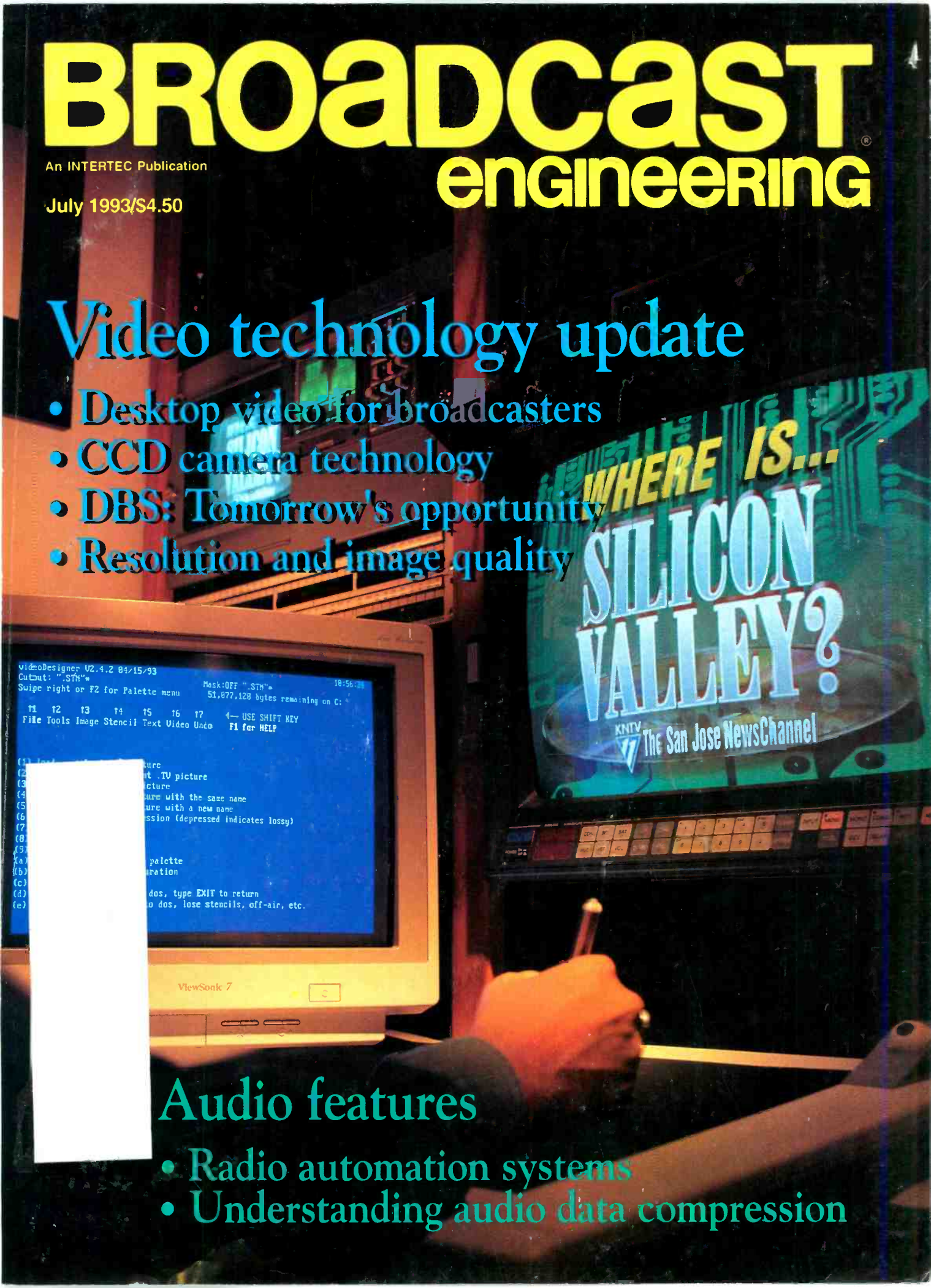
BROADCAST ENGINEERING

An INTERTEC Publication

July 1993/$4.50

Video technology update

- Desktop video for broadcasters
- CCD camera technology
- DBS: Tomorrow's opportunity
- Resolution and image quality



