announced recently that General Instrument (GI) will share its compression technology with Zenith Electronics, acknowledging that the technology will be cross-licensed with competitors, with the hope that hardware companies are taking the industry's interoperability issues to heart.

The agreement allows Zenith the right to use DigiCipher compression technology, while GI will gain access to Zenith's Vestigial Sideband (VSB) techniques, which were selected by the Grand Alliance (GA) as the transmission standard for HDTV. The decision by the GA to choose Zenith's VSB is a major boost for the company. If the VSB modulation technique proves to be a better system it could provide major income for Zenith.

Compression made easy

Because compression is becoming a major issue, you will be seeing it constantly along with references to MPEG and adaptations to the computer industry. Here's a quick tour on the fundamentals of compression.

To start, a single frame of broadcast-quality video is comprised of 640x480 pixels (computer world numbers) x 24 bits of color data equaling 900kB, and that does not include audio and ancillary data. Just how to do this is an artform onto itself, but looking at single-image (intraframe) video compression, there are seven basic processes involved.

The first four preprocessing steps are *filtering*, *color-space conversion*, *digitizing* and *scaling*, all of which have an effect on compression. The last three 'pure' compression steps are transforms, quantization and encoding. MPEG uses all of these steps plus predictive coding, motion compensation and picture interpolation because it deals with moving images (interframe compression).

• *Filtering.* This first process eliminates high-frequency noise from the signal that could lead to aliasing. This is usually done by averaging neighboring pixels or lines to produce a lower data rate.

• *Color-space conversion.* In a nutshell, RGB 'color space' is converted to YUV. Converting RGB space to YUV space is done by transforming vector components.

• *Digitizing.* Human vision is more sensitive to changes in luminance than to changes in chrominance. Because of this, a typical scenario would be to sample the U and V components twice for every four samples of Y. In converting from RGB to YUV, half the color information samples are usually discarded yielding image files approximately 600kB per frame.

• *Scaling.* Scaling or subsampling reduces the picture data dramatically. In non-broadcast applications, scaling can be used to reduce date rates to an equivalent 144-to-1 by keeping approximately one-sixteenth of the spatial data, one-third of the temporal data and one-third of the color bit depth data or 16x3x3. In actual use, scaling reduces the digitized data file from 600kB to around 110kB.

• *Transforms.* Transforms convert a signal's 2-D spatial representation to a frequency domain representation. In DCT, which is used in JPEG and MPEG, an FFT converts the image to frequency space (which is comprised of coordinates, dimensions or vectors) where most of the signal's energy is concentrated in low-frequency components (coefficients). DCT works on 8x8 blocks of pixels, which result in 64 coefficients. Using a matrix, the lowest-frequency term is at the upper left, higher-frequency horizontal coefficients increase from left to right and higher-frequency vertical coefficients increase from top to bottom.

Wavelet compression uses image transforms then decomposes the image into multiple spatial images (low-pass or averaged and a high-pass or differenced image) that shows only the rapid changes in the image. This keeps the transformed information relatively local, enabling more selective data reduction at the quantization step while ensuring that high-frequency data stays where it's needed. The image size is still approximately 110kB at this point.

• *Quantization.* In this lossy process, digitization is used in which fewer bits are used to describe the same overall quantity of information with larger quantum steps. JPEG and MPEG are limited to uniform quantization where the step size stays the same. This is in contrast to vector quantization that permits non-uniform quantization. Going back to the matrix, quantization truncates most of the high-frequency components to zero. This process yields approximately a 3:1 compression ratio, taking the 110kB file down to around 35kB.

• *Compaction encoding.* The final step in intraframe compression is data compaction. Codecs use three basic types of compaction schemes. Run-length encoding replaces consecutive identical digits with the number and kind (222224444 is 5244). Huffman coding (variable length or entropy coding) takes strings of often repeating characters and replaces them with variable length codes. The most commonly occurring strings get the shortest codes. Arithmetic coding makes compacted data appear as a long floating point number that encodes the common strings with fractional bit codes. The result is usually another 1.5:1 compression bringing down the 35kB file to approximately 24kB.

• *Interframe compression.* In a typical video image, the greatest amount of redundancy can be found in successive frames that generally change slowly. By predicting a pixel will remain the same and only encoding differences, you can end up with a string of zeros or small numbers suitable for efficient run-length encoding. In interframe encoding, an intraframe compressed frame (I frame) is used to predict another frame (P frame). The bi-directional frame (B frame) uses earlier and later frames for predictions. Motion estimation and compensation, as well as picture interpolation, are used when a scene changes entirely. The total interframe, with predictive encoding, motion estimation and interpolation, results in another 5:1 compression bringing the total down from 24kB to approximately 5kB. Resulting in an overall 200:1 compression of the image.

■

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

Part 4

Management

Departmental motivation

Being a balanced manager

By Rick Morris

Joe has successfully tackled the job of improving the motivation and morale of his engineering department. But he found himself working 12- to 14-hour days in addition to being on-call 24-hours a day. His attitude toward the job and on the job was getting worse, even as his staff's was improving. At 3 a.m. one morning, he had to take his team out to repair a section of transmission line so the station could get back on the air. It was difficult to keep his staff's morale up when his was so down. Joe was gratified by the improvement in his department, yet he feared that because of the stress and the hours, he would accidentally say something that would be detrimental to staff morale.

Joe had made friends with the station's sales manager and decided that a lunch discussion might provide insight into how he motivated and managed his sales staff. During lunch, the sales manager recognized what Joe was up against and offered suggestions on interpersonal management and how to improve his situation by becoming a *balanced manager.*

You are always "on"

In a management situation of this type, a chief engineer has two challenges: 1) determine and act on the concept of what constitutes balanced management, and 2) select the tools and actions that will allow you to maintain the balance. Some managers find themselves at an extreme; either they are too task-oriented or they seek authority and obedience; on the other set of extremes they pay too much attention to the needs of relationships or they fail to manage strongly.

These extremes are signs that a manager needs more balance. A balanced manager will consider the needs of the organization for getting work done, as well as the needs of the persons involved for maintaining morale. Many managers know what they are supposed to do, but under much stress, move toward being task-oriented and seek authority and obedience. It is then that a staff's morale can be affected.

Part of balance is making sure that you maintain leadership. Shifting unpredictably from one mode of management to another or acting inconsistently will damage your credibility as a leader.

Part of balance is making sure that you maintain leadership.

Some of the personality traits of a good leader include a range of interests, emotional maturity in the face of failure or success, self-respect, a high tolerance for frustration, respect for others, and the ability to communicate effectively. Maintaining these traits requires consistency of actions and words. Also, interpersonal relations with the supervisor is one of the leading factors of basic job satisfaction. In order to give out some of the most powerful motivators to your staff — *recognition and responsibility* — your credibility must be high.

Under pressure, defuse the situation

One key aspect of a manager's job is to deal with problems. When an employee brings you a problem, try not to react immediately. Sit down together and discuss the problem. Discussing the possible courses of action in a relaxed atmosphere can prevent you from moving from the center balance to one of the edges of management practice. Similarly, when upper management brings a problem to you, rather than reacting, take time to consider your possible courses of action. If you have enough time, convene members of your staff to brainstorm. Communicating the problem clearly to others and soliciting input will help maintain a rational decision-making process.

Delegation is part of being a good manager

Unfortunately, *delegation* is one of the most difficult skills for managers to learn, but planning improves delegation. Determining who will be in charge of certain activities before the project starts shifts the responsibility to the proper person. In day-to-day operations, assigning areas of responsibility and abiding by those assignments will help your staff develop and allow you to perform your duties.

Train your replacement

It is a truism that an irreplaceable person is unpromotable. An irreplaceable person finds it difficult to get away from the station to recharge his batteries. Both situations will affect your morale, job satisfaction, and perhaps your interpersonal relationships with your staff. Engineering is an important job. Being off the air is a serious situation that halts the rest of the station until the failure can be repaired. In the 24-hour-a-day-every-day-of-the-year world of broadcasting, engineers have their evenings and weekends interrupted by emergencies and often find it difficult to take a vacation. Identify someone as your replacement and train them with enough skills to keep the station going and the department running smoothly.

What about your own job security? There is no more secure person than a competent employee who is well recognized. While making sure that management is knowledgeable of and comfortable with the arrangements you make for the station in your absence, you may take the opportunity to communicate your position and value in the big picture of the station.

Your own time is important; it is how you maintain your interest in the world and reinvigorate your motivation to the job. Do not unnecessarily postpone vacations; it is easy for engineers to find reasons to stay on the job. In the long run, your company is more interested in your being a good employee than in seeing you working too many hours. By keeping a balanced sense of management, properly delegating, and assuring that there is someone available while you are absent, you will preserve your quality of life and let consistency of your actions and words keep departmental morale intact. ■

Morris is an assistant professor of radio/TV film at Northwestern University. He is a former TV manager at station and network levels.

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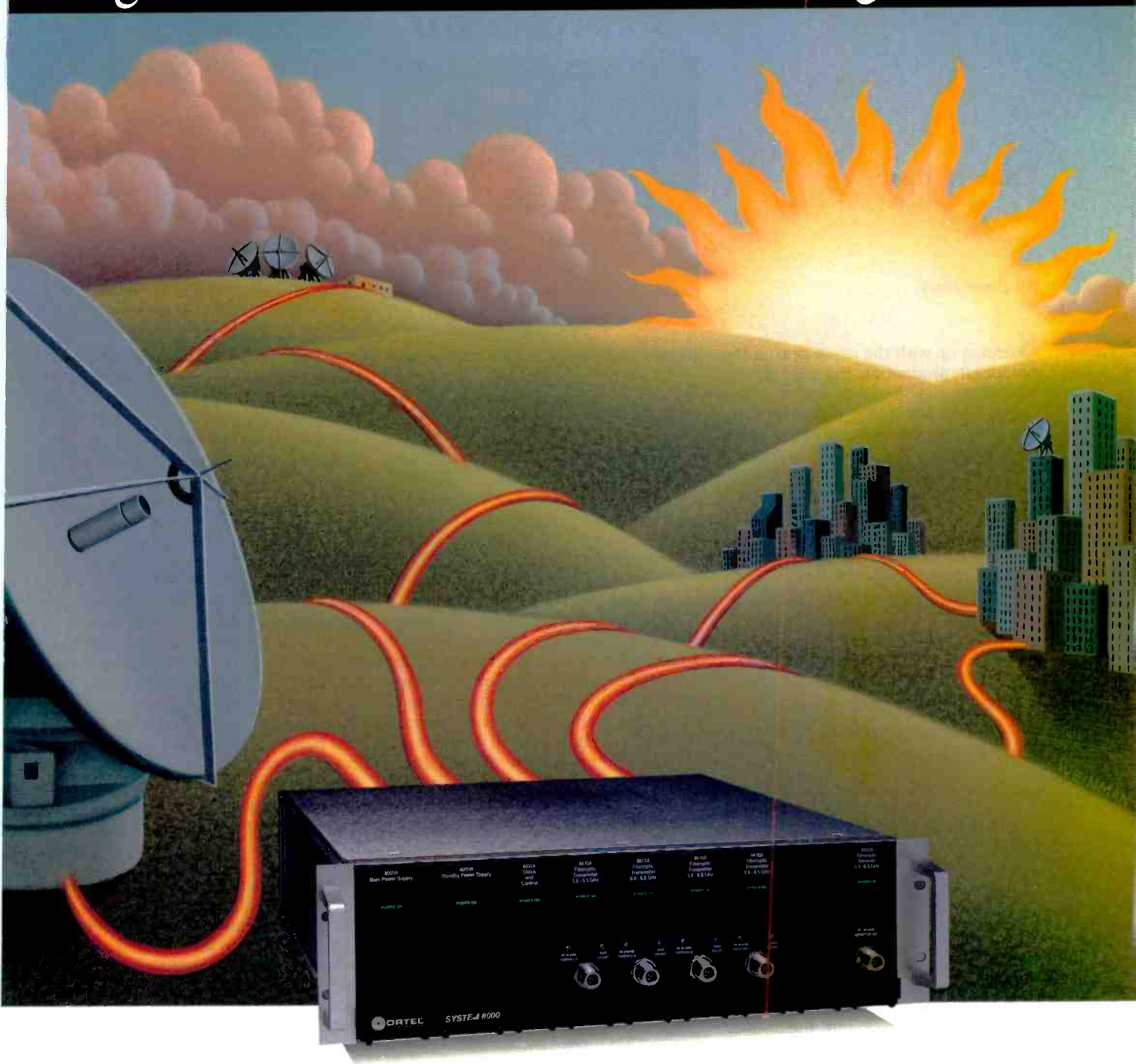

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Production

Camera tips

By Dave Doré

Keeping up with the latest gear in the broadcast production business is like visiting an all-you-can-eat buffet ... you keep seeing something else you want, but your body is saying, "Hey, you went way over budget with that raspberry chocolate truffle, put that cheesecake down and go home!"

No matter how many tools you get that morph, warp or bend, you still have to go out and get original video; and that is often what separates the video professionals from the hobbyists.

A well-executed hand-held shot is a masterpiece; a poor one is hideous to watch.

Today's hobbyists may have the latest video toaster and home Hi8 system, but can they point a camera and take good pictures? Years ago, when "zoom in" meant rotate the lens turret, the cameras were set up on big pedestals, cranked up to eye level, and used to shoot the subject. Film people could do hand-held shots and creative cinematography, but the video professionals had their tripods and they had to make sure their shots were rock solid. News photographers were told that nothing airs unless it was shot from a tripod or there was a good reason to shoot from the shoulder.

Then along came MTV and a rash of reality shows in which it was decided camera movement enhanced the dramatic feeling of the production. Directors of commercials, sports, and even news programs began to add motion and non-traditional angles to their projects. In some cases they created "looks" that were copied by many others, and in other cases, shots ended up looking like an amateur video of a family outing.

Somewhere in between those two extremes is where every videographer tries to be — not too stale and static, but watchable by the majority of people who may find MTV enough of a visual barrage. Occasionally, videographers need to find the edge and cross it, but static, wide shots have their place as well. Knowing the rules will allow you to learn how and when to break them. With that in mind, here are some of the techniques today's videographers are using.

Doré is sports director for KSMO-TV, Kansas City, MO.

Shouldering the burden

Today, a large percentage of video is shot from hand-held cameras. This can enhance the ability to move the camera in ways that are difficult or impossible on a tripod. In addition, hand-held cameras can create constant movement, such as what is sometimes called "jiggle cam" (AT&T commercials are a good example). A well-executed hand-held shot is a masterpiece; a poor one is hideous to watch. Here are some ways to avoid hand-held hell.

1. *Don't tighten your body when shooting.* It may be an intense moment during take 24, but even minute quivering of tense muscles translates to vibrating video. There is a difference between jiggling the camera for effect and having every shot oscillating slightly. Taking a deep breath before beginning the shot will help.

2. *Don't move too fast.* The human eye can dart around a room in seconds, but don't do that with your hand-held camera because you will confuse the viewer. If you need swish pans and dramatic movement, plan them carefully and think about the editing process. (Will dynamic motion or effects be used?)

3. *Explore different angles and hand-held positions.* A camera does not have to merely rest on the shoulder. Most viewfinders tilt up and down, and some great shots come from cradling the camera under an arm or resting it on your foot, and then performing a move. Canted (or tilted) angles are becoming increasingly popular, and it is much easier to achieve this hand-held because most video tripods do not tilt to the left or right. Rather than holding the camera and tilting it, stand with the camera on your shoulder and tilt your whole body. This way you maintain control over the shot as well as the angle you want.

Techniques

• *Snap zooms.* Although most cameras are equipped with sensitive variable electric zoom controls, there are times when you may need to take more control. You can create some nice effects when you manipulate the zoom lens manually. Usually lenses can be switched from "auto" to "manual" zoom control. Many programs in the kids TV genre, as well as commercials, use the technique where you move your shoulder-mounted camera quickly while at the same time "snapping" the zoom lens at the same rate into or away from your subject. Manual zoom also allows you to "bounce" your zoom lens to a beat.

• *Swish.* "Swish pans" or any rapid camera movements don't have to ruin a production. If planned and executed properly, they can add to the drama of a shot. A quick pan or zoom might look horrible in real time, but if slowed down in editing or strobed, these snaps and swishes become an effect in themselves.

• *Let it run.* Unless you have a tape shortage, let the tape run between takes (if the time is not too long). Useful shots can come when you're not planning them.

Not all shooting these days is rapid fire wacky-cam. There are plenty of situations where you will still need to set up the tripod and shoot a sitting or standing object nice and steady (for example, a lawyer in front of his bookshelf).

There are millions of hobbyists out there with camcorders, and slightly fewer video professionals. Look at what you do, and see how you can improve. Experiment when the time is right, but know when to do it by the book. ■

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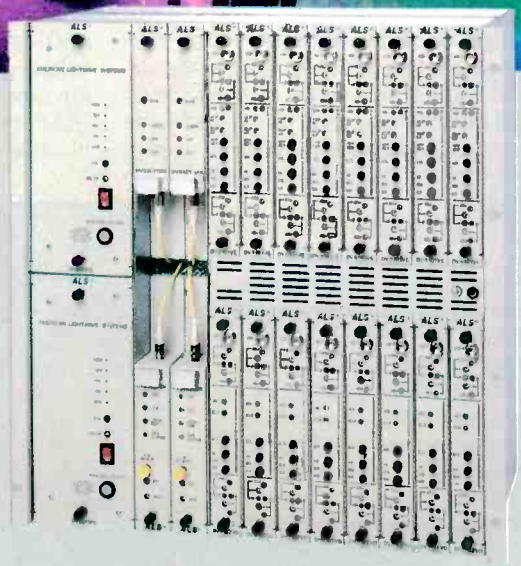

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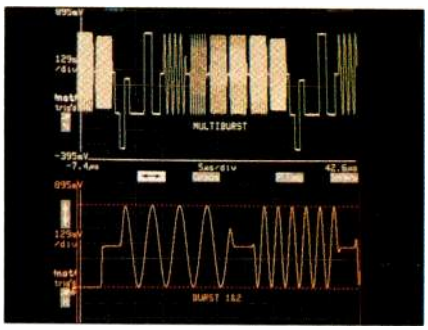

LAN technology

LAN basics

By Kevin McNamara

If you don't have a PC-based local area network (LAN) at your station, chances are it won't be long before someone starts asking questions about the "N" word. The PC-based LAN is fast becoming another tool that stations can use in an increasingly competitive environment. Unfortunately, too many operations have implemented a network without any real thought or planning. An improperly configured system will not deliver the desired results. This series will provide insight into basic network theory and some practical information that can be used in selecting and managing a small network.

Terminology

A network is comprised of a file server and at least one workstation (the user's PC, also referred to as the "client"). Most small networks contain a file server and several workstations. If a network uses a dedicated file server and some workstations, it may be called a *client-server* network. The term *dedicated* refers to a computer controlled directly by the network operating system that also acts as a storage device for files common to the network. This network can have more than one file server.

Another type of PC-based LAN is called the *peer-to-peer* network. These networks allow PCs to share files, printers, or send messages to other properly attached computers.

Background

The concept of networking has been around as long as the computer. Many established computer manufacturers use proprietary methods for interconnecting workstations and the central processing unit (CPU). It was clear that a standard needed to be defined allowing for a seamless transfer of data between systems. As the desktop PC became more visible, companies such as Novell sought a way to interconnect the PC.

Networking is the ability of computers using different hardware and/or operating systems to share data seamlessly. To address the problem of system interoperability, the Open Systems Interconnect (OSI) model was developed. The International Organization for Standardization (ISO) has been the primary body in developing the OSI standard. The Institute for Electronic and Electrical Engineers (IEEE) has defined specific data communications standards to be used with OSI.

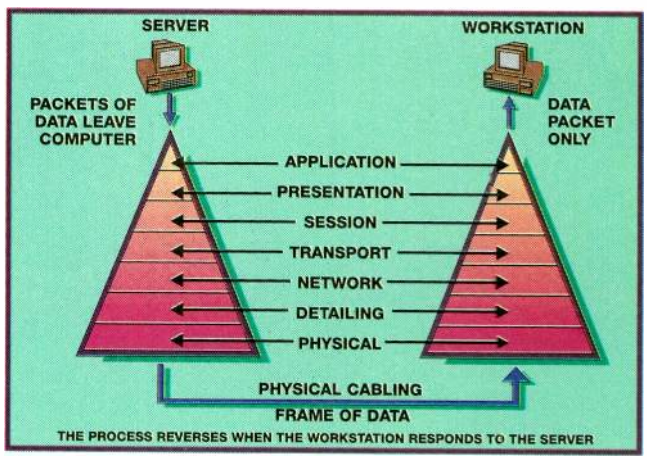

Figure 1. *Headers and address information are added to data packets as they pass through each layer forming a data frame. After being sent over the network cabling, headers and address information are stripped from the frame by each layer, leaving only the original data to be handed to the workstation.*

The OSI model

The OSI standard is divided into seven *layers*. Each layer has a specific job and can only communicate directly with the layer directly above or below it, within a given system. Between systems, layers can only communicate with layers of an equal level. (See Figure 1.)

1. The application layer handles communication between the user (or the user's program) and the layers below. The use of "application" is misleading because it does not refer to the actual program that may be running, such as a word processor or database. The application layer provides file transfer, terminal services and mail delivery. This layer also interacts with the network operating system.

2. The presentation layer is the "translator" of the network world. A network can be used to connect different types of computer systems. If a PC and Macintosh are hooked to the network, the conversions performed at this level allow the two machines to exchange data. The chores related to maintaining compatibility between different monitor types are handled here.

3. The session layer deals with setting up a connection between communicating applications. Once connected, it provides support functions, such as synchronization of data and reporting of errors.

4. The transport layer maintains the integrity of the data communications elements, including flow control and error recovery.

5. The network layer provides the means to reliably route data across a network comprised of multiple segments.

6. The datalink layer packages the data along with the appropriate header information so that it will be recognizable to other computers attached to the network.

7. The physical layer defines the physical hardware that is required to interconnect the system, including:

- The Network Interface Card (NIC) — a card that plugs into each PC on the network. It is the physical interface between the PC data bus and the network cabling.
- Cabling and connectors-networks transfer data at higher speeds than the serial or parallel port on the PC. Data rates vary from about 2.5MB/s (MIP's in network terminology) to about 10 MIPS. Standards for 100 MIPS are being developed. Networks can also be connected by coaxial cables, twisted pair or fiber-optic cabling.

The majority of problems that are encountered with a network can be traced to the physical layer. ■

McNamara is engineering manager for WGAY/WWRC radio, Washington, DC.


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Now, Panasonic introduces the D-5 1/2" component DVTR. D-5 uses the field-proven D-3 technology, tape and transport as a platform. This provides a practical, program-length 300 Mbps-class digital VTR for transparent recording and playback of CCIR 601 digital video in its full 10-bit, uncompressed form, exceeding the quality of the 8-bit, D-1 format. The D-5 VTR records both 4:3 and 16:9 aspect ratio pictures. It can also playback D-3 video recordings in the component domain and with current compression technology can record and playback HDTV.

With such upward compatibility in mind, users such as Channel 4 in the U.K., the Public Broadcasting Service and USA Network in the U.S., have already placed orders for D-5 equipment. And, Panasonic digital VTRs will be used extensively at the 1996 Summer Olympic Games in Atlanta.

In addition to digital VTRs, Panasonic's full line of Digital Signal Processing (DSP) cameras gives operators digital set-up capability and unparalleled creative freedom to master each shooting situation. The National Academy of Television Arts and Sciences awarded Panasonic an EMMY for this achievement in 1992.

Panasonic also was first to introduce seminal technology in digital switcher development in the early 1980s, an achievement recognized with a 1993 Technical EMMY. Panasonic's digital video switcher is now available in component as well as composite versions.

Evidence of Panasonic's commitment to all-digital video production is its roster of linking products that facilitate communication between composite and component domains as well as serial and parallel digital signals. These products include digital routers, format converters, serializers and decoders. Panasonic extends the digital production domain further with the introduction of the industry's first and only *digital* professional broadcast monitor.

Panasonic leads in developing digital video technology in virtually every sector of the electronics market including our businesses, our schools, and our homes. Through its parent, Matsushita Electric Industrial Company, Panasonic is part of the growing alliance of information and entertainment technology companies that are shaping our world for a fuller, richer tomorrow.

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Panasonic stakes its claim as *First In Digital Video* based on the breadth of its products, the vast scope of its research and development, and its firm commitment to leading the way towards the digital future.

No other company offers a complete digital product line, ranging from Digital Signal Processing cameras to the industry's first—and only—professional digital broadcast monitor. No other company holds so many patents on each of its digital products. No other company has won EMMYs—the industry's highest honors for technology achievement—for digital VTRs, digital cameras, digital switchers *and* digital effects equipment.

Panasonic Broadcast & Television Systems Company measures its success within the universe of its parent, the Matsushita Electric Industrial Company, the world's 12th largest corporation. Worldwide, Matsushita employs more than 252,000 people in 38 countries. It reports sales of more than $60 billion annually, with a $3.1 billion investment in research and development.

In pursuit of "human electronics," which the Company defines as products that meet the genuine needs of customers, Matsushita has been granted close to 52,000 patents. Nine of Matsushita's 56 principal research laboratories are located in the United States. The Panasonic Advanced TV-Video Laboratories spearhead research in digital transmission technologies, producing advances for high definition television. Digital studies done at the Matsushita Applied Research Laboratory are being steadily incorporated into the latest Panasonic broadcasting systems. And critical research being conducted both in the U.S. and Japan is advancing the bit-rate reduction (BRR) technology that broadcast HDTV is expected to utilize.

Sure Steps Toward the Future.

Digital recording techniques are now recognized as offering so many benefits over analog recording that virtually all future industry developments will be in the digital domain. Looking to the lessons of the past, one gleans some absolutes about the future: That Panasonic will be first and foremost with digital breakthroughs. That Panasonic will fulfill customers' expectations with equipment that meets their current and emerging needs. That Panasonic is the unrivaled *First in Digital Video.*

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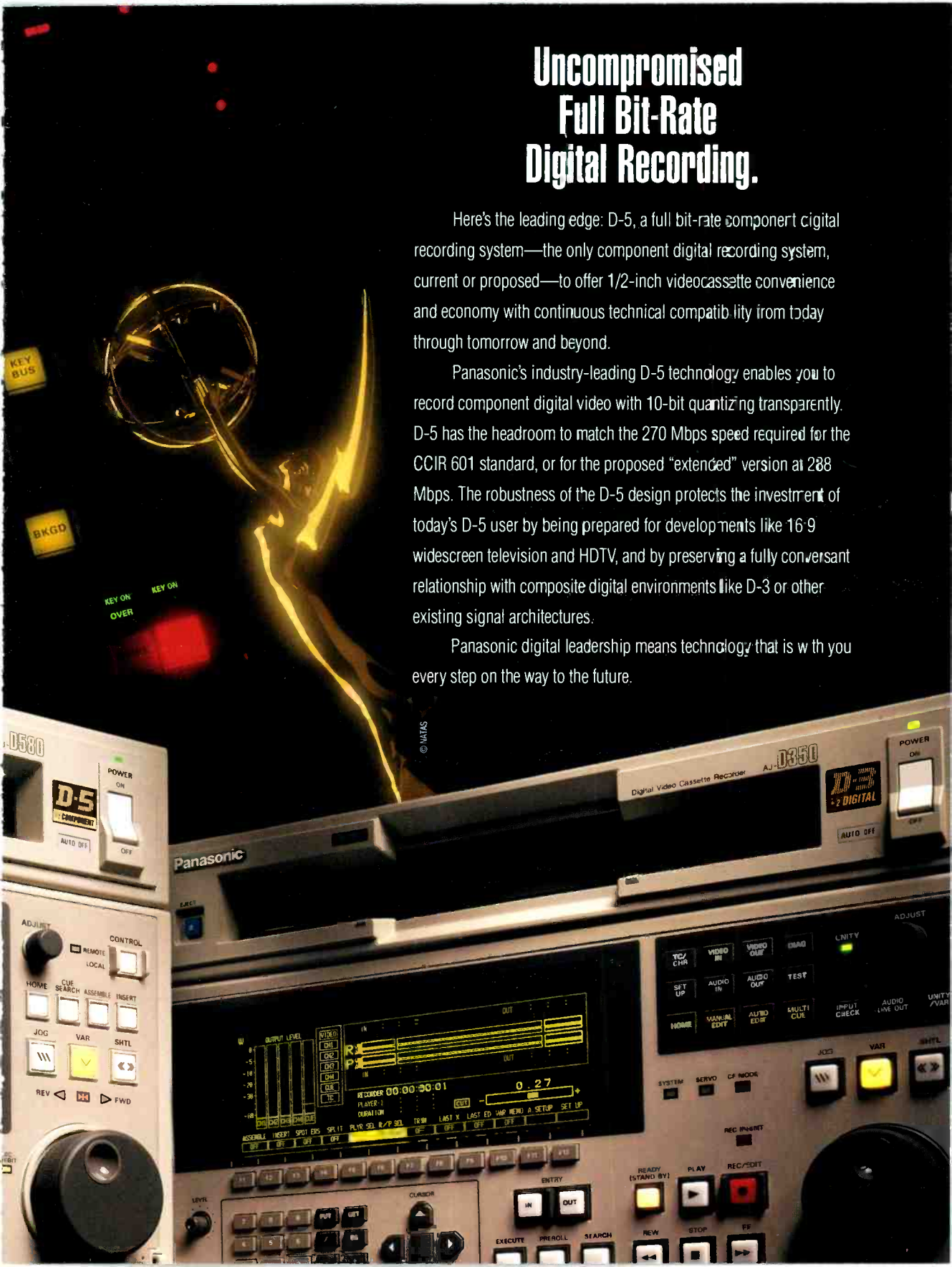

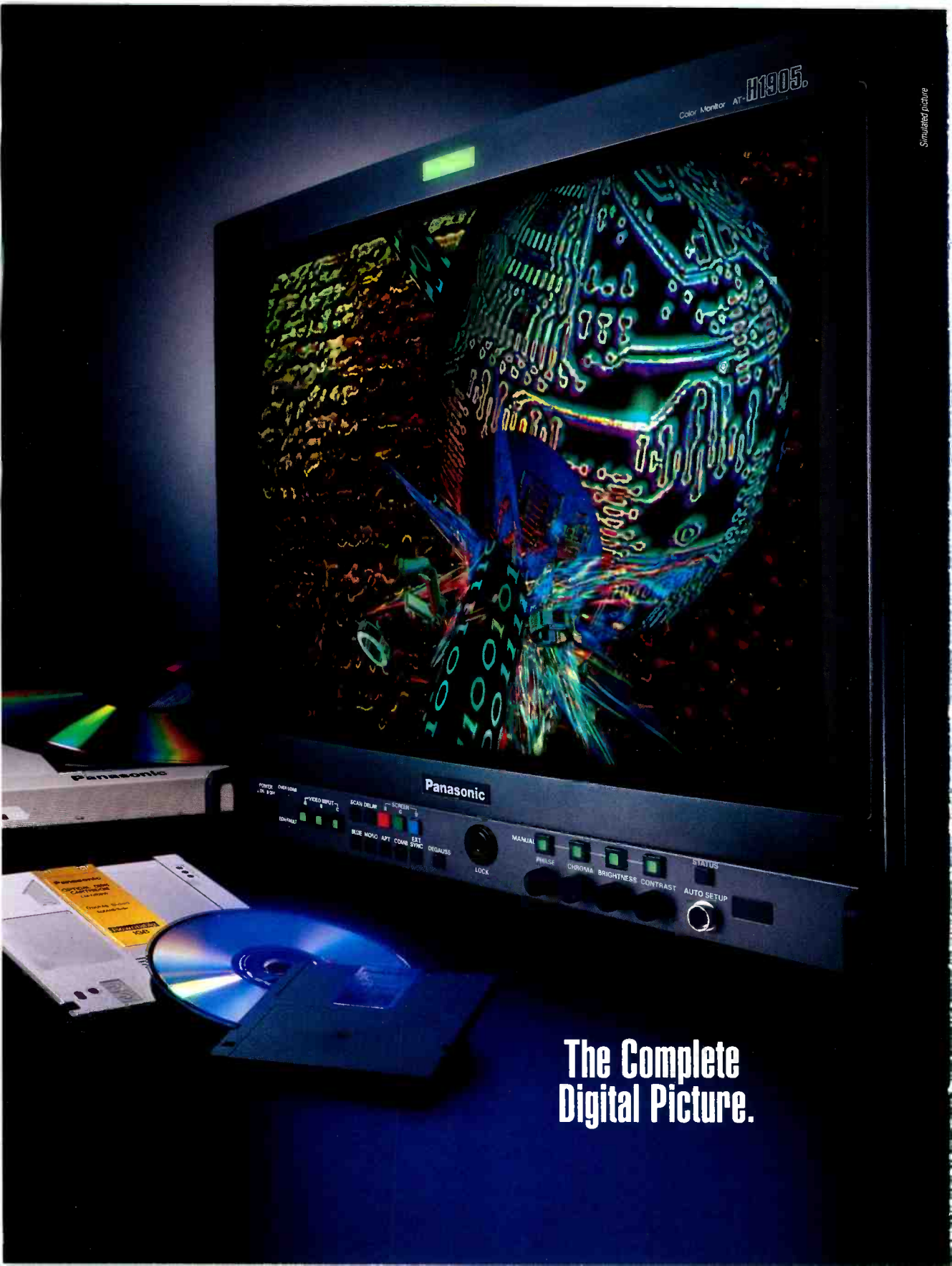
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Contact Renée Hambleton, at (913)967-1732, for information on frequency and pre-payment discounts. To place your classified ad send your order and materials to Broadcast Engineering, Classified Ad Mgr., P.O. Box 12901, Overland Park, KS 66212-2215.