Audio features

- Radio automation systems
- Understanding audio data compression

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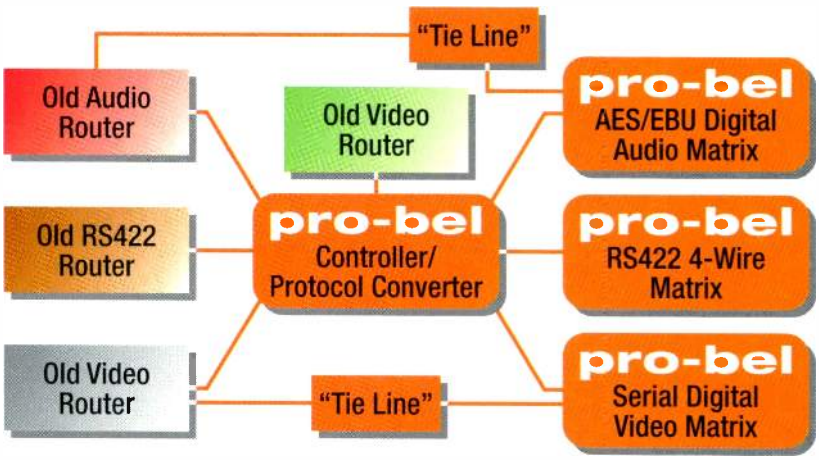

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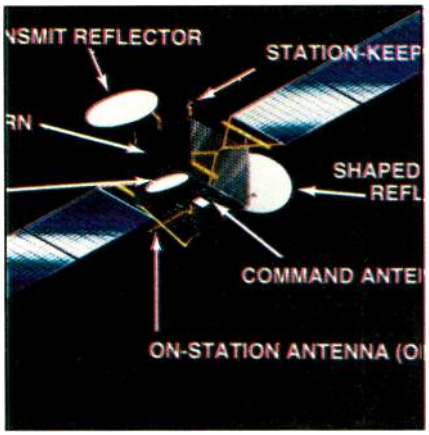

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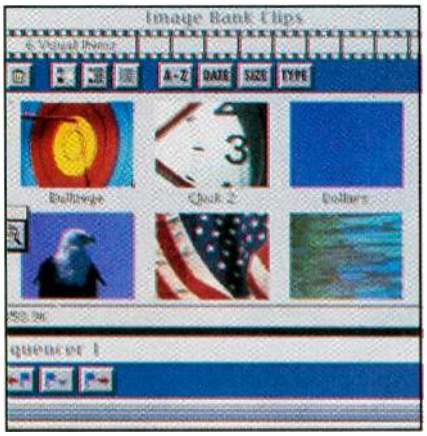

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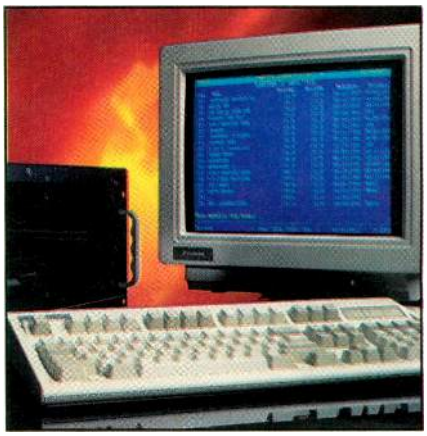

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VIDEO TECHNOLOGY UPDATE:

Keeping up with video technological developments could be considered a full-time job. Today's producers and engineers almost need a program just to keep track of the players. With DBS and DTV finally turning the corner from dream to reality, professionals find themselves faced with new choices and opportunities. This month's issue provides readers with practical insight into where the world of video is and, more important, where it is going.

THIS MONTH...

DEPARTMENTS:

OTHER FEATURES:

ON THE COVER:

Today's production and broadcast facilities are often turning to desktop production technology for graphic solutions. KNTV-TV in San Jose, CA, uses Grass Valley Group's videoDesigner PC-based graphics system to create many of its on-air graphics. (Photo courtesy of the Grass Valley Group. Douglas Schwartz Photography.)

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Shown above: the US-2000 two-channel main station (one rack space high, half-space wide).

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News

By Dawn Hightower, senior associate editor

NAB asks FCC to give stations more flexibility in HDTV transition

The National Association of Broadcasters (NAB) said the nation's 1,100 TV stations are concerned that they may not be able to afford the $10-14 million price tag to convert to HDTV if there are no market-driven approaches. More uses of HDTV airwaves would speed America's introduction into the digital TV world. It would help stations pay for HDTV transition costs and offer consumers wireless data, computer and other digital services.

The NAB has asked the Federal Communications Commission (FCC) to give stations more flexibility in making the transition, perhaps basing transition requirements on market size or ability to pay.

One application would be to broadcast data to 30 million computers in U.S. homes, and offer such services as CompuServe, Prodigy and American On-line at transmission rates much faster than modems.

EIA calls for HDTV in time for 1996 Olympics

The Electronic Industries Association (EIA) called for the government to set a national goal of HDTV delivery to American viewers in time for the 1996 Summer Olympics.

The appeal was offered before the House Subcommittee on Telecommunications and Finance by Sidney Topol, chairman of EIA's Advanced Television Committee.

Broadcasters ask court to reject telco ownership of cable

Broadcasters are fighting an effort by Bell Atlantic, which wants to throw out the cable-telco cross-ownership ban. The ban forbids phone companies from owning local cable systems and other video programming in their phone service areas. Bell Atlantic asserts such a ban violates its First Amendment rights.

According to the NAB, the Association of Independent Television Stations (INTV) and Tribune Broadcasting, banning telephone companies from owning local cable systems is a permissible economic regulation to prevent the development of local media monopolies.

Broadcasters argue that the Supreme Court has repeatedly upheld the value of such economic regulation, in order to increase diversity and other media choices, which advance First Amendment interests. Allowing cable and telephone companies to merge could undo local competition and hinder TV stations' access to local TV viewers.

NAB rejects Time Warner plea for cable law delays

TimeWarner's appeal to the federal court to delay implementation of the must-carry and retransmission consent rules required by the 1992 Cable Act has been blasted by broadcasters.

The NAB and the Association of Independent Television Stations (INTV) filed papers with the U.S. Court of Appeals in Washington, D.C. They said the "stay" motion must be denied because Time Warner did not first seek relief from the FCC. Both groups also called the effort untimely, saying Time Warner waited too long to merit any court-ordered delay.

NAB and INTV pointed out that Time Warner's arguments about the substance of the new rules should be rejected. Time Warner argued the rules on must-carry and retransmission consent are arbitrary.

Built-in closed-caption decoders allow TV access to all

July 1 marked the beginning of the implementation of the Television Decoder Circuitry Act. It mandates that TV sets 13 inches or larger manufactured for sale in the United States must have built-in closed-caption capability.

The bill was initially aimed at helping the 24 million deaf and hard-of-hearing Americans, but has been recognized for additional values. Captions also will help millions of children and adults who are learning to read, as well as those for whom English is a second language. Captions will be beneficial in public places where TV audio is difficult to hear.

Captions display the audio portion of a program as text. They are embedded into an array of programs and videos by encoding, and until now have only been accessible to those who have purchased a caption decoder.

The new feature, called CaptionVision (CC), will allow viewers to turn closed-captions on and off at will. ■

BROADCAST engineering

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BROADCAST ENGINEERING (ISSN 0007-1994) is published monthly (plus three special issues) and mailed free to qualified persons within the United States and Canada in occupations described above. Second-class postage paid at Shawnee Mission, KS, and additional mailing offices. POSTMASTER: Send address changes to Broadcast Engineering, P.O. Box 12960, Overland Park, KS 66282-2960.

SUBSCRIPTIONS: Non-qualified persons may subscribe at the following rates: United States and Canada; one year, $50.00. Qualified and non-qualified persons in all other countries; one year, $60.00 (surface mail); $115.00 (air mail). Subscription information: P.O. Box 12937, Overland Park, KS 66282-2937.