WASHINGTON STATE UNIVERSITY is seeking a full-time, permanent Chief Telecommunications Engineer for its public radio and television broadcasting and instructional microwave system. Position is located at the central engineering support center in Richland, Washington. Duties include: supervising and directing broadcast technicians; design and planning of television, radio and microwave systems, electronic classrooms, TV and radio studios and transmission facilities; allocating resources for installation, operations and maintenance projects; budget development; and other engineering duties. Qualifications: 5 years broadcast and/or microwave/tower construction, maintenance and design experience. Prior experience as Chief Engineer or Assistant Chief Engineer in public broadcasting, SBE certification and Bachelor's Degree preferred. Salary $38,000 to $46,000 plus great benefits. To apply send resume, cover letter and names and phone numbers of three professional references to: Chief Telecommunications Engineer Search, KWSU Radio-Television Services, Washington State University, Pullman, WA 99164-2530. Applications must be postmarked by May 2, 1994. WSU is an EO/AA educator and employer. Protected group members are encouraged to apply.

MAINTENANCE ENGINEER: Top 50 Northeast Affiliate seeking a broadcast maintenance engineer. Experience should include Sony 1" VTR's, Sony 1/2" Beta equipment, Grass Valley production switchers and routing systems. Two (2) years previous broadcast experience preferred. Comprehensive benefits package offered. EOE. Send Resumes to Skeeter Lansing, WTEN-TV, 341 Northern Blvd., Albany, NY 12204.

TELEVISION: Engineering Maintenance Technician: Requirements - responsible for the repair and preventive maintenance of the electronic studio equipment, i.e.,: VTRs, cameras, video switchers, etc. Also responsible for documenting work performed and assisting on-air operators by performing quality control of the station's signal. Must have Associate Degree in Electronics and 2 years or related experience. Resumes to: David E. Smith, Engineering Manager, WPHL-TV, 5001 Wynnefield Avenue, Philadelphia, PA 19131. NO PHONE CALLS PLEASE. EOE.

TV MAINTENANCE ENGINEER opening in Upstate New York. Large facility loaded with state of the art equipment. Must be capable of troubleshooting studio equipment to the component level. Experience in maintaining digital and microprocessor-based equipment required. UHF experience a plus. Send resume and salary history to: WXXI-Human Resources, PO Box 21, Rochester, NY 14601. EOE.

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HELP WANTED

F/T ELECTRONIC MAINTENANCE ENGINEER for television station. Individual must have electronic repair experience, some building maintenance required. Salary commensurate with experience, full vacation/benefits package. Send resume to: WHSV-TV, P.O. Box TV3, Harrisonburg, VA 22801. EOE

AGGRESSIVE AND GROWING Sunbelt affiliate needs an experienced engineer to maintain studio and transmitter equipment in a brand new facility. Equipment includes BTS and GVG switching and graphics, 3/4" video tape, fixed and mobile uplinks, fiber optic and microwave E.N.G. systems, redundant V.H.F. transmitters, as well as all the basics. Please mail or fax resume to: Chief Engineer, WCBI-TV, P.O. Box 271, Columbus, Mississippi 39703, FAX # 601-327-0020

ASSISTANT CHIEF ENGINEER: Need hands-on, take charge manager. Able to supervise and maintain transmitter, production, master control, and studio equipment, microwave truck, and post production facility. Will also supervise regular work scheduling as well as preventive maintenance, people skills are a must. Diploma type First Class radio telephone license required. Send resumes to General Manager, WFMJ-TV, 101 West Boardman Street, Youngstown, Ohio 44503-1305. EOE/No phone calls please.

SELF STARTING ASSISTANT CHIEF ENGINEER for transmitter supervision. Must be experienced in maintenance of RCA TTU-30 and TTU-110 UHF television transmitters. Maintenance of Sony cameras and Beta equipment, ENG van, along with personnel supervision will be required. Send resumes to: John Grdic, General Manager, WFMJ-TV, 101 West Boardman Street, Youngstown, Ohio 44503-1305. EOE/No phone calls please.

SOUTHWEST V.H.F. NETWORK AFFILIATE seeks "hands on" chief engineer. Responsibilities to include experience in maintenance and repair of R.F. and studio equipment. Computer skills a big plus. People skills a must. Reply in confidence to Broadcast Engineering, P.O. Box 12901, Dept 741, Overland Park, KS 66282-2901.

TECHNICIAN—Video: Installation & maintenance tech needed for growing video projection/system company. Barco-Electrohome-Esprit experience helpful, but firm electronics background essential. System level trouble shooting useful. Send resume & salary history to; Future View, Inc., 1250 Taylor St., NW, Washington, DC 20011 ATTN: Manager.

United Nations Office in New York
ELECTRONICS ENGINEER (P-3)

The Broadcast and Conference Engineering Unit of the Buildings Management Service in New York has an opening for the position of Electronics Engineer. Reporting to the Chief of the Unit, incumbent provides broadcast engineering support for design, construction, logistics, training, operations and maintenance of radio and television facilities; evaluates technical needs and introduces new methods, equipment and systems; writes equipment specifications, project proposals and assists in preparing capital equipment budget; works closely with external broadcasters and internal clients; and participates in planning missions for overseas conferences.

Requirements: Advanced university degree in electrical engineering or related field with specialty in audio and visual arts and broadcasting disciplines. Six years of professional experience in broadcasting, post-production or related fields. Candidates with a first-level university degree and at least 8 years of experience may be considered. Fluency in English. Working knowledge of French and/or Spanish desirable.

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Remuneration: Depending on professional background and experience, annual net salary from US$51,291 without dependents to US$54,892 with dependents plus corresponding entitlements. Closing date for receipt of applications: April 30, 1994. Applications with full curriculum vitae, including salary history, birth date and nationality, should be sent to: **Mr. Adnan T. Issa, Room S 2500E, Office of Human Resources Management, United Nations, New York, NY 10017, USA. Fax (212) 963-3134.**

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We are seeking talented and experienced systems engineers to join our dedicated staff of professionals and become involved in some of the most challenging projects in the broadcast, cable, post-production and communications industries.

You will be directly involved in consultations with clients, proposal generation, detailed systems design and documentation, project management/supervision and commissioning of a wide range of projects. This position offers the opportunity to make a significant and direct personal contribution on prestigious projects which often push the limits of current technology.

The successful candidate must have a minimum of eight years of television systems design experience on a wide range of advanced facilities. You will have an in-depth knowledge of digital video and audio systems, be fluent in AutoCAD and have a track record of successfully managing complex projects. You will enjoy the freedom of directing your own project while being part of the industry's leading team. BSEE strongly preferred.

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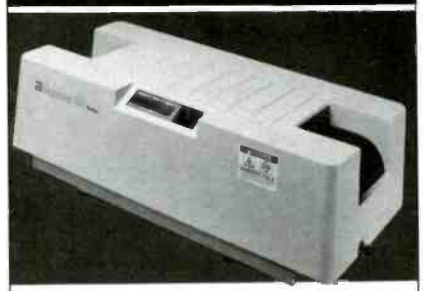

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New Products

Continued from page 80

Computer line

By Industrial Computer Source

• **MIPS-Based Industrial RISC Computer Line:** increases processing power over standard 32-bit, 80486/50MHz systems; each system provides a 1.44MB floppy drive, XVGA 64-bit local bus video and 16MB of RAM; system boards incorporate an Adaptec-compatible SCSI-2 controller, dual floppy controller, and ethernet network port, dual series ports, one parallel port, a keyboard port, PS/s mouse port and up to 256MB of on-board RAM.

Circle (370) on Reply Card

Software

By Video Design Pro

• **VidCAD for Windows:** an engineering tool for planning, documenting, installing and maintaining complex communication systems; links with spreadsheets, desktop publishing, database report and project management.

Circle (371) on Reply Card

Smartphone product systems

By Gentner Communications and Arrakis Systems, Inc.

• **Autoline:** provides access to recording audio feeds on/from the Arrakis Digilink with the Gentner TC-100.

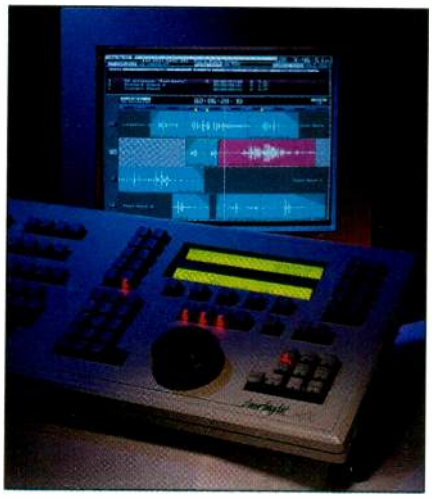
• **PhoneLink:** provides access and control of multiple telephone hybrids from Arrakis equipment.

• **TalkLink:** uses new products from Gentner and Arrakis to control and network screening of multiline talk shows from a hard disk system.

Circle (372) on Reply Card

Digital audio workstation products

By Fairlight



• **MFX3:** a series of products based on the industry standard MFX digital audio workstations; provides 24 tracks of simultaneous playback from a single hard disk, 24 inputs and outputs in digital and analog, and DSP functions.

Circle (373) on Reply Card

Miniature computer-controlled pan-tilt unit

By Directed Perception

• **PTU-46-17.5:** unit measures 3"x5.11" x4.25" and provides a load capacity of more than four pounds; performs at speeds over 300 degrees/s with precise position control of 3.086 arc minutes (0.051 degree) resolution; features power management controls and flexible input power requirements; designed for battery-powered operations; plug-and play using an RS-232 terminal; self-calibration upon reset.

Circle (374) on Reply Card

Heads/tripod

By OConnor Engineering Laboratories

• **515S Ultimate Fluid Head:** accommodates a 36% increase in camera weight; will balance a 25-pound camera with a 6" high center of weight.

• **1030S Ultimate Fluid Head:** accommodates a 36% increase in camera weight; will balance a 45-pound camera with a 6" center of weight.

• **2575V Ultimate Fluid Head:** designed with less pan fluid drag and a lighter touch.

• **65 Tripod:** incorporates 2-stage design and tapered leg design into one tripod; operates from 16.5" to 65"; available in carbon fiber, titanium and aluminum.

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Miller 20 - Series II Fluid Head

- Continuously adjustable fluid drag control
- Sliding/Quick Release camera platform
- Weighs only 4 lbs. will handle cameras up to 22 lbs.
- Counterbalance system designed to compensate for nose heavy or tail heavy camera configurations, and permits fingertip control of the camera throughout the tilt range.
- Includes independent pan and tilt locks, bubble level, dual pan handle carriers and integrated 75mm ball levelling.

#440 - Lightweight Tripod

- Weighs only 4.5 lbs., supports up to 30 lbs.
- Minimum height down to 24", maximum height to 57".
- Extremely portable, folds down to 33"
- Engineered from thermoplastic moldings, diecast alloy and hard anodized tubular alloy.
- Fast one turn, captive leg locks
- Includes 75mm (3") ball levelling bowl

#420 - 2-Stage Tripod

- Two extension sections on each leg. Operates at low levels as well as normal heights without the use of mini legs.
- High torsional rigidity, no pan backlash
- Weighs 6.6lbs., supports 50 lbs.
- Very portable, folds to 27"
- Includes 75mm (3") ball levelling bowl with model 420 model 402 includes 100mm (4") ball levelling bowl.

System 20 Catalog #338

- Miller 20 II fluid head
- 440 Lightweight tripod
- 410 tripod spreader with foot pads **1549.00**

System 20 ENG Cat. #339

- Miller 20 II fluid head
- 420 2-stage tripod
- 410 tripod spreader with foot pads **1895.00**

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Pan and Tilt Heads with Serial Drag

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

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- Consistent drag levels in both pan and tilt axis.
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- Greater control, precision, flexibility and "touch" than any other head on the market.
- Touch activated, time delayed illuminated level bubble.
- Working conditions from as low as -40° up to +60°C.
- SD 12 weighs 6.6 lbs and supports up to 35 lbs.
- SD 22 weighs 12.7 lbs and supports up to 55 lbs.

Vision Two Stage ENG and LT Carbon Fibre ENG Tripods

The ultimate in lightweight and innovative tripods, they are available with durable tubular alloy (Model #3513) or the stronger and lighter, axially and spirally wound carbon fiber construction (Model #3523). They incorporate torque safe clamps to provide fast, safe and self-adjusting leg clamps.

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

Vision 12 Systems

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

SD-12A System

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

SD-12D System

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

Vision 22 Systems

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

SD-22E System

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

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EVW-300

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The EVW-300 is a complete one piece camcorder which includes a variety of innovative and advanced operational features. So, whether your shoots require basic recording capabilities or premier performance, the EVW-300 offers a wide range of features and remarkable recording quality to best suit your needs.

Features:

- Equipped with three high density 1/2" IT Hyper HAD image sensors. Has an excellent sensitivity of F8.0 at 2,000 lux, high S/N of 60 dB, and delivers over 700 lines of horizontal resolution.
- Provides high quality PCM digital stereo and single channel AFM Hi-Fi recording. Has XLR balanced audio connectors.
- Quick start 1.5" viewfinder with 550 lines of resolution plus Zebra pattern video level indicator and color bar generator
- Quick-start recording – takes only 0.5 seconds to go from REC PAUSE to REC MODE for immediate recording in the field
- Built-in 8mm Time Code generator records absolute addresses. (Either non-drop frame or drop frame mode may be selected.) Furthermore the EVW-300 incorporates a variety of time code features such as Time Code PRESET/RESET, REC RUN/FREE RUN and User Bits.
- A variety of automatic adjustment functions for different lighting conditions are incorporated into the EVW-300:
  ATW (Auto Trace White Balance) – when ATW is turned on optimum white balance is always ensured during recording, even for changes in color temperature. Conventional white balance adjustment is still provided with the Auto White Balance.
  AGC (Automatic Gain Control) – in addition to manual Gain Up AGC provides linear gain up in the range of 0 dB to 18 dB.
  Intelligent Auto Iris – for situations where the lighting between subject and background is different (subject is underexposed) the Intelligent Auto Iris automatically examines the scene and adjusts the lens iris for proper exposure.
- Selectable Gain-up from 1 dB to 18 dB in 1 dB steps for Mid & High positions.
- Clear Scan function – provides a variety of selection of shutter speeds ranging from 60-200 Hz allowing recording of almost any computer display without flicker.
- Compact, lightweight (12 lbs with NP-1B) ergonomic design provides well balanced and extremely comfortable operation.

JVC GY-X2

3-CCD S-VHS CAMCORDER

- Three 1/2" CCD image sensor delivers 650 lines of horizontal resolution
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- Variable Scan View allows flicker-free shooting of a computer monitor.
- Quick Record Mode - when turned on the camera is set to the auto Iris even if lens is set at manual. Also activated is (ALC) Automatic Level Control and EEI Extended Electronic Iris which provides both variable gain and variable shutter. Now you can shoot continuously from dark room to bright outdoors without having to adjust gain, iris or ND filter.
- Full Time Auto White circuit lets you move from incandescent to fluorescent to outdoor lighting without changing white balance or the filter wheel.
- Genlock input allow synchronization with other cameras.
- Dual output system allows camera output to be connected directly to an external recorder

TOSHIBA

TSC-200

3-CCD Hi-8 Camcorder

- Three 1/2" CCD chips mounted with spatial offset technology delivers superb resolution of 700 horizontal lines
- Low noise design provides extreme sensitivity of F8.0 at 2000 lux. Min. illumination 7.5 lux with excellent color reproduction
- New LNA (low noise amplifier) delivers a S/N (signal-to-noise) ratio of 62dB - the highest achieved for this type of camera
- 26-pin connector outputs Y/C or component video signal allowing hook up to a portable S-VHS. MII or Betacam recorder and simultaneously record with Hi-8.
- Quick-start 1.5" viewfinder needs no warm up time so you never miss a shot. Zebra pattern in the viewfinder alerts operator to excessive video levels.
- Genlock capability allows synchronization with other cameras. Also full calibration functions are built-in as well as color bar generator.
- Variable high speed shutter from 1/60 to 1/2000 second
- Built-in 8mm time code generator records an absolute address to every frame.
- High-performance back electret condenser mic records to all three audio tracks. Low cut filter eliminates wind noise.
- Sports very low power consumption. The TSC-200 draws only 16 watts per hour allowing 100 minutes of recording time with a single NP-1B battery.
- Camera body is made of magnesium alloy previously found only on broadcast cameras. Still, lightweight at only 13 pounds in standard configuration.

HITACHI

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- Permits contrast control for better reproduction of dark areas when shooting high contrast scenes.
- Six-memory auto white balance provides two memories for each optical filter position.
- Auto Knee circuity compresses extreme highlights preventing white clipping of those areas.
- In addition to the standard 5-step electronic shutter, the new lockscan feature permits the continuous adjustment of the shutter speed in 1H steps to shoot a computer monitor without flicker.
- Four built-in scene files. Seven items memorized in these scene files including, white balance, master gain and detail level.
- Viewfinder display of self-diagnostics during auto white and STATUS display of operational control settings.
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- Very high resolution viewfinder (600 lines) allows easy, fast and accurate focusing.
- Displays "safe title" electronic markers which indicate the effective picture area of home televisions.
- Generates SMPTE color bars with ID numbers so that when recorded the camera can be later identified.
- Movable shoulder mount allows camera to be correctly balanced with different docking VCRs or portable VCRs.
- Can be genlocked even with VCR docked to it.
- Real-time auto white balance continuously adjusts white balance according to the surrounding light source.
- Directly docks to Betacam SP (BVV-5) without need for adapters.
- Docks to Betacam SP (PVV-1), Panasonic MII, Sony Hi-8 (EVV-9000) and S-VHS (JVC and Panasonic) with adaptor
- With CA-Z1 camera adaptor can be cabled to Betacam, MII, U-matic and S-VHS stand-alone portable VCRs.

porta brace

Quick-Draw Professional

FOR CAMCORDERS OR STAND ALONE CAMERAS

- Designed for working from the back of a van or the trunk of your car. The top loading case has a wide open fold back top that stays neatly out of the way. It's lighter and more compact than shipping cases, thus saving valuable storage space. With other equipment crowded around it the sturdy built-in frame provides added protection.
- Heavy duty shoulder strap & comfortable leather hand grip.
- Carry in crowds – crush proof aluminum guard protects viewfinder
- Fits into back seat and fastens securely with seat belt
- Holds camera with on-board battery attached
- Lid closes with Velcro for quick-opening or secure with full-length zippers
- Two trim exterior pockets and clip board pocket.
- Dual purpose rear pouch is an expandable battery chamber or all-purpose pocket.

anton bauer

Logic Series DIGITAL Gold Mount Batteries

The Logic Series DIGITAL batteries are acknowledged to be the most advanced in the rechargeable battery industry. In addition to the comprehensive sensors integral to all Logic Series batteries, each DIGITAL battery has a built-in microprocessor that communicates directly with Anton/Bauer InterActive chargers, creating significant new benchmarks for reliability, performance, and life. They also complete the communications network between battery, charger and camera. With the network in place, DIGITAL batteries deliver the feature most requested by cameramen, a reliable and accurate indication of remaining battery power.

DIGITAL PRO PACS

The Digital Pro Pac is the ultimate professional video battery and is recommended for all applications. The premium heavy duty Pro Pac cell is designed to deliver long life and high performance even under high current loads and adverse conditions. The size and weight of the Pro Pac creates perfect shoulder balance with all camcorders.

- **DIGITAL PRO PAC 14 LOGIC SERIES NICAD BATTERY**
  14.4v 66 Watt Hours 5 1/8 lbs
  Run time: 2 hours @ 27 watts, 3 hrs. @ 18 watts
- **DIGITAL PRO PAC 13 LOGIC SERIES NICAD BATTERY**
  13.2v 55 Watt Hours. 4 3/4 lbs
  Run time: 2 hours @ 25 watts 3 hours @ 17 watts

DIGITAL MAGNUM COMPACS

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

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

PROFESSIONAL VIDEO TAPE

FUJI

H471S S-VHS Double Coated

ST-30	7.69	ST-60	8.49
ST-120			8.99

M221 HI 8 Double Coated

Metal Particles		Metal Evaporated	
P630HMP	4.99	E630HME	8.79
P660HMP	7.19	E660HME	11.29
P6120HMP	9.69	E6120HME	15.79

AMPEX

187 KCA 3/4" U-matic Broadcast (In Box)

KCA05	6.49	KCA10	6.89	KCA15	7.29
KCA20	7.69	KCA30	8.49	KCA60	11.79

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

BSC10 (mini)	8.49	BCA10	8.54	BCA20	9.59
BCS20 (mini)	9.59	BCA30	10.20	BCA60	14.39

297 SPA 3/4" U-matic SP Master Broadcast (In Box)

SPS10(mini)	10.21	SPA10	10.20
SPA20	10.85	SPS20(mini)	10.85
SPA30	12.40	SPA60	16.20

208 Betacam Master Broadcast (In Box)

BC-5A (small)	4.89	BC-10A (small)	5.89
BC-20A (small)	7.59	BC-30A (small)	9.69
BC-30LA	12.69	BC-60LA	23.49 BC-90LA 30.99

398 Betacam SP Master Broadcast (In Box)

BC-5A (small)	15.99	BC-10A (small)	18.49
BC-20A (small)	20.49	BC-30A (small)	22.39
BC-5LA	15.99	BC-10LA	18.49
BC-20LA	20.49	BC-30LA	22.39
BC-60LA	29.95	BC-90LA	46.95

maxell

8Q Certified 8mm High-Grade

P6-60 HG 8Q	4.99	P6-120 HG 8Q	6.49

8Q Certified HI-8 Metal Cassettes

P6-60 HM 8Q	6.49	P6-120 HM 8Q	8.49

P/I PLUS Expitaxial VHS

T-30 Plus	2.29	T-60 Plus	2.59
T-90 Plus	2.69	T-120 Plus	2.79

HGX-PLUS Expitaxial VHS (Box)

HGXT-60 Plus	3.49	HGXT-120 Plus	3.79

8Q Broadcast Quality Expitaxial VHS (Box)

T-30 8Q	5.49	T-60 8Q	5.99
T-120 8Q			6.39

8Q Certified Professional S-VHS (In Box)

ST-31 8Q	6.49	ST-62 8Q	6.99
ST-126 8Q	7.69	ST-182 8Q	14.99

KCA 3/4" High Grade w/Album & Sleeve

KCS-10 HG (mini)	6.99	KCS-20 HG (mini)	7.69
KCA-5 HG	7.29	KCA-10 HG	8.29
KCA-20 HG	8.99	KCA-30 HG	9.49

KCA 3/4" Broadcast w/Album & Sleeve

KCS-10 8Q (mini)	7.49	KCS-20 8Q (mini)	8.49
KCA-5 8Q	7.69	KCA-10 8Q	8.29
KCA-20 8Q	8.99	KCA-30 8Q	9.99

SONY

HI-8 Professional Metal Video Cassettes

P6-30 HMPX	5.99	P6-30 HMEX	8.49
P6-60 HMPX	8.59	P6-60 HMEX	11.99
P6-120HMPX	11.69	P6-120HMEX	15.99

PR Series Professional Grade VHS

T-30PR	2.49	T-60PR	2.79	T-120PR	3.29

PM Series Premier Grade Professional VHS

T-30PM	3.49	T-60PM	4.09	T-120PM	4.99

BA Series Premier HI-Grade Broadcast VHS (In Box)

T-30BA	3.79	T-60BA	4.29	T-120BA	5.29

MQ Master Quality S-VHS (In Box)

MQST-60	8.19	MQST-120	8.59

BRS 3/4" U-matic Broadcast Standard (In Box)

KCS-10 BRS (mini)	7.99	KCS-20 BRS (mini)	8.69
KCA-10 BRS	7.89	KCA-20 BRS	8.39
KCA-30 BRS	9.29	KCA-60 BRS	12.99

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

KCS-10 XBR (mini)	8.49	KCS-20 XBR (mini)	9.79
KCA-10 XBR	8.99	KCA-20 XBR	10.29
KCA-30 XBR	11.49	KCA-60 XBR	14.99

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

KSP-S10 (mini)	9.19	KSP-S20 (mini)	10.69
KSP-10	9.69	KSP-20	10.99
KSP-30	12.49	KSP-60	16.39

BCT G Betacam Broadcast Standard (In Box)

BCT-5G (small)	4.99	BCT-10G (small)	5.89
BCT-20G (small)	7.39	BCT-30G (small)	9.39
BCT-5GL	9.29	BCT-10GL	10.39
BCT-20GL	11.69	BCT-30GL	12.89
BCT-60GL	23.99	BCT-90GL	30.90

BCT Metal Betacam SP Broadcast Master (Box)

BCT-5M (small)	16.99	BCT-10M (small)	19.29
BCT-20M (small)	21.29	BCT-30M (small)	23.29
BCT-5ML	16.99	BCT-10ML	19.29
BCT-20ML	21.39	BCT-30ML	23.49
BCT-60ML	31.99	BCT-90ML	49.95

SANYO GVR-S950

S-VHS Single Frame Recording VCR

- Single-Frame Animation Controller eliminates the need for separate or computer plug-in animation controllers. Industry-standard protocols, make it compatible with most popular graphic and animation software packages.
- SMPTE Time Code Generator and Reader with Built-in Drop and Non-Drop Frame Read/Write is fully programmable from an external computer and resettable from the front panel.
- Video and Audio Switcher with Two independent Video and Audio Channels. Each video channel contains both composite and S-Video inputs. Each audio channel contains two linear and two Hi-Fi inputs. Switching can be performed either manually, or under RS232 or RS422 control. Video and audio channels are switched independently letting you perform break-away edits.
- Auto-Sensing Single RS422/RS232 Input eliminates the need for optional external interfaces. Interface requirements are automatically sensed and adjusted within the recorder.
- Input and Playback Video Processing allows adjustments to the video level of the incoming signal. Signal levels and hue can be adjusted during playback.

BTS

Broadcast Television Systems

Betacam SP-2000 PRO Series

PBC 2600 Player

- Superior picture quality to any other professional system.
- Brings virtual Betacam SP quality within the budgets of professional users.
- More than 90 minutes of playback time using L-size Metal or Oxide cassettes.
- High-speed picture search provides recognizable color pictures at up to 10 times normal speed in forward and reverse (24 times normal speed in monochrome).
- Two longitudinal audio channels with Dolby C-type NR (Noise Reduction) system.
- Equipped with RS-422 9-pin serial interface which is broadcast standard protocol.
- Built-in Time Base Corrector with advanced high quality digital dropout compensator.
- Optional BVR-50 provides remote control of the TBC.
- Built-In LTC/VITC/User Bits reader, and character generator.
- User friendly dial menu operation, enhanced serviceability with built-In self diagnostics.
- Y/R - Y/B-Y component signal outputs via BNC or 12-pin Betacam DUB connectors. Also has S-Video output.
- Optional BKW-2020 provides U-matic DUB output capability.

PBC 2650 Player with Dynamic Tracking (DT)

Same as PBC-2600 plus–

- Dynamic Tracking (DT) provides broadcast quality noiseless playback within -1 to +3 times normal speed.

PBC 2800 Player/Recorder

Same as PBC-2600 plus–

- Built-in comprehensive editing facilities.
- Dynamic Motion Control with memory provides slow motion editing capability (when used with a player VTR equipped with DT function).
- More than 90 minutes of recording/playback time using L-size Metal (for both recording and playback) or Oxide (for playback only) cassettes.
- Built-in LTC/VITC/User Bits generator and reader, also built-in character generator.
- Y/R - Y/B-Y component signal inputs and outputs via BNC or 12-pin Betacam DUB connectors. Also has S-Video input and output.

SONY

PROFESSIONAL S-VHS SYSTEM

SVP-9000 S-VHS Player **SVO-9600** S-VHS Player/Recorder

The SVP-9000 S-VHS player and SVO-9600 recorder are designed as multi-purpose machines with the use of various optical interface boards. By selecting one or more of a particular board, they become dedicated machines for satellite recording, office viewing, video library, sports analysis and editing. At the same time, they adhere to Sonys professional VTR concept of reliable mechanism, rigid construction and easy operation, ensuring reliable and reliable operation in the industrial and professional environment.

They both feature:

- Using the S-VHS format, they deliver superb picture playback and recording. With newly developed Digital Y/C separator maintained picture quality even in composite.
- Newly developed video cross talk canceller eliminates color blur providing more accurate color and sharper images.
- Four channel audio system – Two Hi-fi with a dynamic range of 90dB and two linear channels with Dolby NR.
- Two direct-drive reel motors provide rapid response and smooth operations. Mode transitions such as STOP to REC, FAST FWD to PLAY, STOP to REWIND are instantaneous.
- Picture search from -10 to +10 times normal speed.
- SYNC IN for synchronizing with other video sources.
- Automatic repeat and automatic rewind can be accomplished with programmed operation.
- There is a TIMER switch for either REC or PLAY (SVP-9000 PLAY only) when selected automatically executes the selected mode when the power is turned on. This is very useful for unattended operation such as satellite recording.
- Auto head cleaner – each time a cassette is loaded or ejected, a cleaning roller automatically passes over the video/FM audio heads removing tape residue and providing preventive care of the tape heads.
- The SVO-9600 features sensor recording. When video signals are input, it automatically starts recording.
- 19" EIA rack mountable plus adjustable front controls.

Optional Interface Cards:

- **SVBK-100** 33-pin interface board allows remote control of basic VTR functions.
- **SVBK-120** RS-232 interface board allows for machine control from a computer.
- **SVBK-140** RS-422 interface board allows either machine to be configured into any professional system.
- **SVBK-150** Digital Noise Reducer board reduces jitter, noise and Y/C delay and provides clear, crisp still frames.
- **SVBK-160** SMPTE Time Code interface board (can only be used with SVBK-140 board).

NEWTEK VIDEO TOASTER 4000

- Production Switcher
- Luminance Keyer
- Frame Grabber/Frame Store
- ChromaFX Color Processor
- Digital Video Effects
- Character Generator
- ToasterPaint
- Dual Frame Buffers/Genlock
- Lightwave 3D

NOVA SYSTEMS, INC.

NovaBlox

VIDEO PROCESSING SYSTEM

The NovaBlox Video Processing System is comprised of Individual function modules called NovaCards. The range of NovaCard modules includes time base correctors, frame synchronizers, sync generators, encoders, decoders, transcoders, distribution amplifiers and routing switchers. NovaCards have the flexibility of plugging into either a computer or one of four NovaChassis that hold from one to 15 modules. NovaCards fit into an IBM or compatible expansion slot including Amiga. Most of the NovaCards utilize RS-232 serial date for operational control and include DOS, Windows, and Amiga software. For desktop and portable applications, the C-2B chassis hold two cards. There is also the C-4 single rackmount chassis that accommodates up to four NovaCards and the three rack C-15 NovaFrame, which features 15 slots. To provide operational control when using one of the NovaChassis there are two NovaTrol Serial Control Units to choose from. They provide LCD status display with four button operation or the NovaTrol/2 which has enhanced operation with dedicated function controls and LCD status display.

NOVAMATE TBC/Frame Synchronizer

One of the NovaCard modules of the NovaBlox system, the NovaMate is a unique TBC/Frame Synchronizer that satisfies a wide range of VCR signal correction and video interface requirements from desktop video to satellite systems. NovaMate plugs directly into a computer or one of several chassis configurations. Control is performed either by software or NovaTrol control units. The flexibility of its modular design and microprocessor control plus its superior quality make NovaMate the ideal alternative to stand-alone and computer based TBCs.

WE CARRY ALL OTHER NOVACARDS: ENCODERS, DECODERS, TRANSCODERS, DISTRIBUTION AMPLIFIERS AND ROUTING SWITCHERS

HORITA

BSG-50

Blackburst/Sync/Tone Generator

The BSG-50 provides an economical means for generating the most common RS-170A video timing signals used to operate various video switchers, effects generators, TBCs, VCRs, cameras and video edit controllers.

- 6 BNC video/pulse outputs
- Now available: 6 blackburst, 4 sync, 2 subcarrier
- Each sync output individually settable for composite sync, composite blanking, H-drive, or V-drive.
- Separate buffer for each output–maximum signal isolation
- 1KHz, 0dB sinewave audio tone output, locked to video
- Outputs can easily be configured to meet specific user and equipment needs $269

CSG-50

Color Bar/Sync/ Tone Generator

- Generates full/SMPTE color bars, blackburst and composite sync signals.
- Built-in timer can automatically switch video output from color bars to color black after 30 or 60 seconds. Easy and convenient for producing tape leaders and striping tapes with color bars and black.
- Front panel selection of full-field or SMPTE color bar patterns or colorblack (blackburst) video output.
- Includes crystal-controlled, 1KHz, 0dB audio tone output.
- Outputs: video, sync, ref frame, 1 KHz, 0dB
- Audio tone switches to silence and color bars change to black when using 30/60 second timer
- Fully RS-170A SC/H phased and always correct. No adjustment required $349

WE STOCK THE FULL LINE OF HORITA PRODUCTS INCLUDING:

WG-50 –	Window Dub Inserter
TG-50 –	Generator/Inserter
TRG-50 –	Generator/Inserter/Search Speed Reader
TRG-50PC –	Has all of the above plus RS-232 control.
VG-50 –	VITC Generator, LTC-VITC Translator
VLT-50 –	VITC-To-LTC Translator
VLT-50PC –	VITC-To-LTC Translator / RS-232 Control
RLT-50 –	HI8 (EVO-9800/9850)TC to LTC Translator
TSG-50 –	NTSC Test Signal Generator
SCT-50 –	Serial Control Titler "Industrial" CG, Time-Date Stamp, Time Code Captioning
SAG-50 –	Safe Area, Convergence Pattern and Oscilloscope Line Trigger and Generator

NRG

970 Power-MAX

The 970 Power-MAX is designed for power-hungry professionals who have high-current draw situations and long run times.

- Highest capacity quick-charge capable 12 Volt 14-AMP sintered nicad power pack (removable).
- Rugged high-grade, black leather belt case; chassis assembly with dual 3-pin XLR inputs for pack interchange without shutdown.
- 2,500-cycle cell life provides lowest cost per cycle.
- Microprocessor-controlled 5-step multi-colored power indicator display.
- Belt with cellpack weighs a comfortable 7.5 lbs.
- Charge in little over two hours with the optional 650-III Intelliquick Fast charger.
- Dual outputs allow simultaneous powering of two devices (eg. camera and light). Output configurations include cigarette lighter and 4-pin XLR in any combination.
- Includes Power-MAX belt and power chassis, 14-amp cell pack in 12V or 13.2 volt configuration, model 600 overnight charger, comprehensive owner's manual. Fits waist size 29"-44".

VARI-LITE PRO

Professional DC On-Camera Light

Thanks to on-board control IC's using NRG's Light-Gate technology, light intensity can be infinitely adjusted by the user within a range of 10% to 100% of the lamp's rated power. You can instantly adjust light output to exactly meet changing light requirements, all without changing hot bulbs or fussing with power rabbit diffusion filters. Best of all, the Vari-Light Pro virtually eliminates color shift and dramatically conserves precious battery power by using only the power required for the selected light level. Accomodates bulbs from 20W to 100W DC.

- Prismatic Pyrex dispersion grid provides smooth even light ouput and reduced glare without changing light intensity.
- Sturdy all-metal click tilt mounting bracket with unique ratchet action. Eliminates shake during action shooting.
- Front retainer assembly pops off for instant bulb access without the bother of screws.
- Rugged milled aluminum light head disperses heat and provides years of service under adverse conditions.

Power Station Series

Designed to replace expensive original-manufacture AC power supplies, the affordable Power Stations deliver precisely-regulated 12-volt DC power from AC sources worldwide. High-current capability allows for powering not only large camcorders, dockables, decks, and cameras, but lights, monitors, and other high draw 12-volt equipment as well.
The stations provide up to 9 amps of precisely regulated DC power eliminating the need for battery power in stationary applications where an AC source is available. The Power Stations exceeds all original manufacturer performance specifications.

- Available in different configurations: The 12560 features a single cigarette or 4-pin output and up to 5 amps of output current. The 129100 features dual outputs in any combination of cigarette or 4-pin and 9 amps of output current capability.

Features:

- High-current output
- Worldwide voltage selection
- Rugged steel case
- 4-pin or cigarette lighter outputs
- Lighted power switch

Power Station-2 Series

Just plug the PowerStation-2 into any AC outlet in the world and out comes perfectly regulated 12-volt DC power through four 4-pin XLR connectors and one cigarette lighter connector. It uses an advanced pulse-width-modulated power supply which allows for ultra-light weight and small size . It operates with little heat even at full output. The PowerStation-2 is the ultimate multiple-output professional power source for cameras, decks, lights, monitors, and a host of other video accessories.

- 85-264 volts worldwide auto-adjusting input (just plug in).
- Supply is fully protected from overcurrent.
- Ultra-light weight - under 3 lb.
- Outstanding 300,000 hour mean time between failure is far in excess of any other manufacturer.
- Ultra-efficient PWM regulation generates far less heat than linear type supplies.
- Provides the ultimate in performance and reliability in a universally compatible and compact package.

Panasonic

Broadcast & Television Systems

WV-F500

3-CCD Digital Processing Camera

- Three 1/2" high sensitivity 380,000 pixel CCDs with on-chip optics, plus precision f1.4 high resolution prism deliver 700 lines of horizontal resolution and excellent signal-to-noise ratio of 60dB.
- Achieves a sensitivity of f8.0 at 2000 lux and minimum object illumination is 4 lux at f1.4 with +24dB gain
- *Emmy Award-winning Digital Signal Processing DSP technology:*
  - Dark Detail Circuit enhances contours under varying lighting conditions. Uses luminance sensitive algorithms to determine the optimum degree of enhancement in dark areas of the picture without altering the brightness of other areas in the picture. Enhances contours of objects as fine as strands of human hair, even under challenging lighting conditions.
  - Chroma Detail compensates for poor resolution in high chroma areas of the picture. Provides a wide dynamic range image with clear reproduction in the chroma area.
  - 2-Dimensional Low Pass Filter reduces cross-color caused by high level brightness signals mixing into the sub-carrier. Reproduces fine stripes and lattice patterns with a minimum of color blur.
  - Highlight compression circuit expands the dynamic range of highlighted areas and prevents halation. Produces detailed images when viewed against a bright backlight or daylight.
- The WV-F500 features detail enhancement through 5 stages of switching: Two levels of hand switching (High and Low) and two levels of details switching within each of the bands. And for further flexibility, the detail enhancement circuit can be turned off when shooting close-ups, special graphics or scenes in low light.
- Switchable R-Y, B-Y, or Y/C system allows direct docking to S-VHS and MII VCRs
- *To further enhance operational speed and flexibility, a total of five easy to use Scene File modes are available.*
  - Scene File One is the Standard Mode which sets the WV-F500 to adjust to studio lighting.
  - Scene File Two is the Illuminance Mode, which provides for different shades of black to be reproduced clearly in dark locations without requiring lighting alterations.
  - Scene File Three is the Fluorescent Mode, because under fluorescent lighting conditions certain color hues tend to be reproduced slightly in the blue spectrum. When switching on Scene File Three, these hues are adjusted while using the white balance to provide natural tones.
  - Scene Files Four and Five are the User Modes for flexible data setting. Twenty different digital adjustments can be set including gamma, knee-point, chroma detail, detail, matrix and shading. Individual settings are available for 11 of the 20 items at gains of 0dB, +9dB, +18dB and +24dB. These digital adjustments also allow the WV-F500 to be matched to other color cameras in a studio environment for quick set-ups.

DS5050 S-VHS Dockable Package:

- WV-F500 3-CCD color camera
- WV-VF40 1.5" viewfinder
- Canon 13:1 servo zoom lens
- WV-MH500 mic holder
- AG-7450A S-VHS Hi-Fi VCR
- WV-DKT700S Docking Kit
- WV-CC500 system case
- WV-QT700 tripod adapter

WJ-MX50 Digital A/V Mixer

- Four input switcher and any two sources can be routed to the program busses
- Two-channel digital frame synchronization permits special effects in each of the A/B busses.
- Combination of 7 basic patterns and other effects creates 287 wipe patterns.
- External edit control input for RS-232 or RS-422 serial controls. Also has GPI input.
- Wipe boundary effects: soft/border (bold, 8 back colors available)
- Digital effects including strobe, still, mosaic, negative/positive, paint, monochrome, strobe, trail, and AV synchro
- Real-Time compression - the entire source image is compressed inside a wipe pattern
- "Scene Grabber" makes it possible to move a pattern, upholding the initially trimmed-in picture integrity.
- Non Additive Mix (NAM): selects between A and B sources, passing only the signal with the highest luminance value.
- Fade-in and fade-out video, audio, titles individually or synchronously faded.
- Down stream keyer with selectable sources from character generator or external camera.
- Incorporates 8 separate memories that enable virtually instant recall of frequently used effects
- 8 preset effects include: Mosaic Mix, Position Stream, Corkscrew, Bounce, Flip, Shutter, Vibrate, and Satellite.
- Audio mixing capability of 5 sources with 5 audio level adjustments.

AG-7650H/AG-7750H

S-VHS Player / S-VHS Edit VCR

Editing machines truly designed for professionals

- Built-in Digital 3-Dimsional type, full field (262.5 line) Time Base Corrector eliminates even small amounts of jitter, skew, head impact error, and color blurring. The precise time base correction is invaluable for A/B roll editing, maintaining high picture quality through multiple generations.Also provides full field drop-out compensation.
- Laminated amorphous video heads that provide higher magnetic coercivity than conventional ferrite heads. The expanded color signal frequency response from the amorphous heads minimizes color blurring and noticeably improves color reproduction.
- "Logical" comb filter featuring an advanced 3-line delay line system, enables a huge improvement in crosstalk cancellation during playback. The result is significantly higher picture quality, with reduced color and luminance blurring.
- High-precision aluminum die-cast chassis and extra large impedance roller assures exceptionally stable transport.
- Advanced AI capstan servo control provides for high speed search at 32x normal speed.
- Built-In RS-422A 9-pin serial interface - the standard control protocol for professional broadcast components.
- Both machines provide two Hi-Fi stereo audio channels with a dynamic range of 90dB plus two linear audio channels with Dolby NR(Noise Reduction). Each audio channel has its own input and output with separate individual channel level setting capability.
- Professional 7-pin dub output (AG-7650H) and 7-pin dub input and output (AG-7750H) help to keep the quality of your images during editing. The AG-7750H features manual adjustment of video recording level.
- Optional AG-F700 Time Code Reader/Generator Card lets you perform LTC/VITC (Longitudinal/Vertical Interval) recording and playback for high-precision time code editing. The AG-7750H edits with VITC on one of its audio channels.

LEADER

Model 5850C

Vectorscope

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

Model 5860C

Waveform Monitor

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

Model 5864A

Waveform Monitor

A fully portable waveform monitor for field use, the Model 5864A is a two-channel unit that provides 2H and 2V sweeps with MAG, FLAT and IRE response, and normal and X4 gain.

Model 5854

Vectorscope

2-channel portable vectorscope is ideal for field use and features A and B phase reference, fixed and variable gain. Both units shown with optional battery holder and NP-1 type battery.

MAGNI®

MM-400

- The MM-400 is a combination waveform and vector monitor especially configured for the cost-conscious producer. A low-cost alternative to CRT-based waveform monitoring the MM-400 produces a video picture of the input signal's waveform and displays it on any video monitor. It provides a simple, affordable and accurate way to set camera levels before a shoot, or to check time base correctors and color fidelity in editing. Problems like hue shift, smearing, muddy contrast and loss of detail are easily identified for correction.

FEATURES:

- Converts waveform or vector display information into a standard video signal which can be displayed on a video monitor or routed around a video facility. no need for additional expensive monitors. Switch between pictures and waveforms at the push of a button.
- Incorporates an advanced SC/H phase and color frame indicator that is a must for editing and post production. At a glance it tells you if a signal's subcarrier-to- horizontal phase is properly adjusted and if the signal's color frame matches the house black burst connected to the MM-400 external reference input.
- Works anywhere and with any analog video format—NTSC, PAL, Component or S-Video. It has automatic detection between NTSC and PAL formats.
- Three loop-through inputs can accept three composite signals or one component, or RGB signal
- No complex displays or special test signals are required for component video monitoring
- Interchannel timing and amplitude display make component analog monitoring easy. has color bar limit markings for Betacam, M-II and SMPTE formats.
- Waveform and vectorscope controls, including channel, sweep speed, position control, phase rotation are on easy-to-see dedicated pushbuttons.
- Besides instant toggling between picture and waveform, a mix mode combines waveform and picture displays for simultaneous viewing.
- The MM-400 can be readily used by even novice operators. It has easy-to- understand set-up menus for display color, interchannel timing, SC/H phase alarm.
- Usable in any video facility of any size for displaying signals. its low cost makes it affordable by the smallest studio, while its features and performance make it ideal for monitoring in high-end facilities as well.

New Products

UHF wireless system
By Telex Communications, Inc.

• **FMR-450:** a high-performance, broadcast-quality UHF wireless mic system that operates from 524MHz to 746MHz (UHF TV channels 23-60); operates up to 50 simultaneous systems using hand-held or beltpack transmitters without compromising operating range or audio quality; features Pos-i-Squelch II true diversity circuitry and specially matched 1/2-wave collinear ground independent antenna system; receiver features RF, audio and diversity LED indicators.

Circle (364) on Reply Card

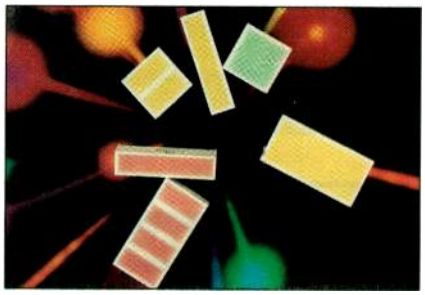
Test instruments
By Leader Instrument Corporation

• **Model 5836A:** a multichannel audio monitor that displays surround-sound image in several formats and accepts up to five channels for left/center/right/surround, and left/center/right/left-surround/right-surround systems; on-screen displays include level readouts in the X-Y mode, and electronically generated graticules for X-Y and surround-sound imaging.

• **Model 408:** a multiformat video/sync test generator; adds 4.5MHz sound to the composite video outputs to simulate the common routing method of routing video and sound; provides baseband and RF outputs from 30MHz to 900MHz; programmed for broadcast and cable channels; 27 test patterns include multiburst, video sweep, modulated stairstep and SMPTE bars.

Circle (365) on Reply Card

LED light bars
By Lumex Opto/Components Inc.



• **LED light bars:** provide near perfect uniformity of light without light leakage to adjoining bars; each bar uses two to eight individually driven chips on a PC board; available in seven sizes ranging from 5x10mm to 10x20mm; power requirements range from 10 to 20 milliamps per chip with typical forward voltage of 2.1V (Vf) per chip.

Circle (366) on Reply Card

Disk recorders
By Recognition Concepts, Inc.

• **RCI Video Disk Recorder:** a series of digital video disk recorders with timeline capabilities; provides random access to video frames or sequences; the 24-hour event list is programmed with up to 64k operations, such as cue, play and record; event list is executed in synchrony with a 24-hour master timeline clock.

Circle (367) on Reply Card

Solvent-filled pen
By Hub Material Company

• **TidyPen:** spill-proof, felt-tip marker that dispenses tiny, measured amounts of Bioact EC-7M solvent, a biodegradable, ozone-safe, citrus terpene cleaner; removes fluxes, ionics, greases, oils and many adhesives; leaves no residue.

Circle (368) on Reply Card

Insulation displacement connector
By Neutrik USA Inc.

• **XY Series:** IDC contacts are constructed as a double U-element providing four gas-tight and reliable contact points accepting a range of wire cross sections of AWG24-AWG26; no soldering or tools are required for assembly.

Circle (369) on Reply Card

Continued on page 84

The Gallery

New Products

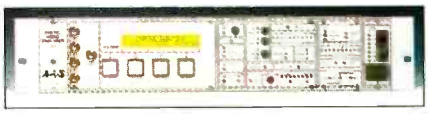
the-minute, detailed graphics with their existing graphics computers.

• **UltraGraphix-32 Weather System:** includes full-resolution 32-bit graphics, three digital video channels, real-time video playback, 2-D/3-D animation, looping, NTSC/PAL output, 3-D font character generator, and full-featured paint/art production; uses Accu-Weather's proprietary InfoNavigation capability.

Circle (361) on Reply Card

Digital video analyzing tool

By Advanced Audio Visual Systems/ Sencore



• **S310 Digital Video Analyzer:** a modular test system that performs real-time, online testing of all digital video signals to ensure that they conform to all international standards (CCIR 601, 656, SMPTE 259M, 244M); fully compatible with serial and parallel signals and can be used with 525- or 625-line systems; some of the tests include direct read out of jitter, levels, errors in the TRS, reserved codes in active video, bit activity, clock/data skew, presence of non-recommended video levels.

Circle (362) on Reply Card

Digital compositing system

By Parallax Graphics Systems

• **ADVANCE:** a resolution independent digital compositing, non-linear editing and effects system; works with an unlimited number of clips at any resolution or color depth; supports free combination of clips from different formats offering full re-sizing and retiming and allows complex multistage processing in a single pass.

Circle (363) on Reply Card

New Products

Distribution amplifier/ equalizer

By Matthey Electronics

• **CS589:** combines a distribution amplifier with a standard video bandwidth cable equalizer; suitable for remote broadcasting locations.

Circle (357) on Reply Card

Tower monitor

By Remote Monitoring of America

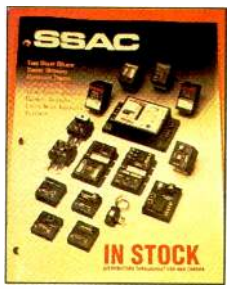
• **RemoteLINQ ITM 100:** detects and responds to tower light and site power outages, temperature variance in shelters or radio racks, and unauthorized intrusions; based on a forward and reflected power monitor that plugs in-line into a tower's antenna cable using standard "N connectors"; features battery backup and protects data and program integrity during power outages; protected operation in RF environment.

Circle (358) on Reply Card

Catalog

By SSAC Inc.

• **In Stock Controls Catalog:** 32-page catalog featuring time delay relays, encapsulated timing modules, universal timers, alternating relays, 3-phase voltage monitors, current sensors, and accessories.



Circle (359) on Reply Card

Circle (50) on Reply Card

Circle (51) on Reply Card

Digital audio workstation

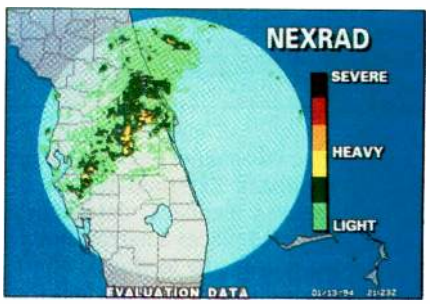
By Digital Audio Research

• **SoundStation Gold:** a complete, integrated production center comprised of an assignable, dynamic automated mix controller, a dedicated edit control console and an enhanced processing unit, which contains both hard and optical disk storage facilities; available in 8- and 16-channel versions; provides a recording capacity of up to 22 track-hours on hard disk, with removable, dual-density optical disks for instant project playback and easy media exchange between DAR and other workstations.

Circle (360) on Reply Card

Weather system products

By Accu-Weather



• **NEXRAD Doppler Radar:** 17 real-time products available for each of 40 radar sites; allows TV stations to receive up-to-

New Products

Editing system and digital video effects system
By Grass Valley

• **Sabre 4100S:** editing system that utilizes the Silicon Graphics Indy desktop workstation; features Power Panel control panel, a marks cache, two live video input windows; and the PixLine edit display.

• **Krystal 4300:** a digital video effects system; features partial keyframes, greater display bandwidth, proprietary filtering techniques, new light sourcing capabilities. Owners of Kaleidoscope channels will be able to extend their useful life by placing them in a "pool" of Krystal channels.

Circle (350) on Reply Card

Automatic feedback controller
By Sabine

• **FBX-1802:** two-channel upgrade of the FBX-900 Feedback Exterminator; automatically senses feedback, determines its frequency, and places a narrow notch filter to cancel only the feedback; offers nine filters per channel; user can lock the filters to prevent the filters from going deeper.

Circle (351) on Reply Card

Serial component digital switcher
By Thomson Broadcast

• **9200:** a high-level component digital switcher with 10-bit processing; features M/E or multilayer mode, key or video framestore, double transition, level correction, source memory, Mem Box with keyframes and sequences, timeline management, 6 auxiliary video or key buses, and DVE control.

Circle (352) on Reply Card

Real-time digital video disk recorder
By Sierra Design Labs

• **QUICK-FRAME EX:** a high-end component video storage solution for production and post-production facilities and computer-based animation and graphics systems; stores just under 12 minutes of uncompressed 8-bit 4:2:2 component digital video in 5 1/4" of rack space; includes VTR-compatible RS-422 control, true real-time non-linear playback, 8/10 bit and 525/625 selectable video formats, ethernet with TCP/IP, RSH and RCP support and a multifunction SCSI port.

Circle (353) on Reply Card

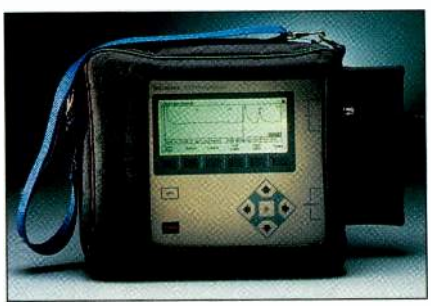
Virtual recorder
By ASC Audio Video Corporation

• **Multistandard (PAL/NTSC) Virtual Recorder:** a digital, random access storage and retrieval system that provides audio and video material instantly for applications designed to work with VTRs or laserdisk machines; records and plays video, 2-channel audio, and EBU time code; any device that interfaces with a professional VTR can use true random access video via industry-standard RS-422 series protocol.

Circle (354) on Reply Card

Audio measurement set/Metallic time domain reflectometer
By Tektronix

• **AM700 audio measurement set:** a fully integrated test instrument with on-board digital capability, processing power, programmability, and rapid-access interface; self-contained system comes with analog and digital signal analyzers, analog and digital generators, internal CPUs, a monochrome VGA display, diskette drive and memory.



• **TV110 CableScout:** a metallic time domain reflectometer optimized for coaxial cable; features CATV-specific software and settings for cable type, waveforms and pulse widths; enhanced with a large, high-resolution display and standard serial RS-232 printer port and 640x200 pixel LCD.

Circle (355) on Reply Card

Modular frame synchronizer
By Nova Systems, Inc.

• **NovaSync3:** a wide-band composite video frame synchronizer that is part of the NovaBlox Video Processing System; features video AGC and serial control for all operate, memory, system phase and calibrate parameters; full broadcast specifications include 5.5MHz bandwidth and drift-free digital insertion of sync and burst; Median Filter Noise Reducer option eliminates noise; Four Field option maintains constant picture.

Circle (356) on Reply Card

Field Report

Sumitomo ViewPlex-2000 real-time video signal multiplexer

By Roy Trumbull

One constant in the changing TV environment is the monitor wall. It was there at the dawn of television and it's still in use today. But with the proliferation of specialized equipment in the control room, the monitor wall may well be on its way out.

Some years ago, KRON-TV needed to use venue producers during election coverage. An executive producer was used to keep an overview of all sites while the program was under way. The problem was there was no place to put him where he could get a good view of the monitor wall.

Around 1986, consumer devices capable of compressing pictures became available. By stacking nine of them, the executive producer could be given nine pictures on one monitor. The size was fixed and there were no legends other than those supplied by pen on strips of tape. The arrangement did the job and is still used, however, one problem exists. You have to pay close attention, because if a shot is lost, the unit will freeze last video. As part of the setup, an audio monitoring panel allowed the producer to hear the audio from each site simply to verify there was audio to go with the picture. A multichannel PL package allowed the producers to have their own channel. This is being mentioned because the product being reviewed is only a part of the answer to the problem.

Unit description

The Sumitomo ViewPlex-2000 is one of several products that have addressed the need to permit monitoring complex productions on one monitor. It is a rack-mount unit with 16 normally bridging video inputs. The input signals can be asynchronous with respect to each other so the unit can be fed with non-frame-synced microwave signals. Unlike our existing system, when a signal goes away on the ViewPlex, it really goes away. The rack-mount unit is controlled by a portable DOS-type computer using a 9600 baud RS-232 port.

Trumbull is assistant chief engineer for KRON-TV, San Francisco.

Performance at a glance:

- *Displays up to 16 channels on one screen simultaneously*
- *40 different display configurations*
- *Real-time picture refresh (30 frames/sec.)*
- *8-color character generator*
- *8-bit picture resolution*

Multiple A/D converters and compression circuits are used to pass the signal through to each frame memory. This keeps the image as sharp as possible at different compression ratios. The software supplied with the system allows a variety of options to be defined. There are 40 screen formats, from a single picture up to 16 pictures, and many of the formats permit one or more larger pictures in combination with smaller pictures. Which picture goes where on the screen is decided in advance by the user. The 40 screen templates, plus the possibility of defining any picture into any location, allows hundreds of possibilities.

Each of the inputs can be identified with a 6-character title entered by the user on the computer. In addition, color for each title can be selected. Border colors on each screen can also be defined, which might prove a useful way to color code a complex event. One feature probably not useful for broadcast applications was a macro mode in which a rotation of picture patterns could be set up. The time each remained on the screen was programmable by the user.

Once the patterns and the arrangement of pictures within each pattern had been selected, the screen was given a number, which was later used to recall the selection. It was also possible to set a power-on default pattern. A primary concern was how the images looked on a small monitor, often that is all we can mount at a working position in a control room. The images were crisp and the CG legends readable even on a small color monitor. Given the distance to monitors on a traditional monitor wall, the trade-off was reasonable for someone making production decisions as opposed to a technician checking quality.

Different applications

The multiplexer was developed for several different applications. Used in a security system, it can be activated by motion sensors. A terminal strip on the back permitted sensors to call up predefined pictures. In addition, an accessory panel permitted calling up 16 predefined pictures. However, the accessory panel was said to be as expensive as the DOS computer that normally controls the system.

For a complex event, three of these systems would work well in a typical control room, because several people would need to look at different screens at the same time. A wish list would include an audio-follow-monitoring system activated by a touchscreen, so a producer could hear the sound to go with the picture without using additional pushbuttons or rotary switches. The act of selecting a picture could also set up the PL and IFB circuits to the venue being monitored. That might be accomplished with a simple tally circuit.

Getting down to specifics, the unit reviewed was one of the first in the country and required an external transformer to get the right voltage to operate. The computer was running a Japanese version of DOS and the screen would sometimes come up in Katakanah ideographs. Given the lack of real estate in control rooms, being able to control the multiplexer under Windows would be a big improvement. That way a single computer could be used for several concurrent tasks. In addition, the chassis had a light rack-mount flange on the front and no provision for mounting rack slides. The problem was mentioned to the manufacturer because the chassis was heavy and should be supported.

The system was certainly useful as provided, but it brought up the possibility of additional tasks that could be streamlined in a control room to provide a radical departure from current practices. Currently, the ViewPlex-2000 costs about as much as a fully loaded monitor wall — hopefully the economies of scale will bring down the price.

Editor's note: Field Reports are an exclusive *BE* feature for broadcasters. Each report is prepared by the staff of a broadcast station, production facility or consulting company. These reports are performed by the industry and for the industry. Manufacturer's support is limited to providing loan equipment and aiding the author if requested. It is the responsibility of *Broadcast Engineering* to publish the results of any device tested, positive or negative. No report should be considered an endorsement or disapproval by *Broadcast Engineering* magazine. ■

➡ *For more information on the Sumitomo Viewplex-2000, circle (330) on Reply Card.*

KHNL/KFVE master control, showing automation terminal display on monitor at bottom of center rack. Note dedicated control panel for automation system on counter behind QWERTY keyboard and switcher.

single list at any one time, two of each device are required to avoid conflicts if both channels call for the device simultaneously. Editing the device assignment list adds any device to any list.

Accommodating last-second changes is another important feature, especially useful in KFVE's live sports events. The cut-and-paste list editing capability and the system's zero-latency allow quick changes of time and sequence.

KHNL/KFVE have been on-air since September 1993 without any major mishaps. The system has required some adjustments, but because it is software-based, these changes can be sent from the manufacturer to the station via modem. Operations personnel felt comfortable with the system after only a few days of training.

It would not have been possible to meet this consolidated operation's business, quality and future growth obligations without automation. This is clearly the way of the future for broadcasting, and experience at KHNL/KFVE has delivered proven, positive results. ■

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➡ *For more information on the Louth Automation ADC-100, circle (316) on Reply Card.*

grade its automation tape product (to Louth's *Turbotape*) with minor changes.

The stations currently use the single-tape version of Turbotape, but plans call for a switch to its multicut version soon, in order to meet tape-library growth demands. This product manages all the media used in on-air presentation. When new commercials are dubbed, there is no typing needed to print barcode labels. Prior to CPS and Turbotape, most of the station's label problems resulted from mistyped information. In addition to barcode labeling, tape identification data is automatically encoded in user bits on each tape and logged in a database.

Program material is screened at the Turbotape station and segmented to allow for commercial break insertion. Segmentation data is also included in the dubbed tape's user bits and stored in the database. The screening work is done offline by a PC workstation. Information in the database is used by ADC-100 throughout the compiling, recording and playout processes.

Multichannel operation

The station's existing ATL was not suitable for supporting two asynchronous channels direct-to-air concurrently because it could only run with a single list, and the demands on the elevator, bins and VTRs in complex multichannel operation would also be excessive. Therefore, it was decided to precompile breaks for each channel and to use the ATL as a large tape library with the added benefit of reduced tape handling.

Compiling is done by the automation system and is monitored by the person handling the dubbing.

Compiling is done by the automation system and is monitored by the person handling the dubbing. Two compile lists running in the server precompile each channel's schedule one day ahead of airing. Each channel is compiled sequentially onto 30-minute tapes. The process takes approximately 12-to-14 hours a day for both stations. The software automatically compiles in the background. If a required spot is missing, the system will skip to the next spot leaving space for the insert, and then return to record it when it becomes available. The compiled tapes are recorded on external VTRs under automation-system control. Because the system is frame accurate at all times, in the event of a change, a compiled tape can be insert-edited without recompiling the whole tape.

In the near future, a hard disk cache or buffer is planned for random access, real-time playout. This will reduce the tape and VTR wear inherent in compiling. Incoming spots will then be dubbed directly from their source tapes to multicut tapes in the ATL. Active spots will be transferred on demand to the cache, which will be periodically refreshed with new spots. The ATL will then hold all commercials and promos in an archive. (See "Disk-Based Spot Playback Systems," p. 49.)

In addition to the two compile lists, the system simultaneously runs the two channels' on-air playlists and an automated satellite record list. The latter controls the recording of time-shifted program material to VTRs, all under control of the device server.

The on-air schedule logs are automatically translated to machine-readable playlists. The two lists control the real-time activity of the 23 devices attached to the server, 17 of which are VTRs.

A Chyron *Codi* and audio cart machines are currently controlled by GPIs, but Louth has committed to support both systems serially in an upgrade. Because these devices can only be attached to a

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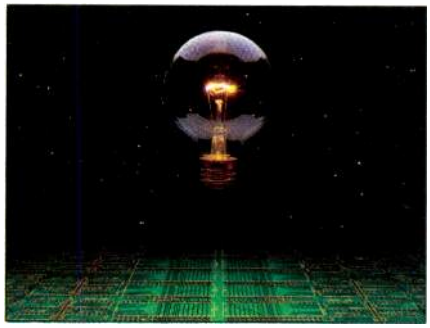
MATROX STUDIO

Circle (47) on Reply Card

Talking chips



By Curtis Chan

We have arrived at the age of talking gadgets. It seems that every new toy, learning aid, electronic game, appliance and even computers, are talking back in the language of your choice. At the heart of these devices is a new breed of affordable speech synthesis and recognition chips that generate speech from sampled data stored in memory.

The two most popular predictive coding algorithms for generating speech are ADPCM and LPC.

Algorithms

The two most popular predictive coding algorithms for generating speech are adaptive differential pulse code modulation (ADPCM) and linear predictive coding (LPC). These algorithms compress speech samples stored in memory while retaining reasonably good speech quality. Speech synthesis chips also come in different quality levels and storage capacities. Here's a look at what's new.

ADPCM

ADPCM is a variant of DPCM, which reduces the amount of data by quantizing and encoding the differential between speech signal samples. ADPCM adaptively changes the quantization width, depending on the quantization width of the previous differential sample. For example, Oki Semiconductor uses ADPCM in its chips. These chips have internal mask ROM ranging from 128kb to 1Mb and feature one-time programmable (OTP) or external ROM memory. Although the 3-bits or 4-bits/sample and variable sampling rates from 4-16kHz will not suffice for broadcast use, it is applicable to consumer products. The $10 (5,000 quantity) 4-bit MSM6379 has 512kb of OTPROM, an internal 12-bit D/A with low-pass filter and stores 32 seconds of speech sampling at 4kHz. Other speech-processing chips, such as the Mosel-Vitelic, based on ADPCM have as much as 256kB of memory and variable bit rates from 16kb/s to 32kb/s.

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

LPC

Elsewhere, companies, such as TI have endorsed the *LPC* scheme of coding. LPC attempts to model the human vocal tract. TI's TSP50C1x chip family ($0.85 to $2.30 at 50k units) combines an 8-bit microprocessor, a speech synthesizer, ROM, RAM, a D/A converter and I/O. In operation, parameters are extracted from sampled speech to create two excitation generators that model the vocal chord restrictions for voiced and unvoiced sounds. The model has a gain multiplication stage to model levels of pressure from the lungs and a 12-pole lattice filter that models the shape of the oral cavity. Because speech changes slowly, the microprocessor accesses parameter samples from memory in frames generally 10ms to 25ms long. The device calculates the input parameters to the model as an average of the parameters for the entire frame. The resulting compressed bit rate is effectively 1.5kb/s. In the case of the ADPCM process, LPC chip companies recommend that external speech coding service companies perform speech development for the speech synthesis chips.

High quality and low cost

ESS Technology offers higher-quality chips, such as the $12 ES1488, which creates all of the speech and sound (except music synthesis) for multimedia boards. Moving up, ESS's $20 ES688 is a 16-bit stereo chip featuring 44.1kHz sampling for recording and playback of CD-quality music. It runs on the ISA bus for PCs and is powered from 3.3VDC or 5VCD.

National Semiconductor's NS32AM160/161 chips are members of the 32-bit series 32000/EP family of embedded system processors. Designed for digital answering machines, the $18 (10,000) chips can also replace microcassette dictation machines. The chip's DSP function compresses and decompresses data using subband coding or LPC algorithms. The processors can execute instructions from on-chip or external ROM. In addition, the chips can detect and generate DTMF tones and provide voice recognition.

Voice recognition

New devices coming to market can also recognize voice commands. Because voice-recognition algorithms are more complex than synthesis algorithms, they require the full power of a DSP chip.

AT&T has developed dedicated speaker-trained voice recognizers for telecommunication terminals. Using ADPCM or code-excited linear predictive plus coding, the recognizers can store compressed speech that achieves bit rates of 5.2kb/s. The company's latest offering, the HVP-S, provides full-duplex operation of a cellular phone with no mic suppression. The chip, along with two codecs, memory, and a microcontroller, stores as many as 64 speaker-trained utterances. The chip allows for speed dialing by voice and can also auto-answer the phone. The price is $20 (10,000 quantity) for the HVP-S with ROM-coded voice recognizer software.

Finally, Vocal Inc. adds voice-recognition software to TI's TMS320C25 DSP chip or National Semiconductor's 32000/EP family of embedded-system processors. The company's TrueWord software stores 100 utterances using a speaker-trained DSP algorithm called Spectral Fit Coding and compresses sampled audio data to 5kbps using a minimum squared error fitting process. ■

➡ *For more information on the following companies, circle the appropriate number on Reply Card:*

AT&T Microelectronics (306)
ESS Technology (307)
Information Storage Devices (308)
National Semiconductor Corp. (309)
Oki Semiconductor (310)
Texas Instruments (311)
Vocal Inc. (312)

Facility automation

A new era of station automation focuses on flexibility and control.

When TV automation was first introduced, it was seen as a competitor for jobs. Although the loss of positions was seldom mentioned by robotic and automation manufacturers, it was an unspoken opinion that camera and some control room operators could lose their positions. The new technology was therefore, presented in couched terms like, *increased productivity* or *improved on-air look*.

History has shown that automation was neither the savage beast nor the savior many thought it would be. Rather, it simply became another tool that wise technical managers used to improve the profitability and on-air image of their stations.

This month's focus is on recent advances in automation technology, especially with respect to spot playback. The advent of both optical and disk-based (video servers) storage has resulted in new techniques for advanced on-air playback systems.

Tape-based automation has been with us for many years and it has proven itself to be reliable, cost-effective and long-lived. And those who claimed, as late as the 1993 NAB Convention, that tape was dead were wrong. Tape library systems provide advantages that are hard to match, especially when all the overhead, ease of operation, operator familiarity, and compatibility factors are considered.

Also, it doesn't take a genius to realize that video servers are the "new kids on the block," and have yet to prove themselves capable of long-term, cost-effective, not to mention, broadcast-quality service. Some believe that combining a tape-based library system with disk- or optical-based storage is currently an effective solution for TV stations. Although only time will tell, computer technology continues to bring exciting new products to the broadcast industry.

This month's issue focuses on several areas where stations can improve their operations through automation. From robotics to master control automation, there is a new era of flexibility and control that is available to stations that want to invest in their future.

Brad Dick

Brad Dick, editor

Master control automation

Understand the problem and make sure the solution doesn't create a bigger challenge.

By Brad Gilmer

The Bottom Line

Specifying, purchasing and installing a master control automation system can be an exciting experience. When tackling a large system integration task, you need to consider several things. To get started down the road to automation, the system that you buy must satisfy the individual needs of the station operation. The first step is studying the existing master control operation.

Any new automation must integrate smoothly with the existing facility. To do this effectively requires an intimate knowledge of how the existing master control operation works. Most of us understand what the equipment does, but may not understand how people use it. A workflow PERT diagram shows how people put together a number of tasks to form a system. Figure 1 shows a typical workflow diagram for a simple master control operation. When you observe the operation, you need to consider these areas:

- How are programming and commercials combined to make a log?
- Where does program material come from and how is it prepared for air?
- How is the log reconciled and how is billing done?
- How do people use the paper logs?
- Where and how are logs converted to transmission lists?

Simple block diagrams can make it easier to explain the operation to others. In addition, they make it easier to identify the problems to be solved.

Gilmer is project manager/technology assessment for the Turner Entertainment Networks Atlanta.

It is important for you to understand the reasons for automating. As the saying goes, "Any road will get you there if you don't know where you're going." You shouldn't automate simply for technology's sake. Use the workflow diagrams and conversations with others to identify problem areas.

One of the main reasons stations automate is to save money by reducing staff, reducing errors and improving billing accuracy. Some stations also automate to improve the on-air look, or cover commercials on a feed to a secondary market. Automation can solve some of these problems, but not all of them. It is more likely to improve the on-air look than to dramatically reduce the staff. (What if the automation fails?)

Whatever your reasons are for automating, take a moment to write them down. Refer to these reasons often and focus on the task at hand. You may find that automation cannot fix the problem or the benefits of automation do not justify the cost. If this is the case, do not despair. Other solutions short of automation may be available that can fill the station's needs.

Alternatives

If you have a cart machine, it may have all the automation you need. Cart machine operating systems have been getting more like automation systems over the years. If the program material is prepared properly, most cart machines will playback material from a VTR outside the cart machine and seamlessly integrate it with material played by decks inside the cart machine.

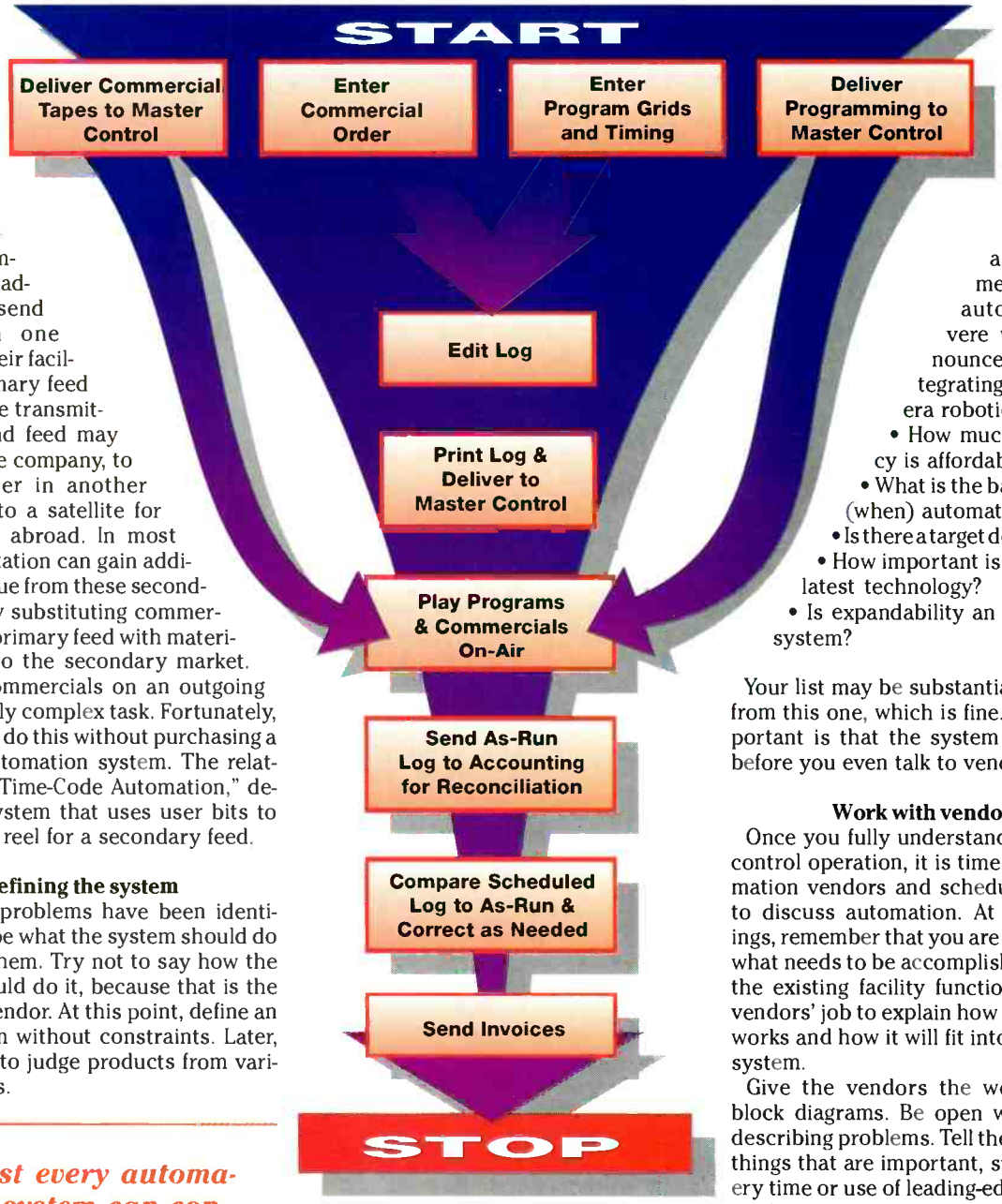


Figure 1. A simplified workflow PERT chart for a typical non-automated master control system.

It is becoming common for broadcasters to send more than one feed from their facility. The primary feed is sent to the transmitter. A second feed may go to a cable company, to a transmitter in another market, or to a satellite for distribution abroad. In most cases, the station can gain additional revenue from these secondary feeds by substituting commercials in the primary feed with material specific to the secondary market. Covering commercials on an outgoing feed is a fairly complex task. Fortunately, stations can do this without purchasing a full-scale automation system. The related article, "Time-Code Automation," describes a system that uses user bits to cue a cover reel for a secondary feed.

Defining the system

Once the problems have been identified, describe what the system should do to resolve them. Try not to say how the system should do it, because that is the job of the vendor. At this point, define an ideal system without constraints. Later, use the list to judge products from various vendors.

Almost every automation system can connect to a traffic system and control external devices. The decision lies in the details.

Most automation vendors can supply a basic system, such as the one shown in Figure 2. Almost every automation system can connect to a traffic system and control external devices. The decision lies in the details. Here are some things to consider:

- What is the budget?
- What capabilities are needed?
- Are there any requirements, such as automating severe weather announcements or integrating with a camera robotics system?
- How much redundancy is affordable?
- What is the backup plan if (when) automation fails?
- Is there a target delivery time?
- How important is it to use the latest technology?
- Is expandability an issue in the system?

Your list may be substantially different from this one, which is fine. What is important is that the system is designed before you even talk to vendors.

Work with vendors

Once you fully understand the master control operation, it is time to call automation vendors and schedule meetings to discuss automation. At these meetings, remember that you are an expert on what needs to be accomplished and how the existing facility functions. It is the vendors' job to explain how their system works and how it will fit into the current system.

Give the vendors the workflow and block diagrams. Be open with them in describing problems. Tell them about the things that are important, such as delivery time or use of leading-edge technology. Automation vendors will need information to design an adequate system. Get bids and proposed solutions from at least three vendors.

It is important that your proposals be complete. Nothing can ruin the day like going back to the GM for another $10,000. One technique is to take the vendor's block diagram and add to it, showing all the connections needed. Don't forget to also include software connections. Identify how each connection will be made, who has responsibility for it, and who will pay for it.

The master control area at TNT Latin America. Operation is semi-automated, with VTRs under the control of the cart machine.

Document, document, document

Once down to the last one or two serious contenders, you

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should closely examine the proposals. Verify that the salesperson has included everything discussed. Here are some things you need to look for:

- Identify how many computers are used and who provides them.
- Define conversion of the current log and determine if any custom work will be required above and beyond what is stated in the proposal.
- Determine who will provide cable and connectors.
- If the system will have as-run reconciliation, will a translation be required? If so, how much will it cost and who will provide it? Is the traffic system ready to accept the reconciliation data?
- Who will provide the computer networking hardware, software, cabling and installation?
- What are the installation costs? Will someone from the factory come out to install the system?

Be fair and impartial as you evaluate prospective vendors...and you should only evaluate existing products.

- Is operator and/or maintenance personnel training included in the price of the system?
- What kind of warranty comes with the system?
- Are there any software maintenance fees, and if so, what do they cover? Are these fees required? One more thing is to get the system features in writing. Identify clearly what features are available now and what features are in development (sometimes called vaporware).

Make the decision

Once the proposals are in order, it's time for you to select a vendor. However, there is still some work to do. Ask for a client list — most automation vendors will supply one. Call the people on the list. Speak to traffic and master control personnel, not just engineers. Visit an automated station if possible.

Be fair and impartial as you evaluate prospective vendors. You should only evaluate existing products. Do not evaluate an existing system against a future product because this is not a fair comparison. It is easy for a salesperson to talk about new features, but it is much harder for manufacturing to implement them. This is especially the case with software-based systems. If a company promises a future feature that is a must-have, think about postponing the purchase until the feature is available. The hazard of this, of course, is that a wait of a few months may turn into a year or more. If you must buy vaporware, be sure to get a good contract. Consider including non-performance penalties if the vendor fails to deliver.

Another area to evaluate when comparing prospective vendors is the cost of the

Continued on page 26

Time-code automation

Using user bits

By Tony Mancari

For the past 12 months, VITC user bit information has been used to signal switch closures in custom automation systems at Turner networks. For example, domestic feed commercials in the Cartoon Latin America feed needed to be covered with other program material. By encoding bumps that play before and after a break, one operator can control two networks.

At the first video on the bump, a user bit-controlled switch closure is used to send a cue tone to cable operators to break away eight seconds later. This same closure spins the heads on the cover machine. Three seconds later another user bit puts the cover machine into play mode. At the end of the bump, a bit switches opto-isolated router heads to the playback crosspoint. At the end of the break, a one-second black tape is aired containing the user bit information to switch the routers back to the domestic feed and sending a cue tone for the cable operators to return at the same time. Five seconds later, a user bit recorded on the cover reel tells the cover machine to stop, leaving it cued for the next 5-second preroll command. One user bit even sets off a sonalert in master control to alert the operator to change the cover reel. This system is also in use at TNT and TNT Latin America to automatically send the data packet for cue tones.

The custom system is installed at dub quality control (QC) stations and the readers are fed by router outputs, which enables any source to be routed into the verify station. This helps verify that each piece on line is passing the information. In addition, proc amps, VITS inserters, and other equipment in the chain must be set to pass the VITC info.

The system is designed around a VITC reader and encoder. The reader has six switch closures available. For more than six functions, the switches can be encoded to make up to 64 functions possible. Modified time-code comparators are used to give a longer contact closure to ensure the user bit is written where desired. An expander panel is used to write four user bits a frame apart if needed.

To complement the time-code readers, I designed and built a 2-rack unit box with encode switches to set a code to encode the tapes and decode circuits to verify and trip the ground closures. This one box could be used to encode and decode the tapes and verify and control the switch closures. We use multiple systems at TBS for redundancy

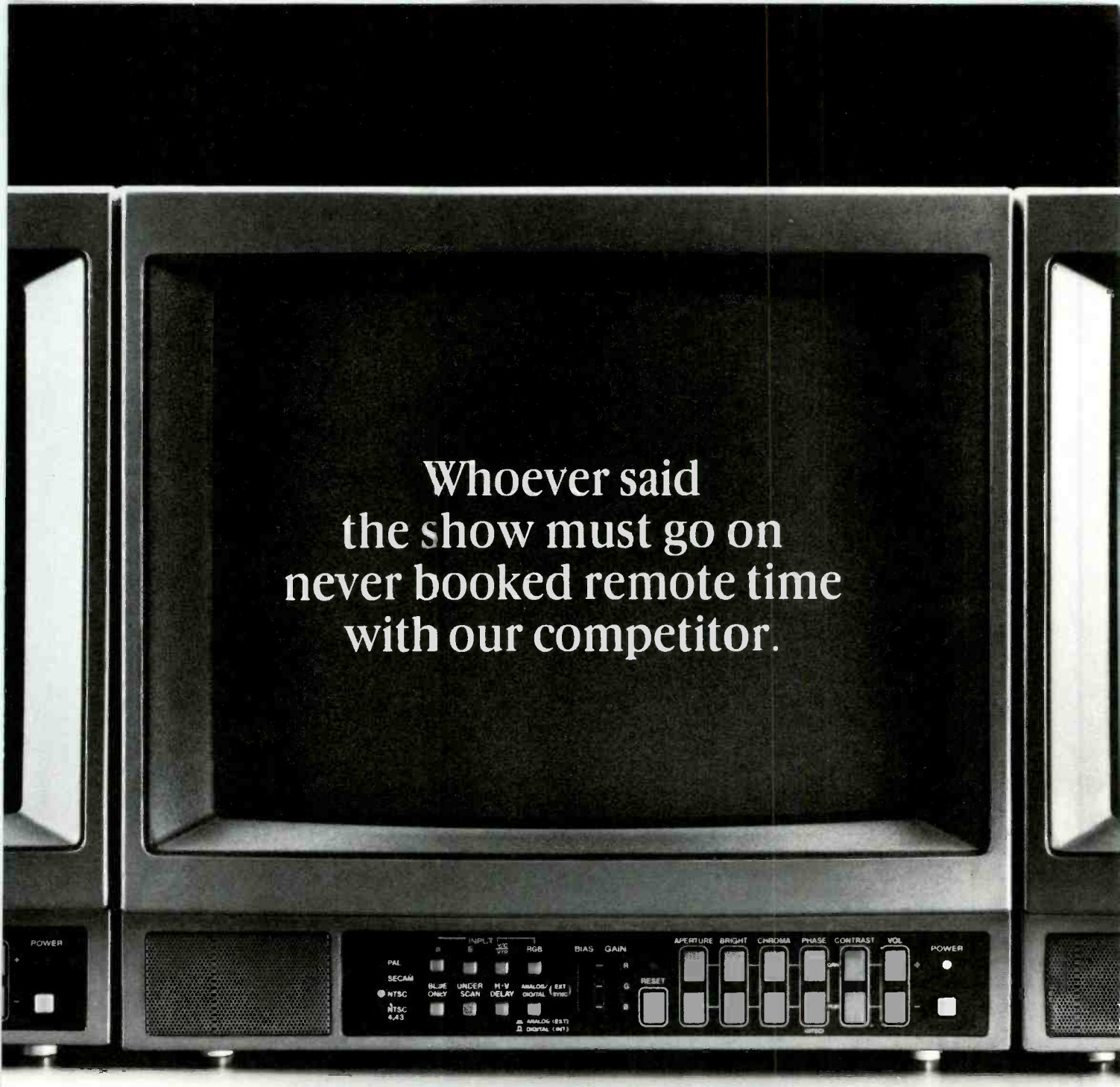
The trick is making sure the right lines are used to write the VITC. For D-2, lines 12 and 14 are used, for Betacam, lines 16 and 18 were chosen. These lines are recoverable at jog and the user bit info can be verified by lighting LEDs at a dub/verify QC station as the bit is read.

Once the tapes are encoded, a reader installed at the output of the program DA allows only the tape on air to trip a switch of the controlled network. Whatever is needed — play, switch a router, stop a machine or send a cue tone — it's possible with VITC user bits. ❑

The dub/verify QC station in use at TBS. The time-code encoder is located above the tape machine, the custom 2-rack unit is below the tape machine.

Mancari is maintenance engineer for the Turner Entertainment Networks, Atlanta.

➡ *For more information on time-code equipment, circle (412) on Reply Card. Also see "Time-Code Equipment" on p. 66 of the 1994 BE Buyers Guide.*



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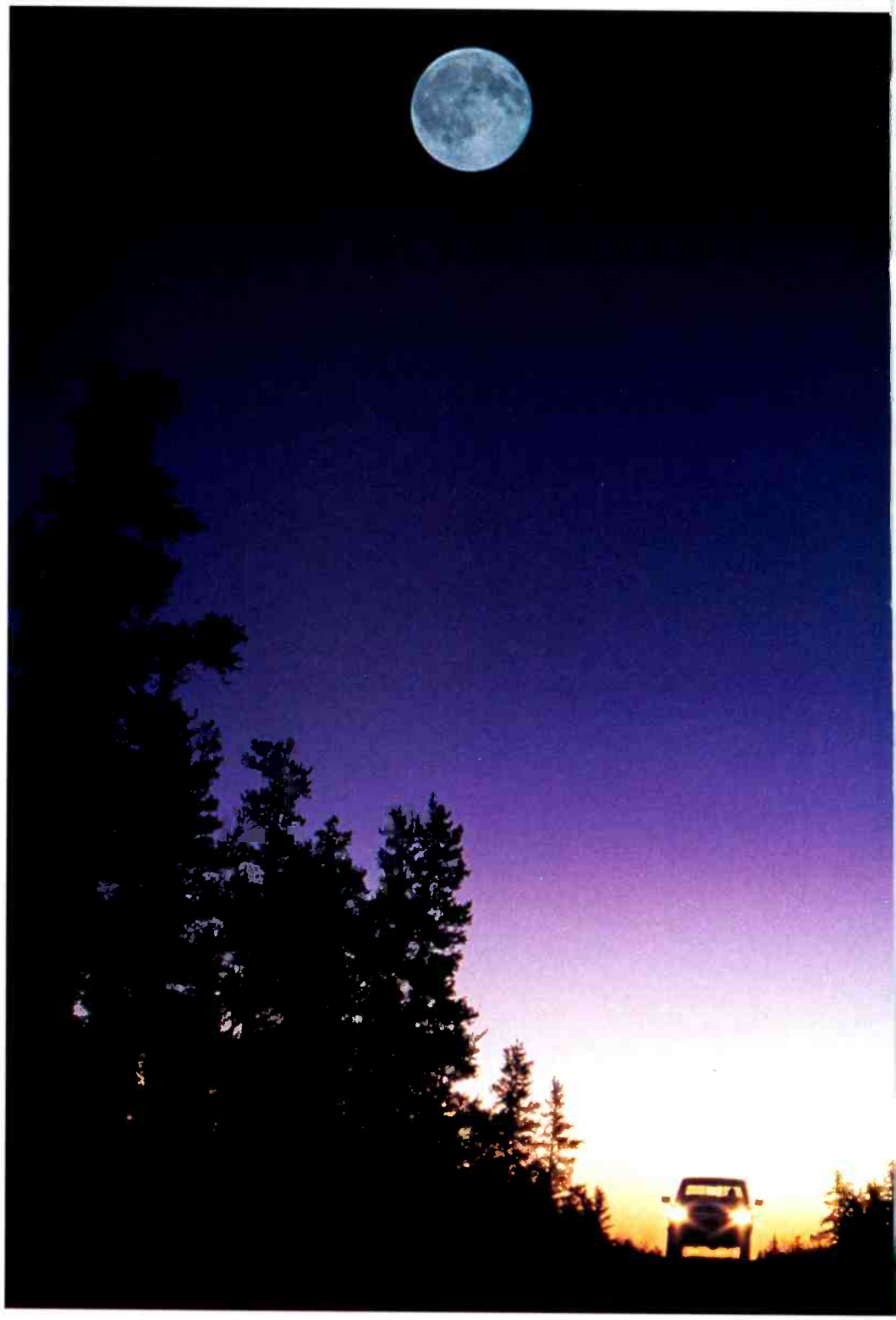

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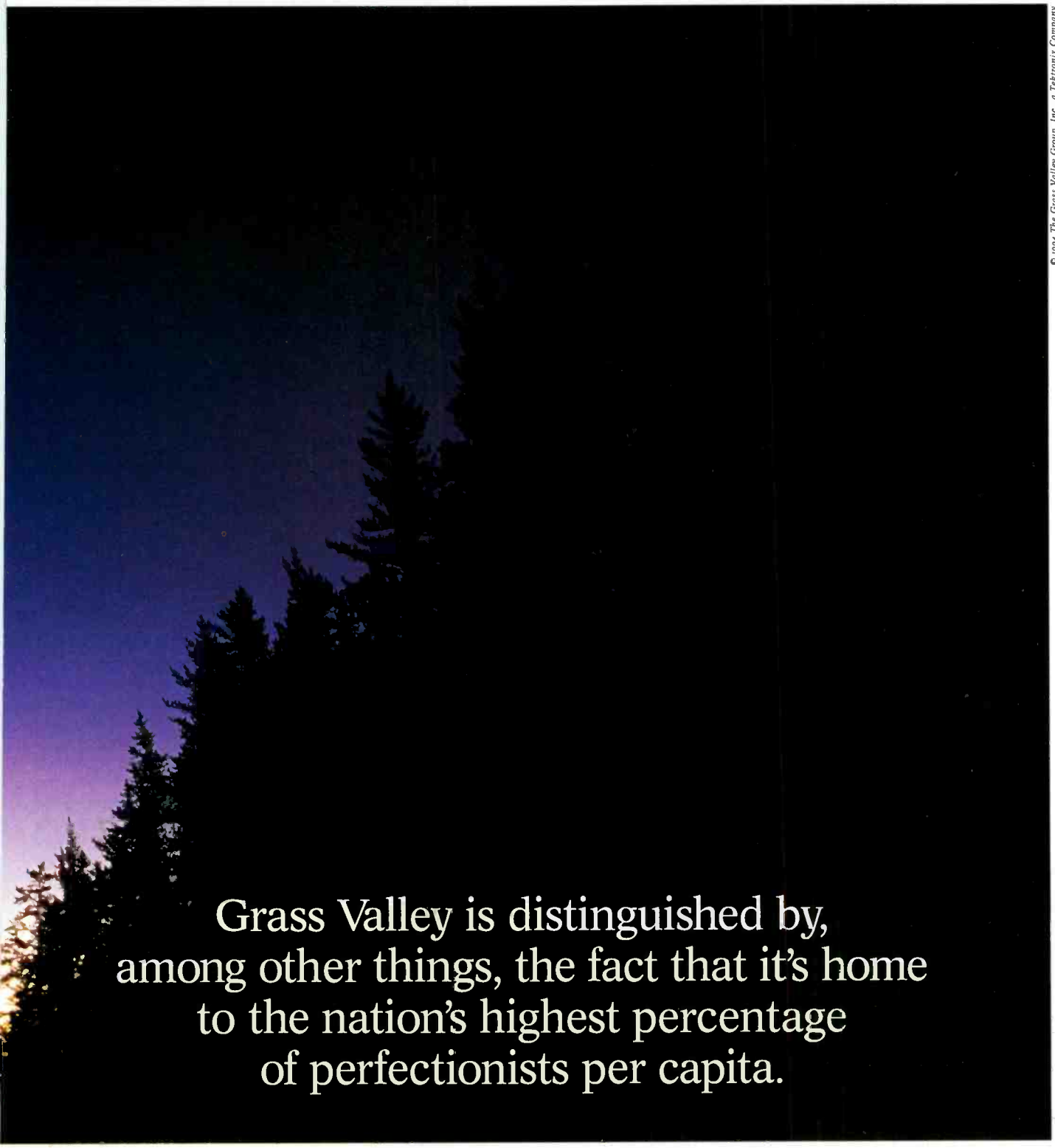

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Grass Valley

Continued from page 22

External VTRs under cart machine control at TNT Latin America.

system. The cost of an automation system is not as easy to determine as it seems. Hardware and software costs are obvious. But there are other hidden costs that are significant. Some less obvious costs are as follows:

- Installation costs, station costs above what is paid to the vendor.
- Training costs, including lost time and overtime.
- Human systems re-engineering costs, the cost of changing the way people work. Some of these costs will be the same across all vendors, others will not. Be sure to include these costs when evaluating prospective bids.

When you have completed the evaluation, ask one last time if automation is really needed. Go back and look at the problem to be solved. Will the top prospect fix it? Think about the alternatives mentioned in this article. Think about the big picture. Ask if this particular system really fits the facility, or is it creating new problems that will be worse than the existing problems. Finally, take five minutes at this point and write down why you are choosing to automate and why you are choosing this vendor. The GM may ask these questions later. It is easier to write them down now while they are fresh in your mind.

Double-check the contract and verify the salesperson has included all the hardware, software, and features that were discussed. Also, if any custom work was discussed, be sure to define it now. Take the time in this process to be thorough. Detail counts. Remember, get it in writing.

The final steps

You now own a new automation system. The work has just begun. Delivery, installation, training and fine-tuning are all things to look forward to. But the most important work will come after that. Go back once the system is in place to see how well the system works and how well it fits the initial criteria. Also, human beings are ingenious beasts and the people who work with the equipment may have reinterpreted the carefully laid plans. Don't accuse people of using the system "incorrectly." They may be using it to the best of their ability, or they may be using it in a way that makes the best sense in the real world. In any case, it's a learning experience to examine a project once it's complete. ■

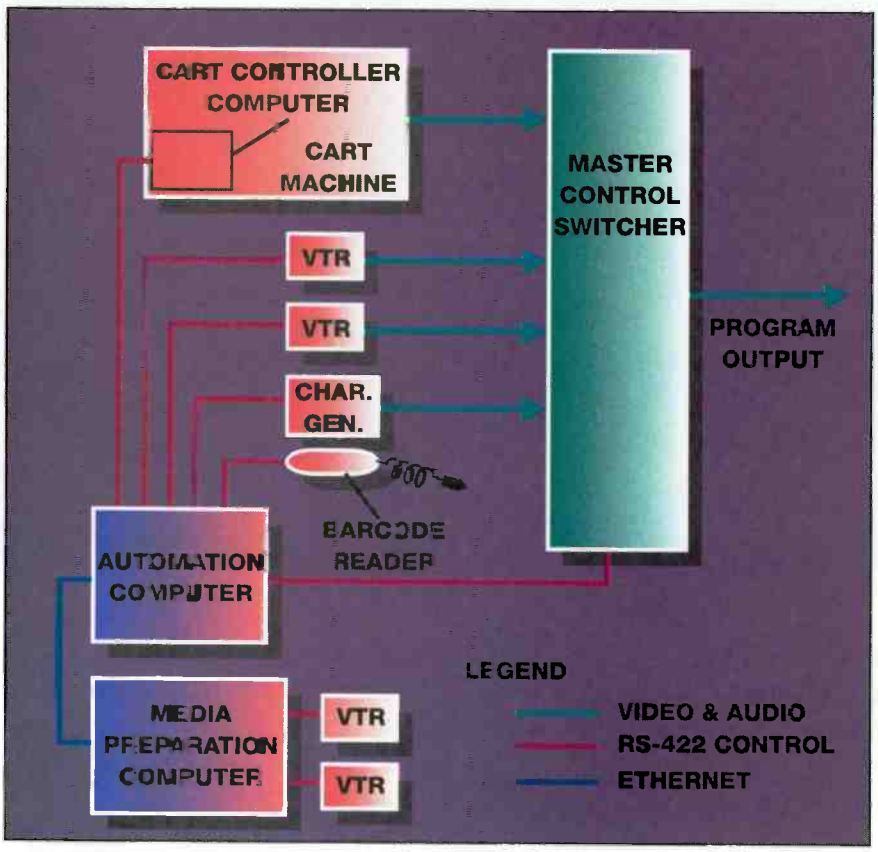

Figure 2. Basic block diagram of a simple automation system. Automation computer is capable of controlling VTRs, cart machine and the master control switcher. Media preparation computer is used to prepare commercial and program tapes for use in the system.

➡ *For more information on master control automation systems, circle the following numbers on the Reply Card. Also see the automation section beginning on p. 71 of the 1994 BE Buyers Guide.*

Alamar Electronics (400)
Ampex (401)
BASYS Automation Systems (402)
Channelmatic (403)
Columbine Systems (404)
FloriCal Systems (405)
Louth Automation (406)
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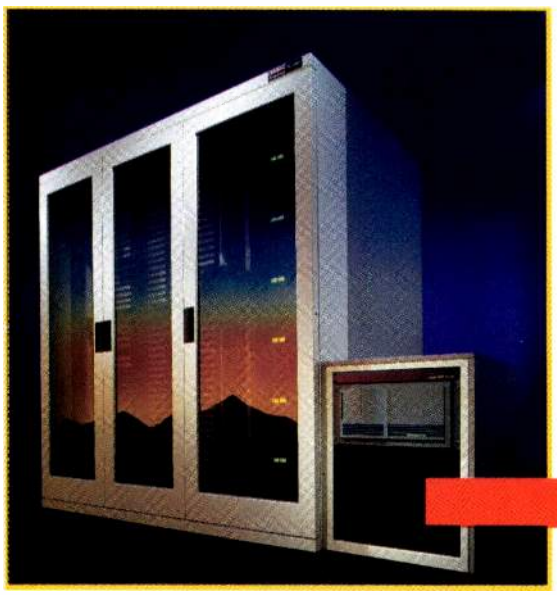
Robotic camera systems



From miniature models to full-size studio units, these systems are on the move.

By Curtis Chan and Verner Dixon

The Bottom Line

Recent innovations have brought robotic camera systems one step closer to becoming more affordable, cost-effective and user friendly. These systems have a wide range of applications, from detail work to daily use on news sets. Today's systems allow one operator to control several cameras, and have redundant safety systems to prevent mishaps.

Robotic camera systems have been helping the movie and TV industry bring a producer's vision one step closer to reality for some time. For example, the recent VIPER series, the Intel Inside commercial and the Star Wars X-Wing fighter traversing the man-made canals of the Death Star scene all have used robotic camera systems to add realism. This article will look at some recent advancements in camera control technology to see why everyone has their eye on robotics systems.

Different strokes for different folks

Robotic camera systems come in all shapes and sizes. They range from products used for extreme close-up shots to large systems used for broadcasting. Accordingly, prices range from a few thousand dollars for table-top systems, to several hundred thousand dollar broadcast systems. Regardless of the system, some basic fundamentals apply:

1) Systems must be well damped to minimize or eliminate image vibration and backlash.

2) Systems should be capable of remote control and/or have the flexibility to memorize moves (and camera parameters in higher-priced models), either in real-time or be recorded for later playback.

3) Capabilities should include pan, tilt, zoom and elevation, plus pedestal rotation and movement forward or backward and side to side.

4) Control systems must be intuitive.

5) The system and features should suit the application. Areas of suitability include the size of the camera and lens accessories, fluidness of motion, speed and angle of deflection accuracy, controllability, durability and ruggedness.

With the basic requirements nailed down, let's take a look at what's available.

Table-top technology

Designed for primarily table-top, product or miniature work, these systems can range from $5,000 to $35,000. Manual and remote-controlled systems are available. Typical systems allow the operator to manipulate objects backward, forward, side to side and in rotation. Depending upon the setup, the camera can be moved inside, underneath, around and through larger objects for unusual and creative points-of-view. These table-top units are designed to include the carrying capacity of extreme close-up lenses. Because of this, these systems tend to be extremely smooth, which is important when shooting the front of a coin or passing over miniatures.

Construction of the jib arm assembly is critical in keeping the image free from the effects of vibration. In the manual market where the operator acts as the robot, many state-of-the-art units are constructed of lightweight composite materials. The counterweighted arms can range upward of nine feet in length and feature

Chan is principal of Chan and Associates, a marketing consulting service for audio, broadcast and post-production, Fullerton, CA. Dixon is an associate of Chan and Associates.

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a retractable extension arm for additional backward and forward travel over the table-top. Some units can extend in excess of seven feet vertically. The center shaft interfaces with a Mitchell-type camera plate or a ball adapter and yields 360° of fluid, continuous pan. High precision ball bearing components give smooth operation and Teflon caliper brakes yield precise control over pan and tilt. In newer designs, counterbalance is achieved with either standard bucket weights or via a weight bar that accepts barbell-type weights.

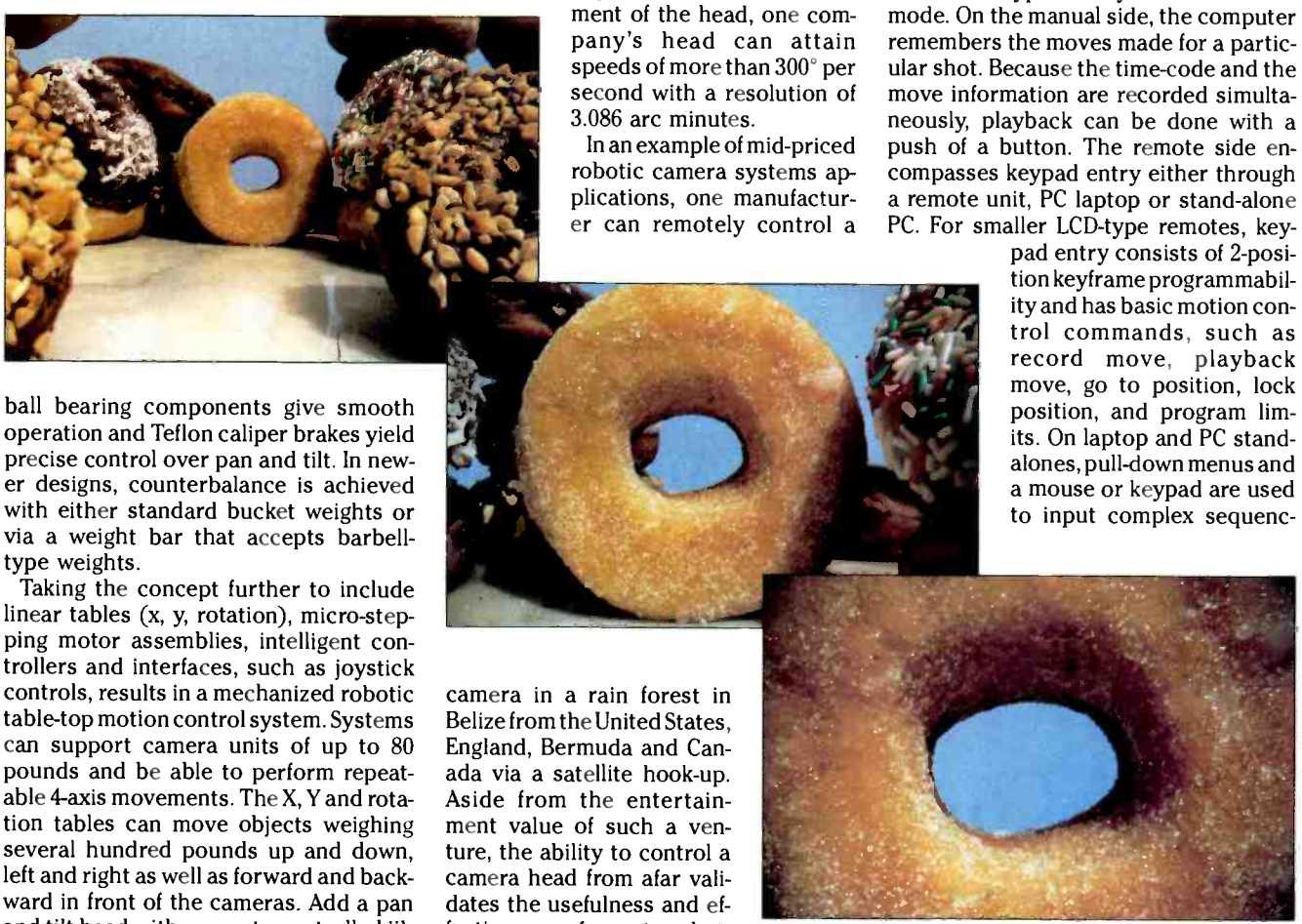
Taking the concept further to include linear tables (x, y, rotation), micro-stepping motor assemblies, intelligent controllers and interfaces, such as joystick controls, results in a mechanized robotic table-top motion control system. Systems can support camera units of up to 80 pounds and be able to perform repeatable 4-axis movements. The X, Y and rotation tables can move objects weighing several hundred pounds up and down, left and right as well as forward and backward in front of the cameras. Add a pan and tilt head with a remote-controlled jib arm and you have the ability to suspend the camera over a large set and control it remotely. Typical speeds are variable from 1° to 20° per second. Some companies opt for intelligent controllers instead of using PCs to control the robotics. In this case, joysticks may be used instead of keyboards. The joysticks are constantly monitored for velocity and direction and the memorized moves are replayed back at the push of a button.

Additional applications

Another growing market area is for computer-controlled pan-tilt heads. Typical applications include computer vision, video animation, security camera control, teleconferencing, tracking, photography and special effects.

For small applications, such as security camera control and teleconferencing, pan-tilt heads as small as 3" x 5.11" x 4.25" can provide a load capacity of more than four pounds. Remote control of these units is typically via RS-232. Self-calibration upon reset ensures reliable absolute positioning. Many units have the capability to make on-the-fly position and speed adjustments. In addition, some units have RS-485 multidrop network capabilities that allow a single host port to control up to 30 pan-tilt devices. Accuracy plays an important role in the movement of the head, one company's head can attain speeds of more than 300° per second with a resolution of 3.086 arc minutes.

In an example of mid-priced robotic camera systems applications, one manufacturer can remotely control a camera in a rain forest in Belize from the United States, England, Bermuda and Canada via a satellite hook-up. Aside from the entertainment value of such a venture, the ability to control a camera head from afar validates the usefulness and effectiveness of remote robotic camera technology.



This series of photographs shows the view through the lens. This type of miniature work involves motorized tables and special lenses. (Photo courtesy of Innovision.)

A variety of companies cater to larger applications requiring the use of heavier cameras. However, only a few have precision motion control camera mounts (pan-tilt-head) for video and film production capable of repeatable human-generated natural camera moves. These heads allow spontaneous tracking with pan, tilt, zoom and focus of actors or action. This is especially important for 3-D graphics and DVE moves. A more interesting benefit is the fact that aesthetic problems associated with mismatched effect and non-effect shots cut together are eliminated. The heads themselves can be used for EFP and film-style productions, supporting from 35 pounds to 150 pounds respectively. The EFP mounts, the control unit and a battery beltpack can be carried by an individual.

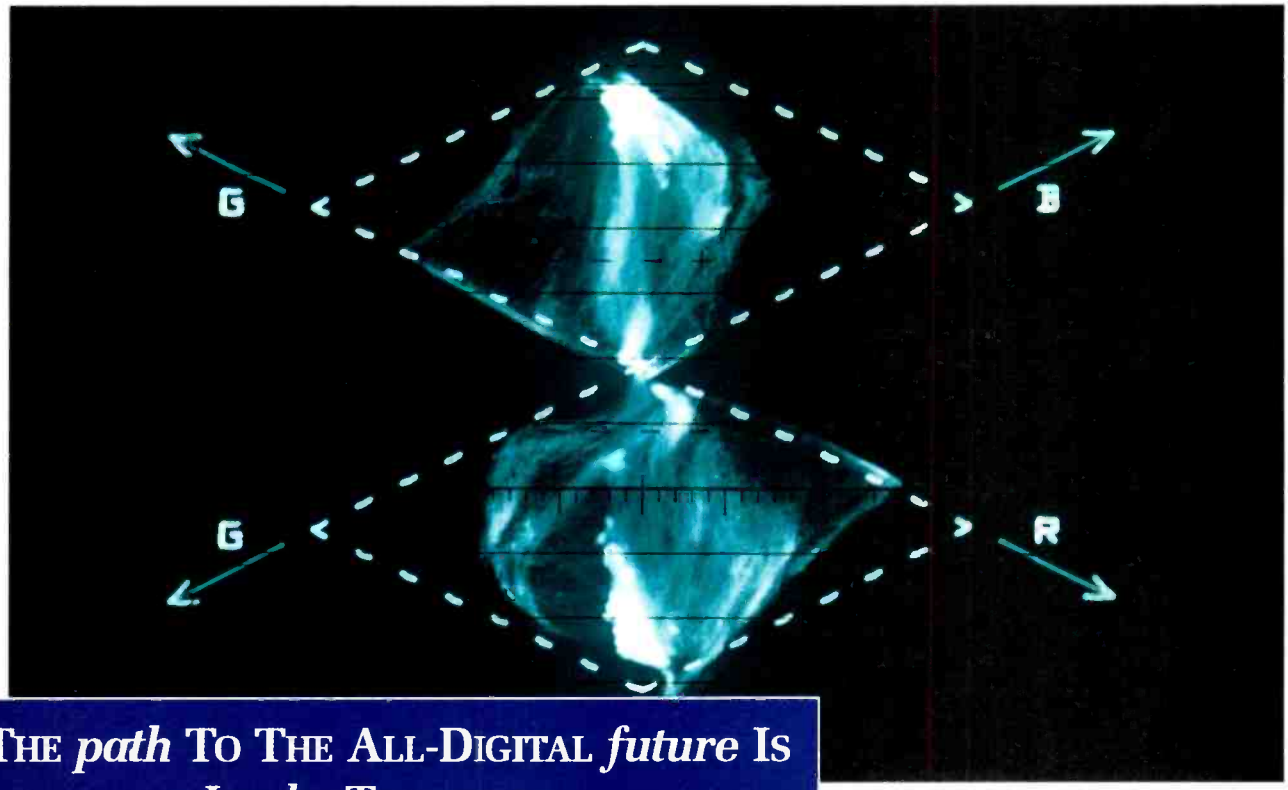
Remote heads use a control unit of some sort, in most cases, the control unit can control multiple motors. In some instances, manufacturers have integrated the capability to accept time code or a tach pulse from a film camera motor to allow slaving to sources.

Controlling heads would prove problematic if it were not for user-friendly interfaces. These interfaces come in two varieties: keypad entry and interactive mode. On the manual side, the computer remembers the moves made for a particular shot. Because the time-code and the move information are recorded simultaneously, playback can be done with a push of a button. The remote side encompasses keypad entry either through a remote unit, PC laptop or stand-alone PC. For smaller LCD-type remotes, keypad entry consists of 2-position keyframe programmability and has basic motion control commands, such as record move, playback move, go to position, lock position, and program limits. On laptop and PC stand-alones, pull-down menus and a mouse or keypad are used to input complex sequences. Some examples of complex keyframe moves include translation of memory head moves for use with CGI and DVEs, time lapse and stop frame programming, auto scene scanning for multimedia type work and the splicing of multiple head moves together.

Broadcast robotic products

In larger applications where system prices start at $100,000 and go up, broadcast robotic camera systems play an important role in news, current affairs and specialized programs. Expansion capabilities are the norm and it's not surprising to see expansion to eight cameras with additional control over standard parameters, such as pan, tilt, zoom and focus to also include iris, black level, X, Y and height.

The new generation of robotic pedestals, aside from supporting studio camer-



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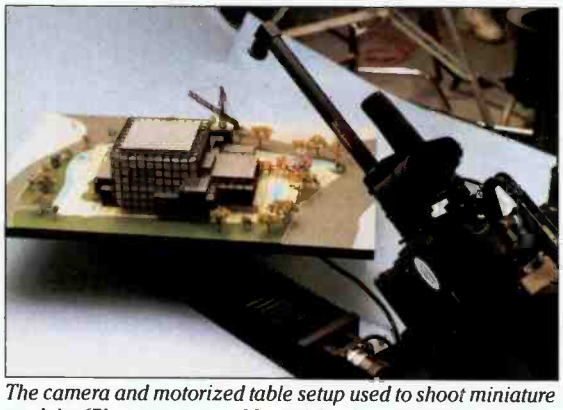
as, also support lightweight EFP/ENG-type cameras. The small form factor provides maneuverability essential for multiple camera positioning in multiset studios. The pedestals are fully controllable manually as well as having remote capabilities. Most pedestals have triple level safety systems for collision avoidance and intelligent navigation. These systems negate the need for tapes or homing plates on studio floors. For increased height, several companies offer vertical elevators that are clamped onto the base of a wide range of studio pedestals. Accuracy is good, with average specs of ±0.59 inches for x, y positional repeatability, 9.84 inches/s for drive velocity, ±0.12 inches for height repeatability, and up to 56 inches for height range. Usual loads for the pedestal can be up to 155 pounds.

The head assembly is just as sophisticated, having the capability to hold from 55 to 198 pounds. This usually takes care of EFP/ENG to studio cameras. Typical mechanical travel specs for heads are 350° for pan, ±45° tilt, 40° per second for speed and repeatability of three minutes of arc.

Robotic control systems

Control systems allow the operator to store and recall a number of shots. Previous models used numbers or alphanumeric text to store shot IDs. The new generation of control systems have comprehensive operational modes to simplify shot entry, making them ideal for high-pressure situations associated with live broadcast. For instance, a typical studio might have multiple heads but will use two control systems; one in the studio and the other in master control. This way, a person in master control can cue any of the heads linked to the control bus network.



The camera and motorized table setup used to shoot miniature models. (Photo courtesy of Innovision.)

The heart of these systems is usually the cue computer, which forms the centralized control, storage and management system. When used with either a data tablet, touchscreen or light pen, the system provides a powerful and responsive means of control over multiple broadcast camera installations. In many cases, preprogrammed simultaneous movement of up to eight robotically controlled cameras may be synchronized with instructions and commands transmitted to peripheral equipment, such as caption generators, VTRs, lighting control systems, microphone selection systems, switchers, newsroom computers and CGs. A typical cue computer may have up to 500 pre-programmable cues. Each cue contains a shot number for one or more cameras, a lighting memory number or a video caption reference and a 20-character comment field. In addition, the use of soft keys helps facilitate special functions. Continuous or random mode selection of shot linking provides interpolation between preset

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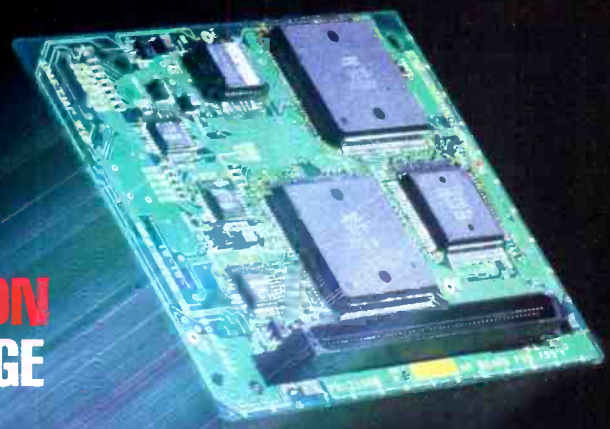

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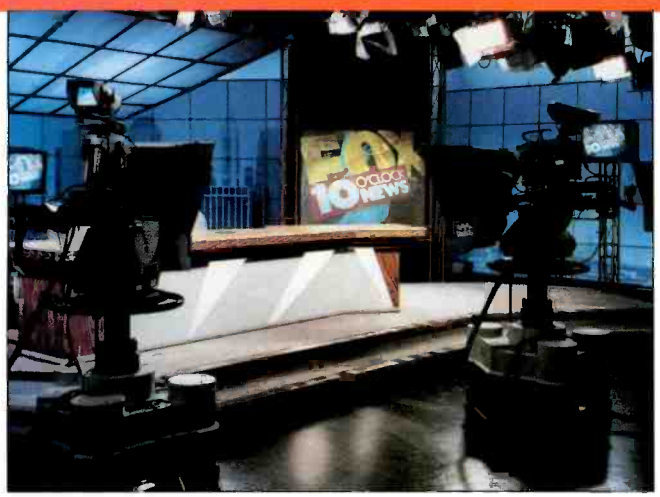

Two recently installed robotic camera pedestals on the news set of WNYW, New York. (Photo courtesy of AF Associates.)

shots and the creation and storage of simple or complex multishot sequences. Either manual or continuous replay modes are available to operators.

There are several ways to optimize the way a shot is stored. When using a tablet, geographic studio representations, diagrams or text depicting key shot information are placed on the tablet and preprogrammed. Frequently used shots can be easily and quickly recalled by touching the pen on the required shot.

Another method involves using a spotter camera to provide an overall view of the studio or coverage area. Display of the viewed area on a touchscreen connected to the cue computer enables cameras to be rapidly positioned onto areas of interest by simply touching the desired area on the touchscreen.

The new generation of control interfaces makes it easy to program shots. One system uses a feature called "See and Select." In this system, the need for labeling shots is eliminated, because the actual video coming from the camera under control is frozen when a shot is stored and then displayed on a monitor for later recall. In actual practice, the operator selects the camera for control using camera selection keys on the control panel. Then the camera and lens are positioned in the conventional manner using the control panel joysticks and encoder. When the desired shot is achieved, the action of storing the shot causes the video to pass into the computer where the image is frozen and reduced ($^1/_{16}$ original size), then 'tiled' with 15 other stored shots on the monitor screen. The operator or director/producer can recall shots by looking at the prestored shots on the monitor and selecting the required one via a touchscreen, mouse or light pen. The recalled shot also loads all of the camera parameters and positions. Paging of the displayed shots allows more than 16 shots to be displayed for each camera and a separate page enables a "storyboard" of shots from a mixture of cameras to be constructed and made available.

As we move into the next century of broadcasting, expect to see new innovations in robotic camera systems and their continued integration into every facet of broadcast programming. ■

Acknowledgment: Thanks to the following for their help on this article: Radamec, AF Associates, Innovision Optics, Inc., TeleMetrics, Ultimatte, Bill Bryan, and Vinten Broadcast/TSM and Directed Perception.

➡ *For more information on robotic systems, circle (318) on the Reply Card. Also see "Camera Support" on p. 60 of the BE Buyers Guide.*

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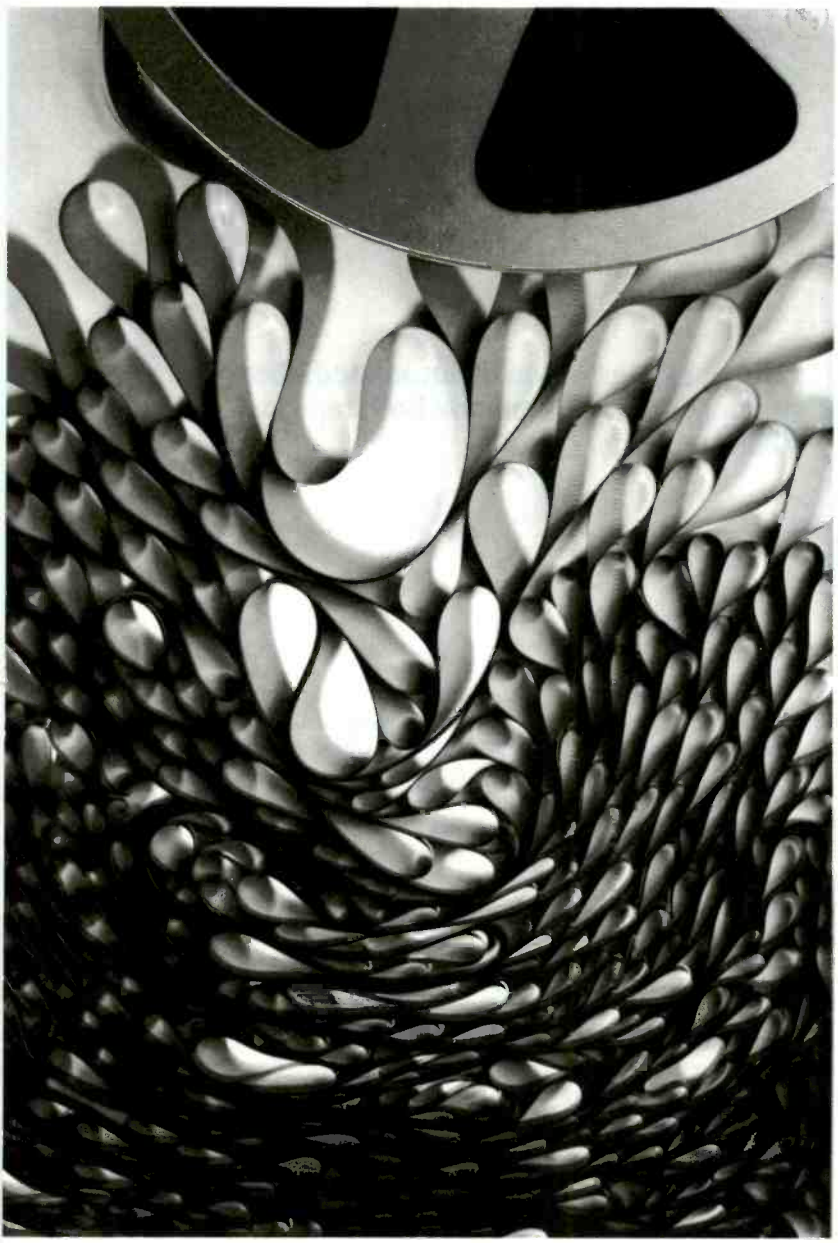

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Hybrid tape and disk storage for on-air automation

The next generation of automated library management will include both tape and disk elements.

By Raymond K. Baldock

The Bottom Line

Disk-based and tape-based storage systems each present different sets of strengths to their users. Neither is ideally suited for all of the possible applications that a typical broadcast facility might require. An optimum system applies the best of both technologies. Appropriately combined, such a hybrid system can lower costs while increasing capacity and reliability.

Broadcast technology is an evolving science. With each turn of the calendar the industry witnesses technical advances that present opportunities and challenges for manufacturers and users. Technical advancements that truly pique our interest tend to have three common characteristics: They promise to make us more productive, they vow to make us more competitive, and they invariably pledge to open new markets. These new technical frontiers are never without their peculiar caveats, however. For example, becoming more productive might involve discarding old equipment and learning new operations, while becoming more competitive often requires a sizeable monetary investment, and entering new markets could mean dealing with new competitors.

Data compression (or *bit-rate reduction*) is just such a technology. It will affect our industry as significantly as the microprocessor once did. In fact, the process has already begun.

Data compression is lowering the cost of satellite distribution and has given rise to many new or revitalized services, including direct broadcast satellite (DBS), teleconferencing, regional advertising and private video networks. Planned video-on-demand (VOD) services also rely heavily on data compression to provide additional channels for bringing signals into the home. Some of these services will undoubtedly compete with the broadcaster for slices of the viewership and advertising pies, while other applications represent new markets in an expanding industry.

New data compression applications that use hard disks for storage have the potential to provide an alternative to videotape for some applications. The non-linear access provided by disk systems is a powerful feature, and one that many broadcasters are eager to employ. Companies that manufacture videocassette library systems and the broadcasters who purchase them must examine the potential benefits (including cost-effectiveness) that the technology affords for different applications. Caution is advisable during this process, so that maximum benefits can be obtained from new disk-based storage and existing hardware inventory. Consider also the current state of flux in data compression technology.

Baldock is director of product development at Odetics Broadcast, Anaheim, CA. Respond via the *BE* FAXback line at 913-967-1905.

Complexity of cost analysis

Disk-based storage is not new to television — it is commonly used for layering in post-production environments and in still-stores. The data-transfer rates used in such high-quality, digital component-video recording results in expensive recorders with short recording times.

Data compression systems are now allowing digital mgnetic hard disks to be considered for *mass storage* applications in a cost-effective manner. Assessing this cost-effectiveness is difficult, however, because of the complexity of comparing prices between tape and disk storage. For example, a one-hour program record-

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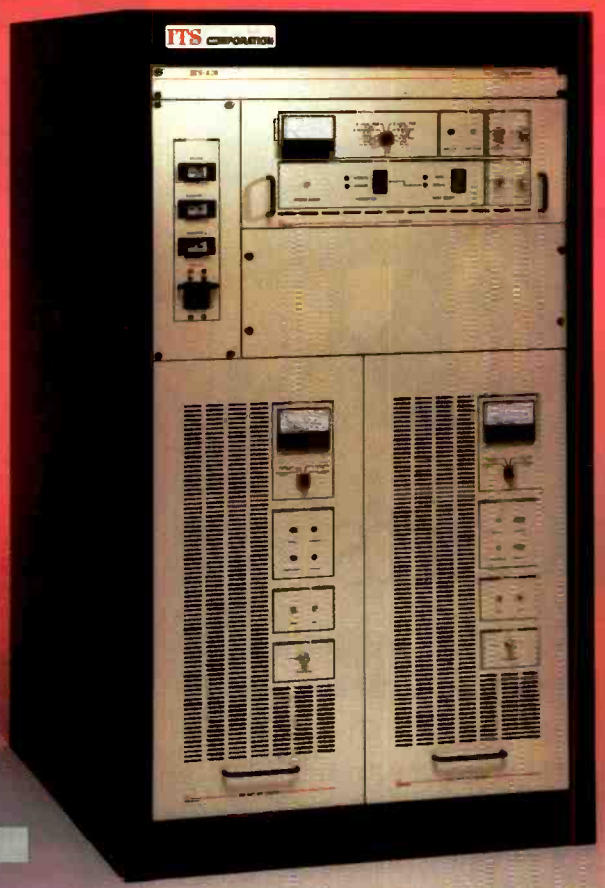

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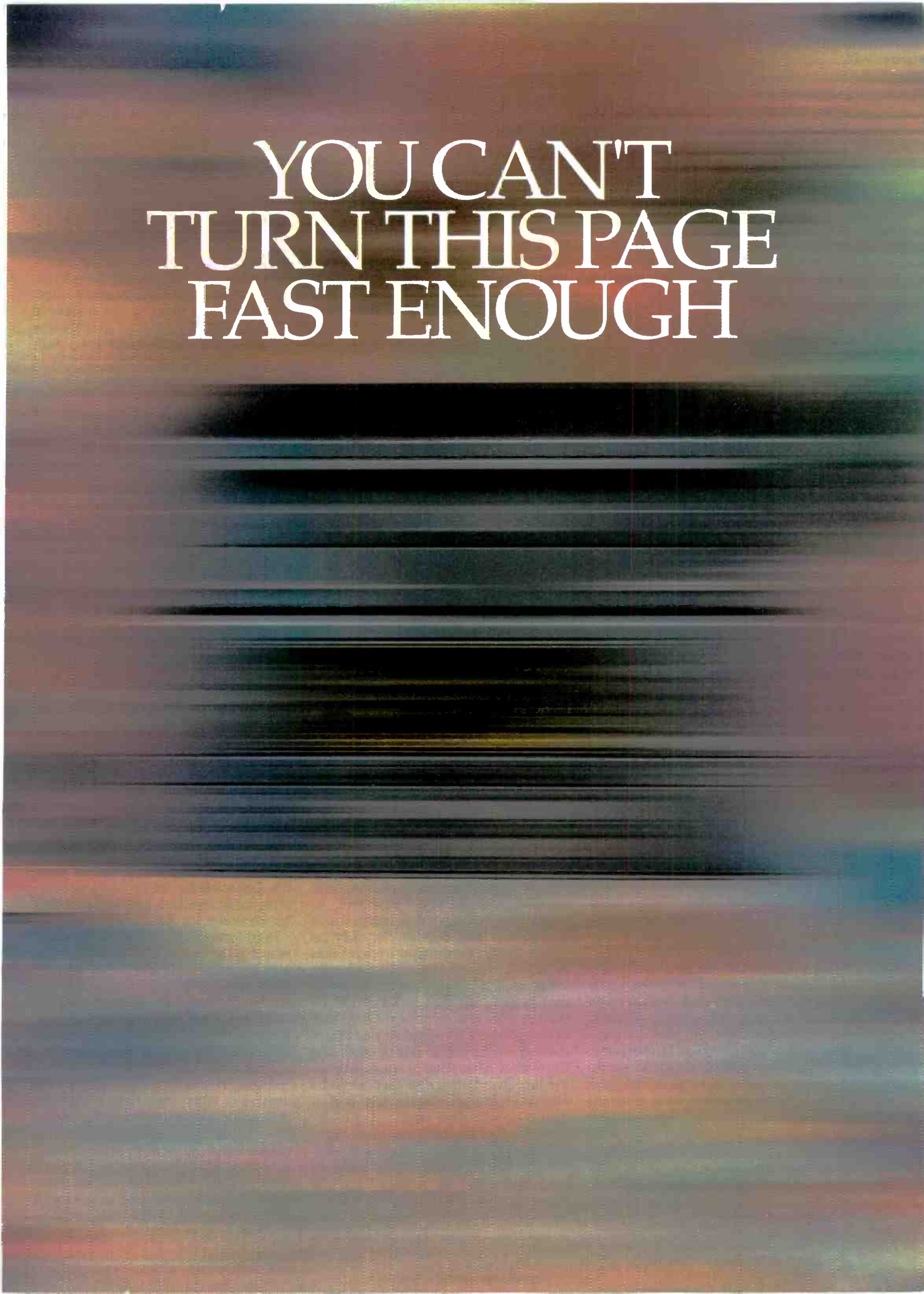
ed at a data rate of 100Mb/s (the effective data rate for about 2:1 compression) consumes 45GB of disk storage. At current prices, the hard disk array required for this could cost approximately $70,000, while the same amount of video data can be stored on a single 1/2-inch or 19mm digital videocassette (under $100). Of course, this involves a bit of apples-and-oranges analysis between disk drives (which are hardware/media combinations) and tape (which is pure media). Both systems require additional hardware to actually record and play video programs, but their relative storage vs. overhead cost ratios are quite different. The typical disk array accounts for a sizeable percentage (perhaps half) of a complete disk-based storage system, while tape costs represent only a small portion of the VCR (and, for some applications, the robotic library) costs of a tape-based system. Viewed incrementally, however, as the amount of inventory increases, the per-unit cost of storage for disk media can exceed that of tape by up to 2 orders of magnitude.

Furthermore, disk-based systems can offer random-access and multiple-output capabilities, whereas tape provides high reliability. (Consider that when a disk-based system fails, the entire program contents of a drive-array are at risk, while a VCR failure only threatens a single tape's contents.) It's clear that a large matrix of parameters must be weighed when comparing disk- and tape-based systems. In the end, a single, industry-wide answer will remain elusive, with differing applications (such as short-form vs. long-form programming) instead finding their own separate solutions to the question. To achieve optimum balance, many applications will benefit from a *hybrid* solution — one that combines tape and disk storage — while others may be better served by one technology or the other exclusively.

Data compression: The enabling technology

Real-time video data compression lowers the bit-rate of digital video signals. It is an *enabling technology*, which permits high-bandwidth video signals to be recorded using storage systems operating at much lower data rates.

Although data compression makes disk storage practical, users face the difficult task of balancing diminishing performance as the compression ratio increases. Engineers should be wary of compromising performance standards just to bring this exciting new technology within the range of their budget. The amount of compression acceptable for any application will ultimately depend upon the capabilities of the distribution and display system, as well as competing delivery systems.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Expectations for disk-based systems have reached new heights, yet it is clear that significant hurdles must still be overcome before these systems can move into high-risk applications like on-air spot replay. Some systems do not record all active lines, and many cannot pass data for closed-captioning, Nielsen codes (commercial verification), or other data in the vertical blanking interval. Manufacturers using disk-operating systems designed for data rather than real-time video are experiencing problems as the data becomes fragmented over extended use, or when soft errors are encountered. These are not usually included in mean-time-between-failure (MTBF) figures quoted by drive manufacturers, but they can have a devastating effect on real-time video if the data flow is so interrupted that the video or audio output buffers are emptied. To ensure reliable performance, operating systems, and to some extent the drives themselves, need to be developed or modified specifically for video applications.

Nevertheless, data compression and disk media hold tremendous potential for video applications. In time, the challenges identified today will be overcome. Interchange standards must be established to permit transfer of compressed data between products from different manufacturers. Until then, we must look beyond the emotional appeal of disk storage, assess its current evolutionary state and — with a specific application in mind — weigh it against other options to determine real benefits, respective costs and comparative risks.

Disk caches vs. video servers

The market for disk storage can be separated into two significantly different applications: *video servers* and *disk cache* systems.

Video servers are usually large-scale computers with redundant disk arrays capable of storing hundreds or thousands of hours of video. They often provide simultaneous access for a greater number of viewers and are typically associated with video-on-demand applications.

On a much smaller scale, this same technology has been demonstrated by a number of manufacturers as a replacement for VCRs, using hard disk-based video recorders. These systems provide superior uncompressed performance and durations measured in minutes, with prices comparable to D-1 recorders.

With the addition of data compression and audio, these devices can maintain acceptable performance at storage times measured in hours rather than minutes. When used in conjunction with a broadcast system, the disk recorder can be used as a *cache* to increase the flexibility of the system. If the required capacity of the cache is limited to one or two hours (instead of attempting to handle the entire inventory), then disk caches can be affordable and provide the high performance broadcasters need.

For greatest flexibility the ideal cache will be able to record and play simultaneously. Several output channels should be provided and the recorded material should be available to all channels simultaneously. Because compression algorithms are rapidly improving, an upgradeable compression engine would be advantageous. Because a cache is used only for temporary storage, then conversion of material from one compression format to another is not a major issue.

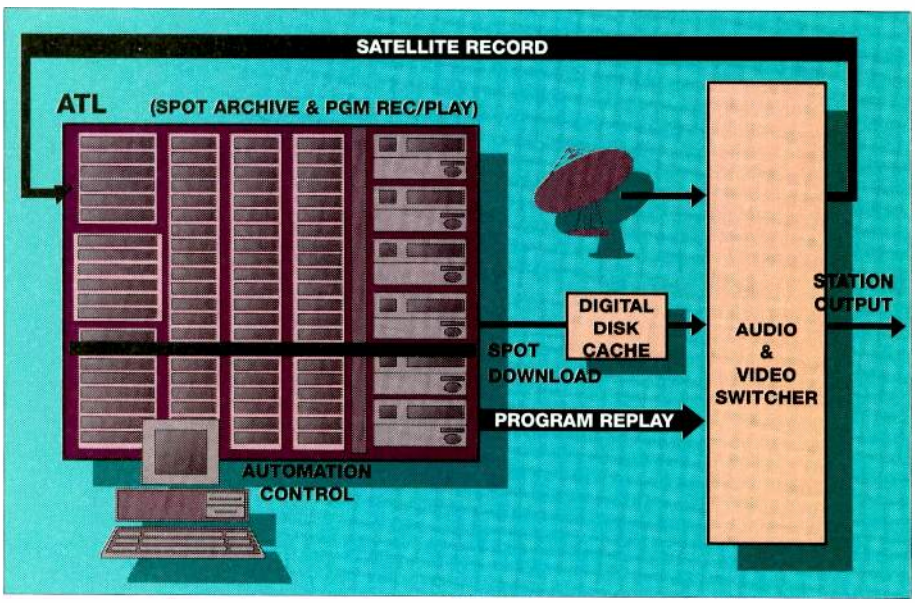

Figure 1. *Basic configuration of a hybrid system, implementing an automated tape library (ATL) and a digital disk cache. The ATL is used for long-term storage of all programs and playback of long-form programs to air, while the cache is used for temporary storage and playback to air of short-form programs (spots). A second disk cache can be added for redundant operation.*

Video on demand

Video on demand (VOD) is the perfect application for disk storage. Access to a large volume of material must be provided for many users on a continuous basis.

A videotape solution limits the number of start times to the number of copies of the program available on the system. Users must either wait for the next start time or join in progress. A sophisticated VOD system also offers the potential for start/stop (or even a limited amount of rewind/fast-forward) remote control for each user.

Companies pursuing the VOD market are currently grappling with the cost of the disk storage and looking to tape as an economic archival format. *Automated Tape Library* (ATL) systems, combined with random access disk storage, increase the available inventory in the most cost-effective manner. This minimizes the expensive disk storage and allows programs to move in and out of the system as the demands for particular titles change. As an example, US West is planning to test such a system in its upcoming VOD and interactive video trials, using ATL systems with capacities of 2.5TB each.

Hybrid solutions for broadcast

In a traditional broadcast application, long-form program material is played once and stored for an extended period. The cost and time to dub these programs to another format (tape or disk) is rarely worth the trouble. This is why stations prefer to air long-form programs using the media and format on which they are received or recorded. Disk storage offers no advantage for this situation.

Short-form (spot) programs are another matter, however. A disk cache can provide significant advantages for management of multiple short programs within an ATL context. Such a *hybrid* solution combines an ATL with a digital video disk cache as shown in Figure 1. The cache's ability to record and play simultaneously optimizes the efficiency of downloading material. This arrangement reduces the number of VCRs required by the ATL for playing spots — typically from four decks down to one. Spots are downloaded from the library to the cache hours in advance using a single VCR, then aired directly from the cache. The cache's non-linear nature requires that only one copy of each spot used in a given time period be

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The hybrid arrangement can also serve another timely purpose. Although automated program and spot recording/replay on ATLs is common practice around the world today, this procedure can almost fully occupy a station's VCR resources playing spots and programs direct-to-air for a single channel. Meanwhile, current economic conditions are forcing stations to adopt more creative business ventures, such as establishing LMAs, offering split regional advertising or adding new, separate program services for cable feeds. Naturally, there is considerable pressure on operations and engineering managers to run these new services without additional staffing. The need for automation is therefore increased in this environment.

A disk-cache and ATL can be configured to feed those additional output channels, as Figure 2 illustrates. When the same material must be replayed on multiple channels, it is desirable that the cache use common storage to feed all output channels. This allows the material to be downloaded to the cache only once. The cache must be capable of feeding the common material to multiple channels either simultaneously or at staggered start times.

Even for a multichannel system it is still likely that only one VCR will be required for downloading of spots to the cache. (Future tape formats may offer *faster-than-real-time transfer* of compressed video to disk, further speeding and streamlining a hybrid system's operations.) The VCRs freed by reassigning spot playback to the cache can be used for recording additional satellite feeds or for originating programs for the additional program channels.

The addition of a disk cache to an ATL includes some other advantages:

• *Increased capacity:* With on-air replay originating from the cache, the need to limit the number of spots-per-tape (because of shuttle time constraints) is eliminated. Therefore, the number of spots-per-tape can be increased, allowing a typical station's *entire* spot inventory to reside within the ATL. The ATL therefore becomes an on-line spot-archival system.

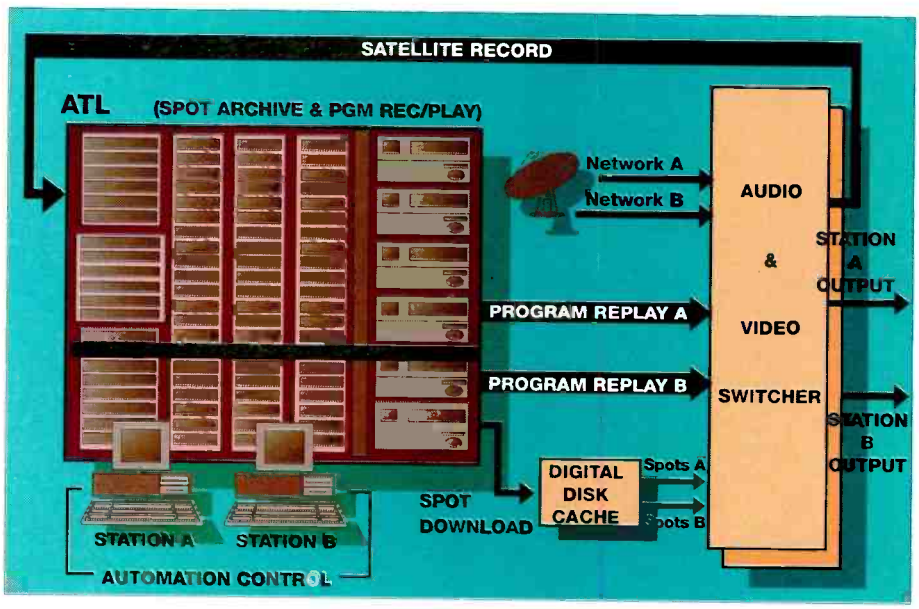

Figure 2. *A 2-channel automated operation using dual-output disk cache and ATL.*

• *Improved conflict resolution:* Because it is a random-access device, the digital cache also solves the challenges faced by ATLs in direct-to-air, multicut operation. Traditional tape-based solutions that use dual recording, conflict resolution or conflict avoidance all require extra time and/or resources, either at the recording time or during playback. The cache solution is much simpler, more efficient and less prone to error than any method used by cart systems today.

• *Increased reliability:* As noted earlier, the high reliability of disk storage is deceptive, because of the risk of *many* spots' loss in the event of a cache crash. A hybrid system typically keeps backup copies of these spots on-line, however, allowing quick recovery from a cache failure.

• *Backup protection:* To guard against such failure, two separate, redundant cache systems can be connected in parallel at the output of the cart system for simultaneous downloading. This provides total protection against failures in the disk cache itself. In contrast, tape-based systems' redundancy schemes all involve precompiling a spot reel for backup, which doubles wear and tear on VCRs and robotics, thereby effectively shortening MTBF.

• *High-quality archive:* The use of tape as the archive medium is not only economical, but the air masters are not subject to high compression that would otherwise be required if the entire inventory were stored on disk. Downloads to the cache can be accomplished via serial digital interfaces, thus minimizing possible quality losses.

Doing more with less

Non-linear disk-based storage makes it easier to do more with less. With the addition of disk caches, cart machines gain increased capacity. A single-channel system can also gain multichannel capability when integrated with a digital cache.

Reliability is also a paramount concern. At most TV stations, the commercial inventory is a most valuable asset. Any system that puts this inventory at greater risk also jeopardizes the station's financial security. A hybrid tape/disk system maintains a high degree of reliability, especially when a parallel backup cache is used.

As disk cache technology matures and proves its reliability in an on-air environment, there will be opportunities to add exciting capabilities to existing ATL systems. These hybrid devices will provide the industry with more cost-effective storage and origination of program material, while increasing overall reliability. Hybrid systems therefore provide a safe, flexible and affordable migration path to broadcasting's future. ■

➡ *For more information from makers of automated video library systems, circle the following numbers on Reply Card. Also see "Recorders, Video" p. 64, "Commercial Insertion Systems" p. 71 and "Record/Playback Automation" p. 72 of the 1994 BE Buyers Guide.*

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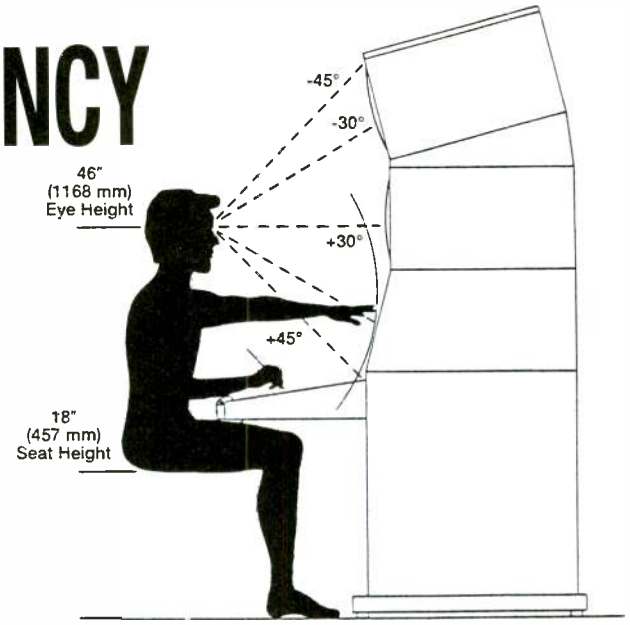

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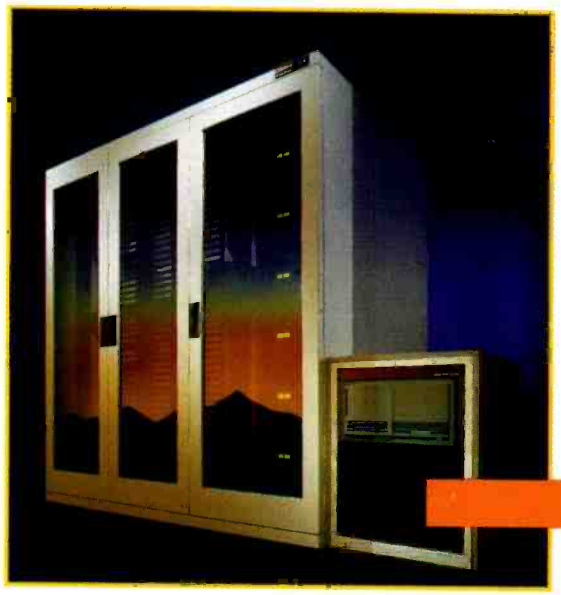


PC-based automation and optical disc technology can form a powerful alliance.

By Barry N. Fisher

The Bottom Line

Broadcasters have always been searching for improvements in spot playback systems. Technology has continually evolved toward smaller, cheaper, higher-fidelity and more reliable systems. Recently, magneto-optical (MO) recording has become a practical option, serving all of these criteria well. With proper interfacing, an automated array of MO recorders can provide a reliable and cost-effective system for short-form storage and playback to air.

At the 1990 NAB Convention in Atlanta, a company called Optical Disc Corporation had an interesting display. It was showing a $180,000 optical recording system that was as big as a large VTR. It was designed for mass duplication of optical discs using write-once media. More interesting than that was something that was tucked around the back of the booth. It was a little $2,000 optical player with a Macintosh computer controlling it. For this demonstration one optical disc with about 15 commercials was used. You could select which commercials you wanted to play by clicking a mouse, then pushing a play button. The concept was great, but not practical until Pioneer introduced its rewritable magneto-optical disc in 1992.

By that time, broadcasters had begun to take notice of the technology and found it impressive. Some were concerned with durability of the format's hardware and media, but generally concluded after exhaustive testing that the system performed admirably and consistently in their facilities.

Building a system

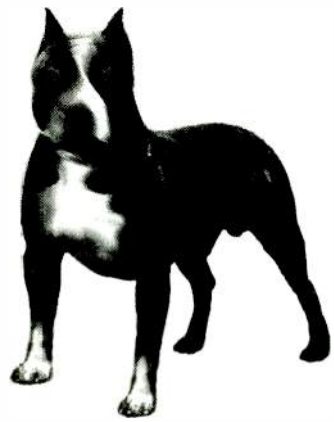
One such station was WFMZ-TV, Allentown, PA. In 1992, the station's engineers met with American Broadcast Systems (ABS), who had just introduced the Micro-Cart 100. This PC-based system provided a stable commercial playback system using multiple tape machines with several spots on each tape. Certainly, if it had the ability to do that, it could deal with the instant search capacity of the optical disc player. Instead of putting 60 spots on a Beta tape, it seemed possible to put 60 spots on a 32-minute optical disc. ABS began working to modify its programming to be able to handle what WFMZ considered a "video hard drive" — the Pioneer VDR-V1000. These technologies eventually developed into the system that the station uses on air today.

The ABS software is written in Windows and is designed to be run on an off-the-shelf PC. As long as the PC platform is adequate (e.g., 486DX/33), the Windows environment offers the advantage of simple user interface and training for non-DOS-literate operators.

The system software is designed to be straightforward and easy to use.

The system software sends its commands to the optical disc players through an RS-422 card in the PC. The RS-422 bus is connected to rack frames of intelligent machine controllers called *tributary cards*. Each playback machine in the automation system (disc or tape) has its own tributary card, which controls the machine's transport. A separate tribu-

Fisher is director of Engineering Operations for Maranatha Broadcasting, Allentown, PA. Respond via the *BE* FAXback line, 913-967-1905.



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tary card is assigned to an AFV switcher that selects which of the optical disc players or tape machines is on-air. (See Figure 1.) Another tributary card connects a dedicated remote-control panel to the system, allowing "hard" control of any machine's start, stop and recue functions.

For redundancy, a second 486/33 computer is loaded with identical software. The RS-422 outputs of the main and standby computers are passed to an A/B switch, which allows the system to be switched to backup if a failure occurs, and the system to be back on line within five seconds of changeover.

Operating the system

The system software is designed to be straightforward and easy to use. Color is used extensively on the operator's screen to provide as much feedback as possible. (See Figure 2.) The time of day appears constantly in the upper left of the operator's screen with the current-event countdown clock in the upper right. Each machine's status is constantly displayed in the center of the screen, below which is the playlist. An event in white has already run, yellow indicates cued and ready, and red indicates a problem. Because the Windows environment allows multiple tasks to run concurrently, operators leave a playlist editing window open in addition to the on-air windows. This allows any last-minute changes to be made to the upcoming event schedule. Because the on-air tasks and the editing tasks are dynamically linked, any changes to the playlist (which are made in the edit window) are immediately reflected in the on-air playlist.

Changes to the playlist are made easily and can be made up until four seconds before air. A spot can be added by simply entering its in-house number or by looking it up in the spot database. Spots can be chained sequentially (one spot will instantly follow another), started manually via the remote-control panel, or programmed to start at a specific time.

When operators add new spots to the video database, they are prompted to enter several items, such as spot number, start date, kill date and length. Other optional fields include recording media, master reel, description, subject and agency. The extra fields are provided for ease in sorting. An operator could, for example, get a printout of just the public service announcements available. The system also keeps an as-run log on its hard drive. No changes can be made to the as-run log with the exception of adding comments. For instance, an operator could add a comment explaining why a spot wasn't run.

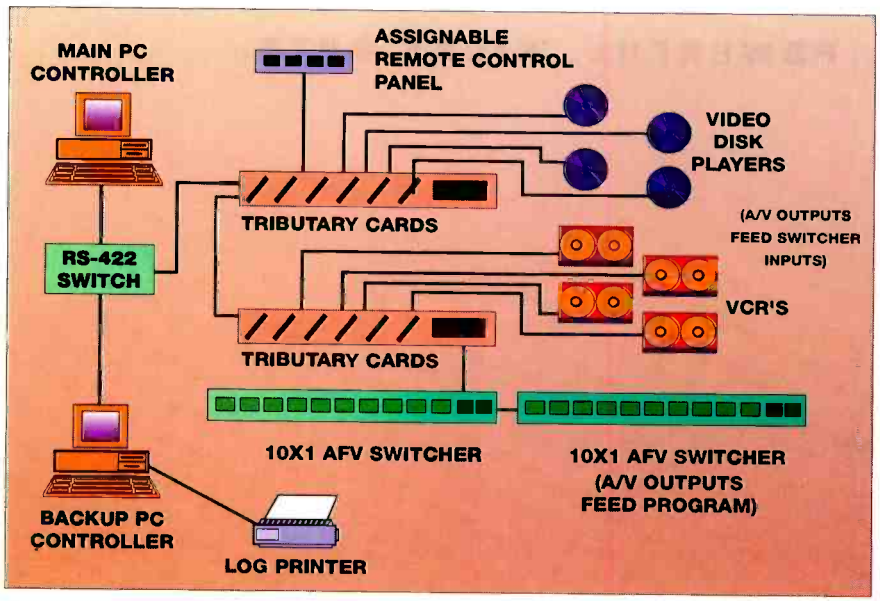

Figure 1. *Block diagram of control functions in WFMZ-TV's automation system.*

Disc capacity and formatting

Each optical disc holds 32 minutes of video. Because the disc players offer random, single-frame access, a disc can also be used to hold 57,600 frames for stills or slides.

For motion-video, in order to fit as many 30-second spots as possible on a 32-minute disc, each disc is divided into 32-second segments. The extra two seconds allow for black on either side of the spot and help prevent accidental overdubs. With four disc players, 240 spots are available on line. The timed segments exist only in the database, not on the discs. In other words, when a spot is scheduled to play, the computer only tells the disc player to cue to a specific time-code location and play for a certain length of time.

The VDR-V1000 disc player has another handy feature. It includes 99 non-volatile cue memories. Each cue memory location can be programmed for any time-code location. All the disc players used in this automation system have had the time-code start-points for each of the discs' 32-second segments loaded into these memories. A 4-digit coding scheme has been established to track spots all the way through the traffic system. For example, a commercial numbered 4017 means that the spot is on disc 4 at cut 17. To find the cut, cue memory 17 is simply recalled on the player holding disc 4. This makes off-line dubbing spots easy, because the start time of each disc segment always remains the same. It also means that the person dubbing doesn't have to worry about the time-code start-point for the commercial. The playback system doesn't even need to be told which player holds disc 4, because individual disc-identification header information is recorded in the first two seconds on each disc.

Another benefit is the ease of emergency operation. In the unlikely event that both control PCs are down, an operator can use the printed paper log to manually cue up spots from the front panel of any disc player. If spot 3045 is scheduled next, cue memory 45 is recalled on disc 3. When the previous spot has finished playing on-air, the operator presses play and then manually takes the appropriate disc player on the air switcher. The operator can then go on to cue the next spot, even if it is on the same disc. The disc player contains two playback heads and can play spots back-to-back instantly.

The tape machines in the system are handled in a similar fashion, except without random access. Each spot must have a cue header recorded before it. This 7-second burst of data contains the spot number, description, spot length and other information. When dubbing a spot to the playback tape, the operator can choose to have the tape rewound and ejected immediately after it has played, or to have the tape cued forward to the next spot. Using the "cue forward" method, many spots (such as PSAs) can be recorded consecutively on one tape. The only drawback is that the spots will always air in the same order. The system also allows for access to non-consecutive cuts on a tape with the use of time code.

Any mixture of tape or disc playback can be sequenced in an on-air playlist. Of course, the system can't play consecutive spots from different locations on the same tape, but it has no problem with random spots from the same disc.

Maintenance

The disc recorder hardware has been

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reliable. When a slight degradation occurred in one of the playback heads (while still under warranty), the manufacturer sent a new optical assembly to the station. The replacement took less than 30 minutes and did not require technician training or adjustments. In contrast, tape machine repairs can require considerably more knowledge and realignment effort.

No routine maintenance is required on the disc machines — vacuuming the device every couple of months is all that's needed. The optical discs are said to be good for one million recording cycles. This means that if you began recording a disc today in consecutive and continuous 32-minute increments (around the clock), it would take more than 60 years to hit the one million-pass point. Media replacement, therefore, is not an issue — it's virtually permanent.

The system's video quality is that of Betacam SP with regard to resolution and comparable to Beta for noise. The one difference is that the playback image does not deteriorate over repeated plays as with tape formats. The devices also produce low ambient noise, and their low power consumption can allow smaller capacities to be specified for UPS systems and HVAC.

Figure 2. A sample of the control terminal screen showing window used for log-comment entries at right.

Breakthrough technology

This system represents a significant breakthrough in spot playback technology. It requires virtually no maintenance and allows for multiple levels of redundant playback. It consumes less electricity, HVAC and staff time. The modular, open architecture of the system allows changes and addition of hardware. If a 60-minute optical disc or longer becomes available, the system is ready for it. Magnetic hard drives can also be integrated for airing the shortest program elements, such as PSAs, IDs or promos. Meanwhile, tape will continue to be used for long-form programming and archival storage.

The future success of optical disc systems in broadcasting will be largely dependent on their cost-effectiveness. If the price of players were to drop, significantly larger systems would become attractive. Meanwhile, hard disk systems are beginning to appear, and they show promise as well. A concern regarding hard disk systems involves their non-removable media — data is captive and unreachable if a drive should fail or a system should lock up. For these reasons and others, optical and magnetic recording may coexist in future facilities, with optimum systems exploiting both technologies' respective advantages. ■

➡ *For more information on the systems mentioned in this article, circle the following numbers on Reply Card.*

ABS Micro-Cart 100 (313)
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Disk-based spot playback systems

They've come a long way in a short time.

By Roland J. Boucher, Jr.

The Bottom Line

1993 marked the start of a new era in broadcasting when tape-based library systems were replaced by disk-based units. For the first time, broadcasters employed the systems in applications as diverse as 24-hour news playback and commercial insertion. Although some early adopters are simply seeking to replace an automated tape-based system, others see the new technology as part of a much larger digital video production system.

The first disk-based commercial and news playback system was demonstrated at the 1992 NAB Convention. The system was made possible by a combination of technology advancements including greatly improved video compression techniques and dramatic increases in the speed and storage capacity of disk drives. These new technologies, combined with lower costs, enabled manufacturers to offer affordable video library systems. These systems are practical for commercial insertion and news playback applications. It is possible that program-length playback capabilities will be added as new compression schemes are adopted and disk capacities grow and costs decline.

Cart-based systems

Cart-based library systems were designed to house some or all of a station's commercial library. These systems went a long way toward eliminating errors caused by mix-ups in the loading and sequencing of commercials. These video cassette library systems were basically videotape editing systems controlling multiple VCRs. Additionally, a robot was used for loading, with storage bins used to hold the tapes. The system rolled each machine at the required time, with the tape queued to play back the correct commercial. The systems could also be used to produce spot compile reels on external machines, affording an element of redundancy. Robotic library systems were certainly far more efficient than the manual operations they replaced, but had limitations because of their mechanical nature.

In some cases, software solutions were devised to provide workarounds for playback conflicts. When queuing times prevented the system from playing back two adjacently scheduled spots, many systems would build a special break-reel as a workaround. With cart systems, engineers were concerned about the shortest spot length that could be run back-to-back without interruption.

Disk-based systems

With the development of non-linear editing systems in the mid-1980s, the path was cleared for the eventual development of disk-based video playback systems. Just as robotic library systems relied on edit controllers to schedule and operate the systems, non-linear disk-based editing systems made possible the first digital disk playback systems.

A typical multichannel, disk-based playback system consists of one digital player/recorder per channel, buffer disk drives for each channel, a central storage archive and server, plus control workstations. (See Figure 1.) The central storage archive may be hard disk drives, magneto optical drives, data tape or a combination of these. Using hard disks as the central storage medium allows high-speed access.

In an effort to reduce cost and provide off-line storage, some manufacturers have

Boucher is senior product marketing manager, broadcast products for Avid Technology, Tewksbury, MA.

chosen to use data tape or magneto-optical drives as the central storage medium. However, this approach reduces the transfer speed to the individual channel buffers, thus creating a potential bottleneck in high-volume applications. Although, when used in addition to a hard disk central archive, magneto-optical drives or data tape can provide backup storage.

The basic unit of these systems is the digital player, which is a software application that locates video and audio tracks on the disk or disks and coordinates playback of those tracks so they appear as continuous streams. In fact, the elements of any one clip may be spread across a number of separate disks. It's the player's job to keep track of the location of these elements and to sequence them in the proper order for playback. The player feeds a stream of clips into the video decompression and audio processing system for continuous play-out. Because of the random access nature of disk-based systems the problem of conflicts and "cycle time" are virtually eliminated.

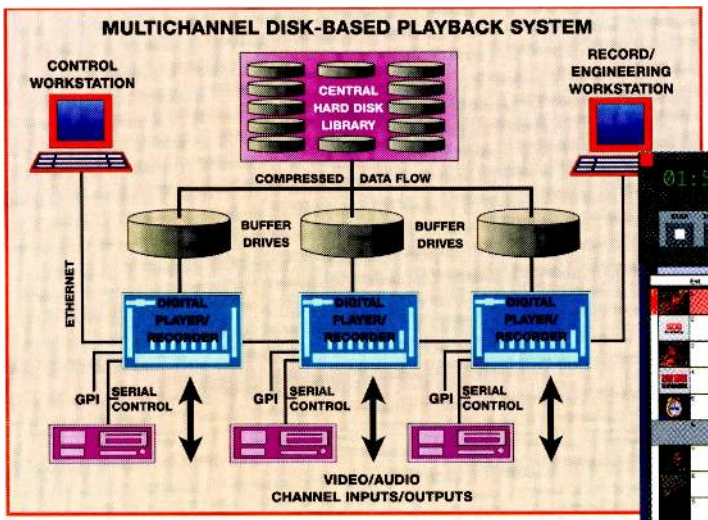


Figure 1. *Block diagram of a multichannel disk-based video library. Information is stored in the archive area and then moved to the buffer drives as needed.*

Figure 2. *The GUI (graphical user interface) used in the video library system.*

The player or I/O module is one element in the modular video disk-based playback system. The other major component is storage. It ranges from a single disk drive to large RAIDed servers in excess of 100GB, supplemented by magneto-optical or data tape storage options. These modular disk-based systems can be configured in numerous ways to suit a wide variety of applications.

In systems where *Redundant Arrays of Inexpensive Disks* (RAID) architecture is not used, buffer drives and I/O modules provide redundancy options. Two I/O modules can be used to provide continuous redundant playback of the commercial schedule. In the event of trouble on one output, it is possible to immediately switch over to the second output, for uninterrupted playback. A third I/O module can be used for recording while the other two are playing back.

The buffers also provide an amount of protection from a failure in the central archive. Depending on the size of the buffer, the operator may have hours of uninterrupted playback before a central archive failure can impact the buffer channel, allowing time for system recovery.

If less redundancy is needed, instead of three I/O modules, the system can be configured with two. The schedule is played out on the first, while the second is used for recording, and as a backup if necessary.

Storage can also be configured as needed. A large central hard disk archive can be configured to hold all active spots. In multichannel applications, individual local storage buffers can be used in each channel to increase redundancy and improve operating efficiency. These local storage buffers can be configured to hold anything from a few spots to a full day's schedule.

Redundancy

The reliability of disk drives used in the new playback systems is extremely high and improving all the time. The Mean Time Between Failure (MTBF) for drives typically used in these systems has been in a range of 300,000 hours, (slightly more than 34 years). Newly released drives are as high as 800,000 hours. (**Editor's note:** These figures are comparable to figures normally specified for disk drive MTBF, however, they reflect only the MTBF for the internal cylinder, not the entire assembly. MTBF specifications for the entire drive assembly tend to be in the 50,000 to 150,000 hour range.) Even with those impressive numbers, many customers choose to implement RAID technology for protection from failures.

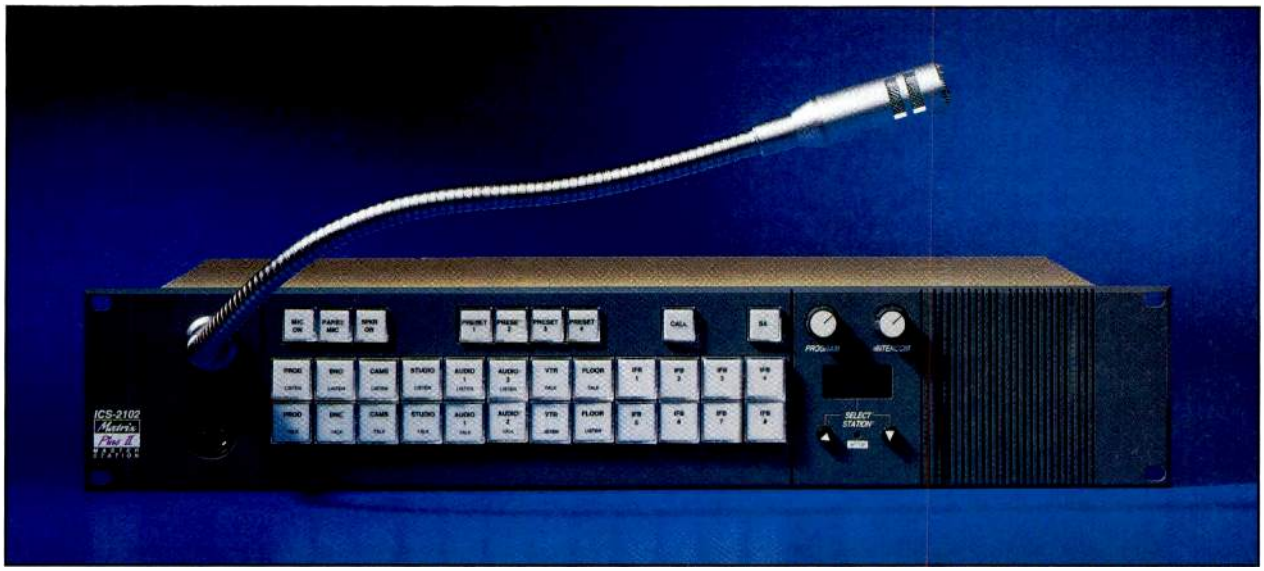
Two RAID configurations lend themselves to broadcast playback applications. The first, RAID-1, provides total mirroring of the disk storage. Should a drive fail under RAID-1, the mirrored drive automatically takes over, with no loss of information and no manual intervention. The failed drive is identified and then removed for repair and/or replacement. RAID-1 obviously requires a doubling of the cost of disk drives.

RAID-3 provides a redundancy alternative that uses fewer drives. In RAID-3 systems, one disk is used to record parity information. The video and audio information is striped across several disks. In the event of failure of one of those disks, the parity information is used to reconstruct the lost information. Again, there is no loss of information and the system continues to perform without interruption. The failed disk can be replaced at the operator's convenience and, because of the parity disk, a faithful copy of the failed drive information is reconstructed during normal operation on the new disk. RAID-3 architecture requires an extra 20% of disk space for the parity information.

User interface

Thanks to graphical user interfaces (see Figure 2), today's disk-based video playback systems provide operators with intuitive displays. Play lists include representative frames of video for each event and changes can be made by clicking and dragging clips from a library to the play list. Warnings of scheduling errors or off-line media are displayed through a pop-up list along with bright color bands across the affected events. Standby clips for emergency use are held in an on-screen window for immediate access.

Multiple user interfaces allow users to perform separate tasks simultaneously. Systems may have terminals located throughout the facility. In the case of video playback systems used for news applications, links to the newsroom automation system allow play list preparation and control to take place on any of the network newsroom terminals or in the studio control room. For commercial playback, links are provided to traffic, billing and automation systems.



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The future

As the implementation of disk-based video storage and library systems moves forward, it is important to avoid applying tape-type models to this new technology. These devices are not simply more flexible cart machines; instead, disk-based playback is a significant feature of a system that can provide station-wide digital capture, editing and storage of video and audio.

The benefits associated with this technology become fully realized when the entire system is implemented. In a commercial insertion application, there is a benefit in preparing the 20 to 30 daily promos on a non-linear disk-based edit system networked to the library. In this way, stored donuts or beds can be used to wrap around recordings of show previews captured from satellite. Each promo is available for playback quickly, without the need for dubbing or loading of tapes.

On the news side, the playback system becomes the final link in the news production chain. Digital disk recorders capture incoming feeds, non-linear editors speed the editing process, and digital playback occurs according to a schedule prepared on the newsroom system and downloaded to the disk-based playback system.

This media sharing capability opens up a host of opportunities for improving the speed and efficiency of the video production process, but the full benefits of this system can only be realized if the digital media is stored in a standard format and all elements of the system are designed to accept this standard.

As we look into the future, one sure thing is this technology will continue to change. Storage devices will increase in capacity and become lower in cost. Networks with servers will provide high-speed access to stored media. It will be possible to locate the I/O modules remotely from the central storage. Dedicated high-speed data links will provide the necessary network communication connection from the central storage archive to the remote I/O devices. Compression standards will improve, allowing program-length material to be stored and played back in affordable disk-based archives.

Conclusion

New formats are the topic of discussion in many stations today, whether it's a change in aspect ratio or the higher scan rates of ATV. Modular disk-based systems, like much of today's equipment, can be upgraded rather than replaced. If there is a new compression standard, simply replace the compression board. If 16x9 aspect ratios become the rule and an ATV standard is adopted, the I/O board is changed and the software upgraded. Individual components can be easily upgraded while the rest of the system remains unchanged. For the user, the graphical user interface maintains continuity throughout.

The computer revolution has come to broadcasting. Performance increases pioneered by industry have resulted in a convergence of technologies that now make disk-based video a reality. Standard computer platforms, disk drives, servers and networks are now being integrated into fast and efficient storage and production systems. As disk-based technology improves, the decision to implement these new systems may become much easier. ■

➡ *For more information on disk-based video systems, circle (315) on the Reply Card.*

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Computer vs. video resolution

The words may be the same, but the meanings are different.

By Tom Ransom

The Bottom Line

Now, more than ever, economic realities force both managers and engineers to consider desktop solutions to a wide range of problems. Understanding the fundamental differences will help you see through the hype and obtain a clearer view of the trade-offs. Here is a beginner's look at some of the fundamental differences between video and computer images.

$

Flip through the pages of computer, multimedia and desktop video magazines and you'll see ad after ad screaming out the benefits of broadcast-quality desktop video. Is desktop video really ready for prime time? Countless TV stations, networks and cable stations are using the technology right now, but realistically, desktop video has a ways to go before a Macintosh, 486 PC or Amiga is ready to serve as the heart of a broadcast video production suite.

This article will address what you need to consider to integrate computer-generated graphics and special effects into professional broadcast video. It is done every day, but like any emerging technology, desktop video requires some fine-tuning before it's ready to air.

Those schooled in traditional broadcast video often clash with the riders of the new desktop video frontier. There's even a language barrier, with words like *resolution* that have different meanings in a desktop context than in the world of analog broadcast television. Before we delve into solutions, we will define an image from the broadcast and desktop computer perspectives.

Broadcast vs. desktop video

Composite video is created when a video camera turns light into an electrical signal. Video monitors turn those electrical signals back into light. Three main video standards exist: NTSC, PAL and SECAM. NTSC is used in North America, Japan and parts of South America. It was set forth by the National Television Standards Committee (NTSC) in 1953 and is based on a black-and-white video standard that dates to 1941. NTSC uses 525 horizontal lines, 262.5 lines make up one field, with 60 fields per second.

The PAL, or Phase Alternation by Line, standard, originated in Germany and is similar to NTSC. This standard, which is used in Europe, Africa and the Middle East, uses 50 fields of video per second, with 625 lines, compared to the 525 lines used in NTSC.

SECAM, an acronym for Systéme Électronique Pour Couleur Avec Mémoire, is used primarily in France, Russia and Eastern Europe. Like PAL, SECAM has 50 fields of video per second and 625 vertical lines.

Today, professional video used for broadcast tends to be mostly analog and is found in composite and component forms. Digital video tends to be used mostly for high-quality post-production, but is also used somewhat in broadcast. Digital video has become a bit of a generic term used to describe any video that has been digitally encoded. Strictly speaking that may be true, however, to video professionals, the term *digital video* refers to one of several industry-wide standards for digitally encoded video, including SMPTE 125M and SMPTE 259M. When referring to desktop video, the term *digitized video* may be more appropriate.

Composite video is a single analog (or digital) video signal that carries luminance, chrominance and synchronization

Ransom is marketing communications manager for Truevision Incorporated, Indianapolis.

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(sync) information. Component video, on the other hand, refers to video made up of more than one signal, carried on more than one wire.

Several forms of component video are common — S-video uses two components, luminance and chrominance. They are carried as separate signals, with sync information carried as part of the luminance signal. Another form of component video is RGB, where the video signal is broken down into red, green and blue with accompanying sync information typically carried separately or on the green signal. In addition, Y, R-Y, B-Y is a form of component video that separates the luminance (Y) from the chrominance signal. The chrominance signal is then split into two color difference signals, R-Y and B-Y.

By comparison, the image you see on an Amiga, PC or a Macintosh monitor is *not* video, but *computer graphics*. Color, image resolution and presentation are handled differently. This is the reason desktop computer images need to be converted to either composite or component video before they can be viewed on a video monitor or television, and vice versa. In computers, images are represented by a fixed number of pixels (picture elements) — one common pixel format is 640 x 480. Each pixel is assigned a value for the amount of red, green and blue to be displayed. Sync, rather than being carried with the signal, is more a matter of hardware implementation.

What makes up an image?

Basically, video is made up of a series of horizontal scan lines displayed in rapid succession to create an entire picture. In video cameras, the light and color information is converted into an electrical signal by an electron tube or a charged-coupled device (CCD). Monitors and televisions display video by using an electron gun to reproduce the light and color information on the screen.

Each frame of NTSC video is made up of 525 horizontal lines. The lines are scanned from the top to the bottom of the screen. One complete set of 525 horizontal lines is called a frame. In NTSC, only half of the lines are scanned each time the electron beam moves from top to bottom of the screen. On one pass, the odd lines are scanned, on the next pass the even lines are scanned. This type of display is called *interlaced*. Each complete pass of the beam from top to bottom is referred to as a field, and two adjacent fields comprise one frame of video.

Computer images are refreshed in a non-interlaced manner. Dedicated display memory is loaded with pixel information starting at the lowest address, progressing sequentially to the highest address.

A 640 x 480 x 24 bits/pixel image. When it's examined closely, the pixels become apparent.

This information is updated or refreshed regularly by the system. Pixel information is passed to the driver in the same manner. Once it arrives at the monitor, it is displayed sequentially from top to bottom. Some older computer monitors, as well as many of the less-expensive varieties, actually display the signal in an interlaced fashion, but this is because of the inner workings of the monitor, not the signal format. The reason you notice the scan line when a computer image is shown on a TV program is because the scan frequencies of the computer monitor and TV monitor are similar, but not locked together. It's much like the wagon wheels apparently spinning backward in the old westerns, because of the strobe effect of the film camera's shutter.

Resolving resolution

Resolution is measured differently in video than it is in computers. For video, vertical resolution is fixed because the number of horizontal lines is set for NTSC, however, horizontal resolution can be as high as the response of the equipment allows, typically 750 lines for broadcast cameras and half that for a TV

set (see "Resolution and Image Quality," July 1993). Basically, resolution refers to the maximum number of alternating black-and-white lines that can be displayed. As the number of lines increases, they eventually blend together and appear grey. When viewing a monitor to check resolution, the monitor must be able to display more lines than the equipment being tested, otherwise the test is meaningless. Color monitors typically display only 350-450 lines, however, a high-quality black-and-white monitor can display upward of 850 TV lines.

In video, the luminance signal contains picture information as well as sync. This signal is basically the equivalent of black-and-white monochrome video. The reason for this is simple. To allow reception of color signals on existing black-and-white sets, the color information was added to the signal in a way that would not affect black-and-white televisions. Color or chrominance information is carried on a *subcarrier*. The amplitude and phase of the subcarrier determines how much of a given color is added to the picture. Each horizontal line contains luminance and chrominance information. Combining these signals causes unwanted artifacts to be generated in the video. Keeping them separate prevents the generation of artifacts, but can create other problems. The generation of artifacts tends to be cumulative, and that is why properly set up multigeneration component video appears cleaner and crisper than multigeneration composite video.

Because of the large amount of memory required, and because of the time involved in accessing that amount of memory, computer designers have made compromises.

For computers, resolution is measured in *pixels*. Color depth refers to the number of bits used for each pixel. Because each pixel is based on red, blue and green values, the total number of bits used must be divided by three to determine how many bits are used to describe each of the three colors. Therefore, 24-bit color typically refers to a signal that uses 8-bits each to describe the red, blue and green values for a given pixel. In general, 32-bit signals have an extra eight bits used for a key signal used to "cut a hole" for the image when performing effects. Taking this one step further, storing an uncompressed 640 x 480 24-bit pixel image requires more than seven million bits, which is the equivalent of 900kB of computer memory.

Because of the large amount of memory required, and because of the time involved in accessing that amount of memory, computer designers have made compromises. For instance, a standard VGA can display 640 x 480 pixels, but to save memory space, only 256 colors can be displayed at once. Those 256 colors are derived from a look-up table that contains RGB values for each of the colors. Six bits each are used for the red, green and blue values. With six bits, the red, green and blue values can be assigned any value from 0 to 63, which allows for more than 262,000 colors, any 256 of which can be displayed at one time. This type of system is what is referred to as 8-bit color, not because eight bits describe the color of the pixels, but because eight bits describe the size of the lookup table. One feature of this method is the fact that by changing the numbers that describe a color in the look-up table, all of the pixels assigned that color will be changed. Higher pixel resolutions, as well as up to 16.7 million colors (24-bit), are available on desktop systems. The additional resolution requires additional memory and system speed, but like high-end video equipment, the resulting higher cost is warranted by the increased quality.

How much is too much?

So what do you need? For the most part, more is better, but there are trade-offs. Cost is probably the most obvious trade-off, and quality is the hardest to define. Today, 640 x 480 pixels with 256 colors (8-bit) may be enough. HDTV advocates, however, are specifying 1,920 pixels by 1,080 lines interlace and 1,920 pixels by 720 lines progressive scan. The best choice is somewhere in the middle. With hardware costs dropping, buying a cutting-edge unit may not be cost-effective, however, getting something slightly better than your current needs warrant and upgrading to stay ahead of the curve probably makes the most sense. Careful evaluation and a reasonable understanding of the fundamental differences between computers and video equipment will lead to the best solution for your needs.

■

The changing face of radio automation

This is not your father's cartridge wheel.

By Skip Pizzi, technical editor

The Bottom Line

Automation is the key to the future for many radio stations. Once limited to "canned"-format stations, its cost-effectiveness is now accessible to nearly any radio operation, thanks to increased flexibility and reliability. Multistation facilities can especially benefit from systems that can manage multiple program services from a single platform. Investment in automation today also may serve as an important first step toward the LAN-based radio station of tomorrow.

In the not-so-distant past, a radio station used automation when it couldn't afford live talent. An automated operation meant small-market, small-audience and low-budget. Automating a radio station was a tacit admission of second-class media citizenship.

Well, things have changed — dramatically. Automation is now a cutting-edge technology. It's still used for many of the same cost-effective reasons, but today it can provide much more. The new wave of computer-based automation systems allows a wide range of programming techniques to be applied with precision and reliability, while keeping costs manageable. New systems are moving into larger markets as they integrate more *live-assist* capabilities, allowing their advantages to be applied *with* rather than *in place of* live talent.

Today's computer automation system is also the kernel of tomorrow's electronic architecture for radio stations. It's likely that the future radio facility will be a multichannel, audio-plus-data, computer-networked operation. The launching point for this transition is in the heart of the station — the on-air control room. It is there that the conversion to a virtual environment takes root and begins its growth outward to the station's other functions. (See "Desktop Radio," February 1994.)

The latest directions

Computer-based automation systems (sometimes called *audio management systems*) have now been in use for enough years to prove their viability, and they can no longer be considered really new. Many systems use standard PC platforms, while others are based on proprietary devices. Their ability to maximize a broadcaster's daypart flexibility and cost-effectiveness is well-established, whether local or satellite-delivered programming is used. Their capacity to interface with traffic systems is also well-known. Some systems integrate familiar control surfaces, such as push-buttons and faders, while others opt for fully virtual (on-screen) control, using mouse, trackball or touchscreen devices.

Today's computer automation system is the kernel of tomorrow's electronic architecture for radio stations.

Today's new directions in this field take the next step toward the future radio facility by including *networked* design. This allows multiple devices to interconnect and share common hard disk audio file storage and access via a *local area network* (LAN) designed specifically for radio operations — the so-called *radio LAN* or *R-LAN*.

This trend was widely evident at the 1994 NAB Convention, with most radio automation manufacturers showing some

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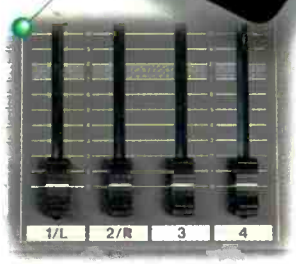

ELABORATE MONITORING

In a recording environment you need to hear what's going through your board at all times. With the M1500's comprehensive monitoring matrix you are able to hear any sound source at any time — inputs, tape, AUX sends, anything — it's your choice, just press a switch.

IN-LINE MONITORING

A sure sign of a recording mixer. This lets you monitor your tape tracks at any time without sacrificing an input channel. Just press a switch. With the M1500's dual section nat only can you monitor tape tracks, it can be used for additional effects sends, or to double your inputs for virtual tracking at mixdown. And do any of this by flipping a switch.

TRUE TRANSPARENCY AND LOW NOISE

In recording, your signal goes through the mixer several times. And each time it goes through, it is important not to lose or gain anything. Especially an identifiable "mixer sound." Test any mixer for its transparency. Take any signal and bounce it 3 or 4 times on your favorite digital recorder. With the truly transparent M1500, you'd be hard pressed to differentiate between the bounced tracks and the original signal.

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M1516 $1699

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Get your hands on a true recording mixer today: the TASCAM M1500 Series. There's one waiting for you at your authorized TASCAM dealer. Go ahead — test it and play with it. It's your next recording mixer.

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sort of networked product. (See *BE's* detailed NAB show coverage in next month's issue).

The R-LAN is the next logical step in radio station evolution, allowing integration of the entire process from traffic to broadcast in a single monolithic device.

Moving to a virtual environment provides defense against the constant need to upgrade facilities.

Although it can never replace the original (and continuing) strengths of radio — smart programming and strong talent — it can make their presentation more effective and efficient. Moving from a "hard" to a virtual environment also provides at least a partial defense against the constant need to upgrade and furnish facilities with the latest hardware.

Perhaps most important, an R-LAN environment can make the most of a consolidated operation, allowing multiple program streams to be managed on the same system. This holds true for either *regressive consolidations* like the duopolies of today — where formerly separate stations are combined into a joint facility — or potential *progressive consolidations* of tomorrow, in which existing stations inaugurate new or spin-off services, delivered by wired or wireless means. If projections about future datacasting opportunities hold true, the R-LAN can also accommodate flexible and cost-effective management of these revenue-producing datastreams as well.

Migration paths

An important element in today's radio automation systems is *machine control*. This allows an automation system to control other devices at the station, typically via a serial control protocol such as RS-422. These external devices include newer generations of DAT machines, digital spot recorders (cart machine replacements), CD players and CD jukebox changers, most of which feature serial control capability.

This approach maximizes cost-effectiveness because it allows previously existing hardware and media to be used for a longer period, and because less-expensive storage formats (i.e., removable magnetic or optical media rather than hard disk) can be used. Eventually, many of these outboard functions may be handled by the R-LAN and its computers directly, particularly if hard disk costs become cheap enough to rival other forms of storage.

The technology deserves serious scrutiny by broadcasters who are concerned about their future facility's design.

Note also that although most automation system manufacturers are developing (or now offer) some sort of R-LAN

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package, most *digital audio workstation* (DAW) manufacturers are not moving toward an R-LAN goal. Therefore, although DAWs may work well in radio station production studios, they may not offer the ideal entry point to a fully virtual future environment that radio automation or audio management systems do. Most DAWs offer no greater ability for facility-wide integration than the conventional production equipment they replace. Therefore, audio management systems may provide a more future-minded, full-facility growth option when compared to DAWs, which are dedicated almost solely to production duties. This may also explain the currently rapid pace charted by some audio management manufacturers in development of software and hardware for dedicated production-studio and newsroom stations on their networked systems.

The list of radio automation and audio management system manufacturers is growing (see Table 1), and the technology deserves some serious scrutiny by broadcasters who are concerned about their future facility's design and operational philosophy. For radio stations, the new paradigm starts here. ■

AEQ	MAR SYSTEM	323
AEV	DIGITAL SPOT SAMPLER	324
ARRAKIS SYSTEMS	DIGILINK, GEMINI	325
AUDITRONICS	DESTINY 2000	326
BASYS	D-CART	327
BROADCAST ELECTRONICS	AUDIO VAULT, FORMAT SENTRY	328
COMPUTER CONCEPTS	DCS, DCS LIVE!	329
DALET DIGITAL MEDIA SYSTEMS	DALET SOUND WORKSTATION	330
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Table 1. The major players in the radio automation/audio management marketplace.

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NOTE NEW PHONE NUMBERS FOR SVS!

Re: Radio

Measuring NRSC compliance

By John Battison, P.E.

AM stations, beware: FCC Rule No. 73.44(e) will be effective June 30, 1994. This will have an important effect on many stations. If your station complied presumptively with the NRSC emission standard (Rule No. 73.44(a)(b)) by installing NRSC-1 filters in 1990, you have been absolved from making the periodic measurements required in Rule No. 73.1590(a)(6) until June 30. At that time, your exemption expires, and the emission standard's requirement for verification measurements takes effect.

The entire RF transmission system is involved, not just the transmitter.

The rules call for measurements to be made at intervals of not more than 14 months to show compliance with the NRSC emission standard. Some engineers feel that this gives AM stations until Aug. 30, 1995 to make their first measurements, while others advise that first measurements should be taken *before* June 30, 1994. In either case, the real impact to stations does not come from taking the measurements, but from the new test equipment that may be required. The measurements call for a spectrum analyzer or, as the rule states, *specialized receivers or monitors with appropriate characteristics.* Disputes will be resolved in favor of spectrum analyzer results.

Although it is probable that properly adjusted AM transmitters using the NRSC-1 filters will continue to comply with the rules, an equipment performance measurement must now be made and kept on file to demonstrate this compliance.

This requirement may be a blessing to stations receiving splatter from overmodulated AM stations. The FCC might be more exacting on AM stations when the new requirements come into force.

Battison, *BE's* consultant on antennas and radiation, owns John H. Battison and Associates, a consulting engineering company in Loudonville, near Columbus, OH. Respond via the *BE* FAXback line at 913-967-1905.

Verifying compliance

Spectrum analyzers are not cheap, and although they are nice to have on hand, few stations are likely to invest in one. Nevertheless, it's a good idea for *every* AM station to make, or contract to have made, a spectrum analyzer check as soon as possible. Stations will then be sure of their compliance with the FCC's rules, or they will be able to make the necessary adjustments to bring the bandwidth into line. Such a measurement will also satisfy the rules for another 14 months.

Over the four years since the NRSC filters were required to provide the presumption of compliance, there may have been variations in performance as components aged. In many cases, preset operating controls have been changed as a succession of contract engineers looked after the station. Probably most of the NRSC filters were properly set up during installation, but as instruction manuals were misplaced, and ambitious engineers devised ways of improving performance, it's possible that many output signals no longer conform to NRSC-1 specification.

If stations continue to rely on presumptive compliance, they may have a rude awakening when the FCC walks in some day after June 30. AM stations are advised to invest in a carrier check or to buy equipment to make their measurements.

An alternative

Some years ago, Delta Electronics introduced the *AM Splatter Monitor*, which makes it possible to evaluate the effects of an NRSC filter on a station's signal. The splatter monitor cannot take the place of a spectrum analyzer measurement in the commission's eyes, but the monitor's indication of acceptable performance should provide a station with peace of mind at a substantially lower price. Its effective indication of compliance tells you that if the FCC should check your signal, you'll have nothing to fear.

Not long after the splatter monitor was introduced, Tom Wright and John Bisset presented a paper, "The Splatter Monitor and The Spectrum Analyzer: Measurement Comparisons" (published in the NAB's 1989 Broadcast Engineering Conference *Proceedings*, or available from Delta Electronics as part of its *Application Bulletin No. 10*). The report cites comparative, simultaneous measurements of stations in the Washington, DC area, and shows agreement between spectrum analyzer and splatter monitor.

Solving problems that may surface

Just making the measurements may be only part of the work. If your testing indicates non-compliant emissions, you'll have to track down the problem and fix it, then make confirming measurements.

The entire RF transmission system is involved, not just the transmitter. Antennas, ATUs and phasers should not be ignored. High-Q systems can make compliance particularly difficult. Check the plate loading on the final stage of the transmitter. Changes in operating values that result in an incorrect plate load can cause RF spectrum problems (as well as premature tube failure). If your final and modulator tubes have been in use for several years, it's a good idea to replace them before making your spectrum measurements. Sometimes feedback-ladder resistance and capacitor values can also change over time. Unbalanced ladders can spoil an otherwise clean spectrum.

Stations need to allow enough time to do this work should it be necessary this year and in subsequent years. Whatever measurement method is used, it is certain that the FCC will insist on compliance and the resumption of regular measurements. If stations attend to this matter promptly, ample time remains for making any required adjustments to transmitters and processing equipment. ■

➡ *For more information on test equipment for NRSC compliance, circle the following on Reply Card:*

Anritsu	*300*
Avcom	*301*
Delta Electronics	*302*
Hewlett-Packard	*303*
Rohde & Schwarz	*304*
Tektronix	*305*

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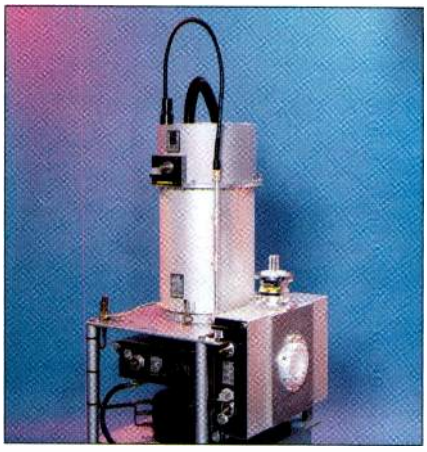
Combined NTSC/ATV operation

By Martha Rapp



Transmitter design engineers and broadcasters are beginning to ponder the question of field-modifying NTSC transmitters for eventual combined NTSC/ATV operation. This becomes a key consideration for those stations evaluating new transmitters today, for purchase and installation prior to ATV conversion.

First, the traditional criteria that have always been important to broadcasters when looking at UHF transmitters still apply. At the top of this list are overall system efficiency, design redundancy/system reliability and signal performance.

With the United States edging closer to adoption of an HDTV/ATV standard and the imminent, mandated transition from NTSC, another question becomes increasingly important: How possible will it be to modify the transmitter purchased today for the eventual combined NTSC and ATV operation?

The short answer is that most well-designed, modern UHF TV transmitters *should* lend themselves to some degree of field upgrade, whether they use solid-state devices, depressed collector klystrons or inductive output tubes (IOTs) for the final power amplifier. Nevertheless, you should keep several factors in mind if you are currently evaluating UHF transmitters for NTSC/ATV operation. These include output device technology, transmitter system architecture and power supply design.

Rapp is manager of public relations for Harris Allied, Quincy, IL. Respond via the *BE* FAXback line at 913-967-1905.

Choice of output power device

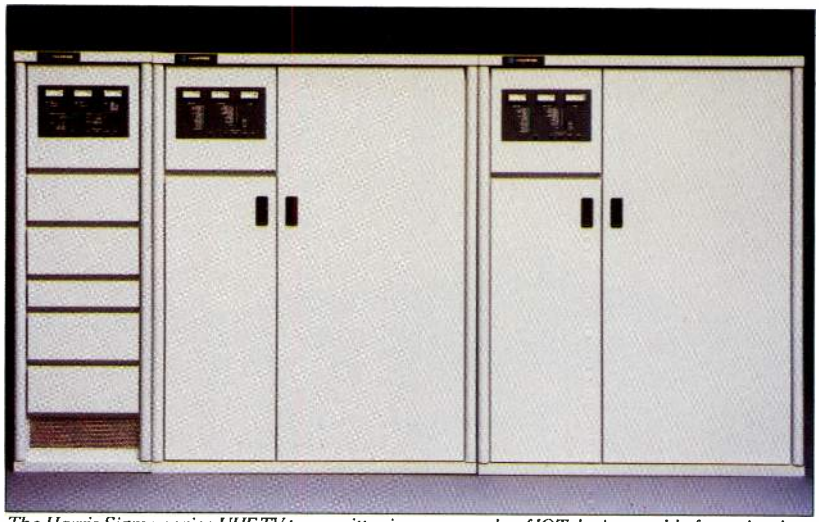
Several field-proven output devices suitable for ATV are available. However, the depressed collector klystron and the IOT currently appear to be the most practical for the majority of U.S. broadcasters purchasing a UHF transmitter for NTSC transmission today and NTSC/ATV transmission in the future.

Like depressed collector klystrons, IOTs offer extremely high levels of AC-line-to-RF conversion efficiency. One transmitter manufacturer reports that a 60kW IOT system achieves overall efficiency higher than 70% (which includes power supplies and cooling).

While individual depressed collector klystrons are limited to power levels of 60kW or 70kW, IOTs with a rated power of 40kW and 60kW are available, and 20kW IOTs are in development. In addition, transmission systems using IOTs are designed to allow transmitter output power to be upgraded in the field by replacing a lower-power IOT with a higher-power IOT.

Regarding solid-state designs, there's no question that these devices have advanced significantly in recent years, or that they offer increased reliability when used in parallel/redundant transmitter configurations. Currently, however, solid-state tends to be most practical at UHF in the low- to mid-power ranges. At the high UHF power levels commonly used in the United States, the initial purchase price of a solid-state transmitter may be prohibitive for many broadcasters. Because solid-state UHF devices do not yet offer comparable efficiency to depressed collector klystrons or IOTs, long-term electricity costs are another concern.

Closely consider your current NTSC power requirements as well as those you anticipate for NTSC/ATV simulcasting before you decide what technology is best for your operation.



The Harris Sigma series UHF TV transmitter is an example of IOT design usable for redundant NTSC or combined NTSC/ATV operation.

The importance of system architecture

Whatever output device technology you choose, the overall architecture of the transmitter is critically important. System architecture will significantly affect the cost and complexity of any required modifications for NTSC/ATV operation.

Transmitters featuring a *distributed*, modular architecture—in other words, a design that logically repeats key components throughout the air chain — should be the ideal candidates for modification. Power amplifier redundancy is also essential.

The distributed architecture of a multiple tube/combined amplification IOT transmitter can lend itself to modification by allowing one PA to be dedicated to ATV and the other to NTSC. If you anticipate substituting a higher-power

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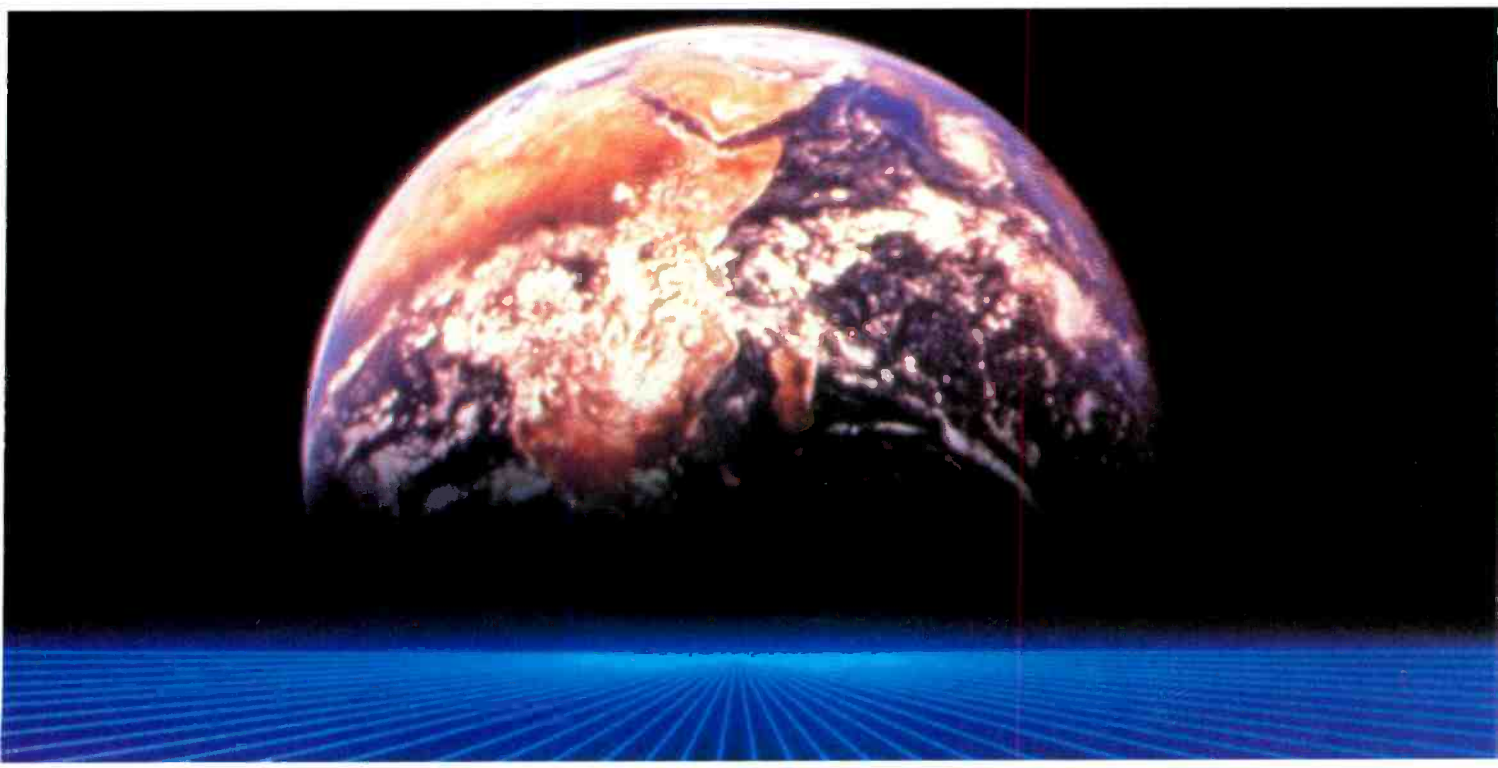

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IOT to increase NTSC power when running only one PA for each service, you'll want to ensure that the transmitter you are considering can accommodate this change. Beam supplies must be sized to handle the upgrade as well as today's peak power requirements. Also verify that the transmitter's design supports *each* IOT with such features as independent monitoring and control, RF correction, IPA, thyratron protection, a beam supply with sufficient capacity, adequate cooling and AC-line control.

Concerning linearity, most modern transmitters provide comparable levels of linearity, regardless of their class of operation. The real issue centers on which technology and (perhaps more importantly) what implementation of technology in an actual transmission system will provide the lowest cost of ownership for the long term.

Considering the issues

Many issues are involved in a TV station's planning for the ATV era, some of which hinge upon undetermined factors that will affect the simulcast period and beyond. Among these are considerations of whether one or two transmitters will be required during the simulcast period; whether a common antenna/transmission line may be used; whether an existing transmitter may be used as a future backup for NTSC, ATV or both services; and whether a single transmitter purchased today can serve until, during and after the simulcast period with minimal modifications.

Your transmitter will be more easily upgradeable for combined NTSC/ATV operation if:

1. It has multiple power amplifiers.
2. It features a distributed architecture that repeats key components throughout the air chain.
3. It supports each power amplifier with RF correction, an IPA, protection, a beam supply, AC line control, cooling, control and monitoring.
4. Its power supply is sufficiently sized to allow amplifier power to be upgraded in the field.
5. Its cooling system is sized for upgrade.

Table 1. *An upgradeability checklist for UHF transmitters.*

Add to these new concerns the conventional issues of system efficiency, redundancy and performance and you have a sense of the complex decisions faced by those who seek a transmitter that incorporates state-of-the-art technology *and* easy modification for eventual combined NTSC/ATV operation.

Although a U.S. standard for HDTV/ATV has yet to be adopted by the FCC, broadcasters can consider several key and known factors today if they plan to purchase a transmitter at this time. Paying proper attention to these matters can reduce the risk associated with such a decision and can allow significant reductions in the cost and complexity of field modifications that might be performed for future combined NTSC/ATV transmitter operation. ■

➡ *For more information, see "Transmitters, TV," p. 69 of the 1994 BE Buyers Guide.*

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Model 5222 NTSC/PAL Waveform Monitor

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SBE Update

Frequency coordination committee

By David Carr

The Society of Broadcast Engineers is working to keep broadcast engineering an effective and rewarding profession by means of a variety of programs. A major service performed by SBE involves communicating concerns to the FCC about proposed rule-makings that would impact broadcasting. This month's focus is on the Frequency Coordination Committee, which is working to protect the frequencies of local broadcasters.

Frequency coordination

The Frequency Coordination Committee is made up of 145 volunteer local coordinators. Gerry Dalton, SBE MIS director, wrote the software program used by coordinators. Paul Lentz, SBE frequency coordination coordinator, constantly updates the list of coordinators' addresses and phone numbers. Lentz also has an extensive list of more than 200 people, businesses and FCC offices to which he quarterly sends updated information. Also serving on this committee is past SBE president, Richard Rudman, chief engineer of KFWB-AM, Los Angeles and Dane Ericksen, of Hammett & Edison, Inc., San Francisco. They monitor the actions of the FCC and "spectrum-hungry" interests. Chris Imlay, SBE attorney, ensures that the committee follows the correct process.

The heart of the FCC's coordination process is licensee-to-licensee coordination. Because the committee members are also users of the spectrum they coordinate, the potential for conflict of interest runs high. Coordinators must function as database administrators – not as entities that assign frequencies. Although experienced coordinators can suggest possible interference solutions, engineering findings that determine if a new user can be accommodated must ultimately be made by the co-channel and adjacent-channel licensees.

Carr is chairman of the SBE Frequency Coordination Committee.

The SBE National is active in an effort to remind broadcasters who do remotes that the frequencies of local broadcasters must be protected at all costs. The use of Part 74 channels must be coordinated prior to the remotes. This makes it possible to have the live microwave remotes often taken for granted in a time of instant news coverage. For example, the Republican and Democratic National Conventions, the Papal visits, the flooding in the Midwest, and the coverage of the earthquakes in Los Angeles would have been chaos if it were not for frequency coordination.

Guarding the spectrum

Guarding spectrum on behalf of broadcasters is another committee responsibility that is becoming increasingly more important because of a growing need for more spectrum. This effort began in 1982 and the society has engaged in a serious and expensive educational campaign to inform the FCC that nothing currently exists to replace Part 74 spectrum if it is taken away.

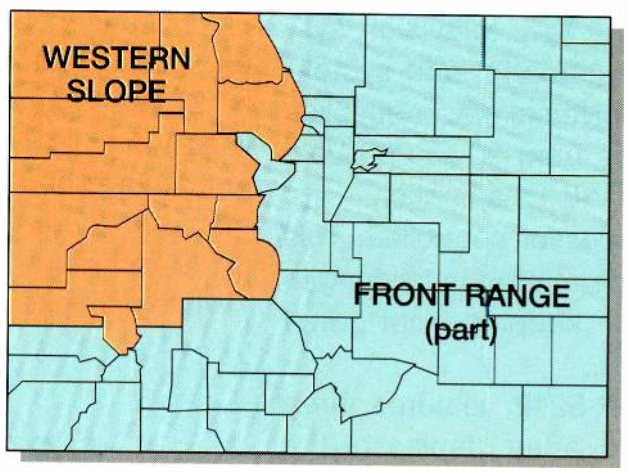

Table 1. *Partial frequency coordination coverage map by county for Colorado.*

A dramatic change is under way at the FCC. The Private Radio Bureau (PRB), longtime custodian of amateur and business radio channels, is handling licensing for Part 74 frequencies and is now located in Gettysburg, PA. SBE National has made formal comments to PRB regarding changes in forms that will affect Part 74. For example, at its Miami convention, the SBE began educating PRB on how the channels are used and how the process works.

The SBE also acts as secretary for a special all-industry group called the National Frequency Coordination Council (NFCC) that includes NAB, SBE and the national broadcast networks. Local coordinators get representation through the SBE, and the NFCC meets at least once a year, usually at the spring NAB Convention, to discuss coordination issues.

Although fiber links to major FM and TV transmitter sites may relieve some pressure of studio-to-transmitter (STL) channels, the need for more ENG and RPU spectrum is still growing. For instance, helicopter video and aural platforms can illuminate receivers for hundreds of miles and may affect several markets.

Part 74 users must learn to make efficient use of the spectrum when new users come along. The commission says all licensees are entitled to use Part 74 channels, but the laws of physics will restrict what is technically possible. Conflict is inevitable, but through continuous effort at both the local and national levels, it can be minimized.

With careful planning and foresight, future problems with the use of the spectrum can be eliminated. By educating the FCC on the ramifications of proposed rulemakings on the coordination process, the SBE is working to protect the interests of broadcast engineering and related fields. ■

Editor's note: Thanks to Richard Rudman and Paul Lentz for their contributions to this article.

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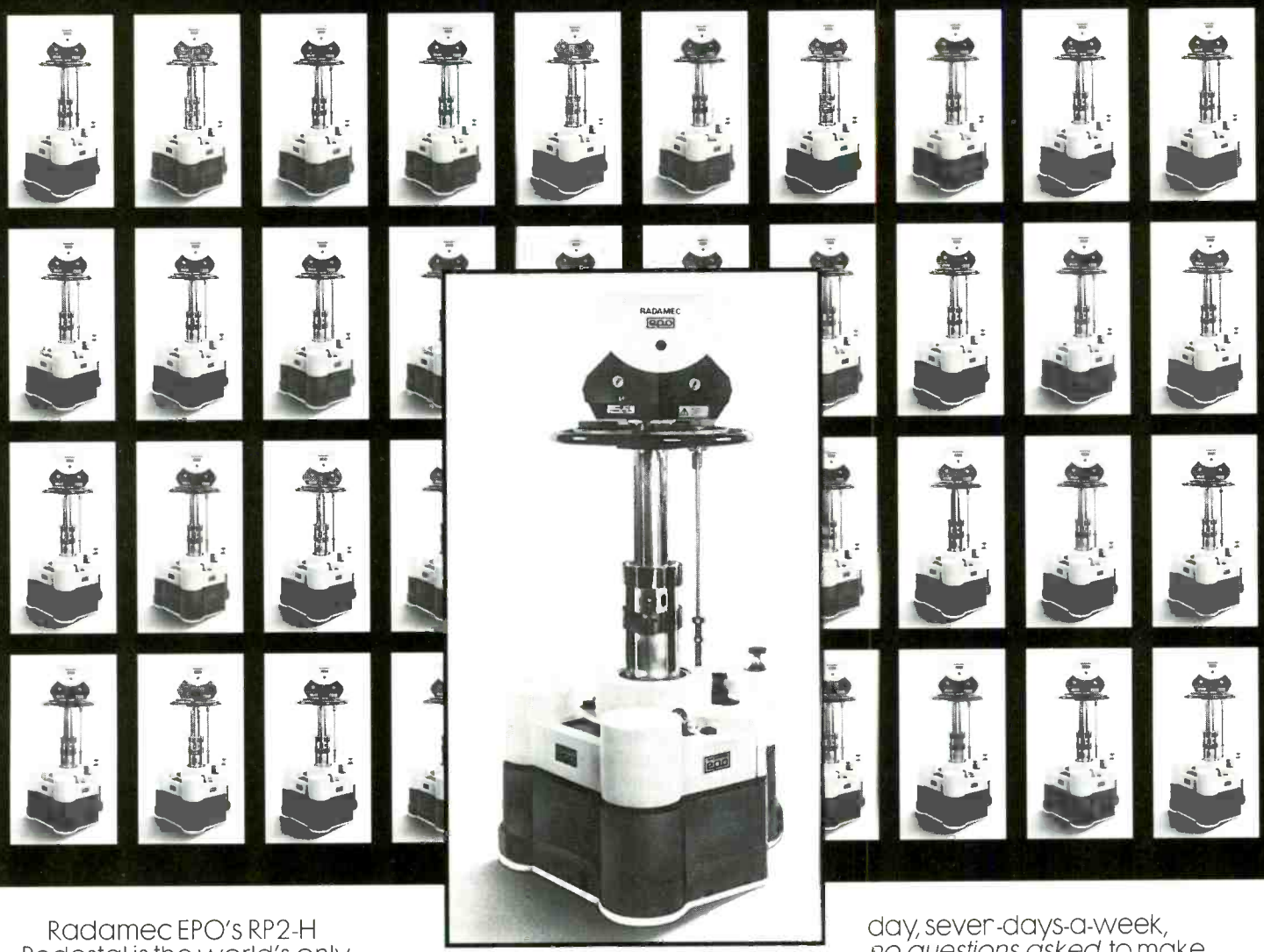

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Field Report

Louth Automation ADC-100

By Keith Aotaki

KHNL is a Fox network affiliate operating 24 hours a day in the Honolulu market. In May 1993, another 24-hour station in the market, KFVE (an independent), relocated to the KHNL facility. Since that time, both stations have been operating from the same control room using common equipment and staff.

When planning for the consolidation began in the spring of 1993, several challenges immediately became apparent. The combined facility had to use already installed equipment only, KFVE had to be converted to KHNL's existing *BIAS* traffic system, and the stations had to function under a single master control operator.

Each station also had to continue to maintain its own identity. The two stations had different operating procedures and programming — distinctions typical between most network affiliates and independents. Two distinct schedules with separate as-run logs were required. Only 35% of the spot commercials would be common to both stations, requiring a tape management system for the large combined library. Hawaii's time zone location (EST-5) and its non-observance of daylight savings time makes time-delay management an important requirement for any system.

It was apparent that a software-based solution would be the only cost-efficient method of managing these two asynchronous channels while satisfying all of the operation's business objectives.

Louth Automation's *ADC-100* was chosen after careful evaluation of available automation systems. This software-based system uses client/server computer architecture, object-oriented software design methods, and offers extensive user-configuration capabilities. Object-oriented programming allows Louth to easily customize for specific needs and respond to new requirements as they arise.

Aotaki is director of engineering at KHNL/KFVE, Honolulu. Respond via the *BE* FAXback line at 913-967-1905.

Performance at a glance:

- *Flexible and easily configurable software-based automation system*
- *Capable of fully automated, multichannel operation*
- *Uses client/server architecture and object-oriented software design*
- *Treats automated tape library system as a single device*
- *Integrates a wide variety of hardware devices and traffic software*
- *Operates with Turbotape multispot tape preparation software*
- *Dedicated hardware control panel available for on-air operator*

System layout

Almost any number of client workstations can be easily connected to the system for control of devices. Device status is available to all clients at a frame accurate rate. The clients sit on the network and perform non-real time tasks, such as playlist editing. Four workstations have been installed, including one in the engineering office that is used primarily for monitoring the system and retrieval of the as-run files. The master control operator's workstation is supplemented by a Louth control panel that allows quick, one-button control of common functions, such as *freeze and skip*. Any workstation can back up the others, and all lists are displayed in on-screen windows.

The server is a rack-mounted 486 PC that performs all real-time device control. Each device has its own 38.4kb/s connection to an intelligent RS-422 serial card in the server. The server can support up to 32 devices through serial control, while parallel devices are interfaced by a GPI card. (See Figure 1.)

The system treats an automated tape library (ATL) system (a Sony *BVC-1000* at KHNL/KFVE) as a single device. The ADC-100 totally integrates the ATL as a peer with the other devices by displacing the ATL manufacturer's operating software with device-control software. The ATL retains all of its functionality, but does not require its own playlist, thereby avoiding system throughput problems.

Schedule logs are sent from traffic to operations via 3.5-inch floppy disks, and as-run logs are returned to the accounting department for reconciliation, providing a closed loop for both stations' business operations. Traffic also creates record (dub) lists for tape preparation and identification for the automation database.

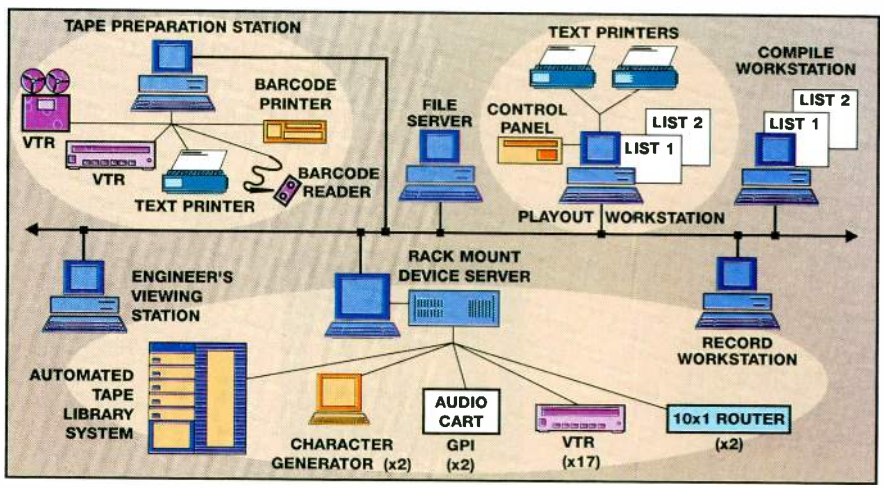

Figure 1. Block diagram of automation system at KHNL/KFVE.

Tape preparation and identification

KHNL was already using Sony's Cassette Preparation System (CPS) for ATL tape management. Because this product was also developed by Louth, the station was able to up-

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