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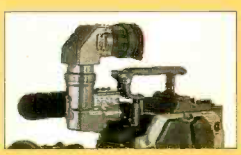

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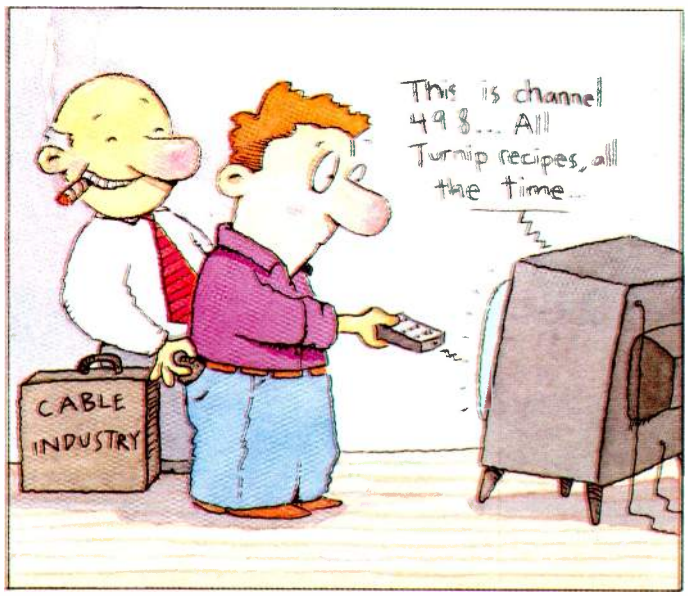
Editorial

More cable channels mean higher rates for viewers

"Television has gotten so complicated you can't use it effectively. We have to make TV friendly again."
– Richard Green, president, Cable Labs

A story in *USA Today* discussed the future of television in the next century. If I weren't so closely involved with the broadcast industry, I would have assumed that nirvana for video is just around the corner. According to some industry pundits, just about every American TV viewer is writhing in anticipation of those 500 channels of interactive video being touted by the cable industry.

The multipage newspaper article reported how wonderful these new 500-channel systems will be. Complete with interactive video games, 2-way communication and more programming options than you can shake a remote control at, your fondest desire will be available through your television. Yeah, sure.



However, once you get past the boldface type heralding the arrival (and of our supposed need) of these 500 channels, the not-so-small matter of higher customer rates is cleverly hidden.

These higher rates are disguised in new services called video TV guides. These computer-like interfaces are supposed to help the viewer find a desired program. Many of the services being proposed come with an initial hardware cost and an additional on-going monthly cost. One system requires a $199 remote-control box and then an additional fee of $15 per month. So much for so-called free television!

In light of the recent Congressional action on cable reregulation, The cable industry should have learned that the American TV viewer is fed up with high fees and poor service. Apparently not, however, because that industry is creating yet another reason to force viewers to pay higher rates.

The American broadcasting system is based on a free service. You don't have to pay a monthly subscription service to get radio and TV signals off the air. You don't have to pay a tax on radio or TV receivers (at least not yet). The service is free to anyone who has access to a receiver. However, the rules change if you choose cable.

Broadcasters know that there are choices out there, and they are meeting that challenge. To compete, a programmer or station has to provide a service the viewer wants at a price he or she is willing to pay.

Show me some research that there is a market for 500 channels, requiring the purchase of $200 remote-control boxes and an additional $15 per month in service fees. Only then will I replace my simple remote control that does all any viewer needs: turn the television on and off, change the channel and adjust the volume and maybe even mute the audio. That, my friends, does not require expensive hardware and software. No, it requires as few as five and no more than 16 buttons.

Technology can and should be used where appropriate. The VCR Plus is a good example of using technology to make the TV recording process easier.

Television isn't complicated. Unfortunately, the cable industry seems to want the American public to think so. After all, they need to justify these new costly services. Charging for yet another unasked for feature isn't making television friendlier, it's making it more expensive.

Brad Dick

Brad Dick, editor

Acknowledgement: Quote taken from *USA Today*, June 30, 1993. Copyright, Gannett Company.

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FCC Update

FCC expands use of VBI

By Harry C. Martin

In May, the FCC issued new rules, effective June 30. They permit the transmission of enhanced closed-captioning and other broadcast-related information on line 21, field 2 of the vertical blanking interval (VBI). The rules also provide for optional transmission of a ghost-canceling reference (GCR) signal on line 19 of the VBI.

New rules defined

• *Line 21.* All of line 21, field 2 is available for captioning channels as well as for program identification, program schedules and other information including, but not limited to the hearing impaired. Captioned information will continue to have priority.

• *Line 19.* The rules reserve line 19 for the optional but exclusive use of the Philips GCR signal. The FCC decided to abandon the current vertical interval reference (VIR) signal in favor of the GCR. The commission said the presence of any other signal on line 19 might confuse ghost-canceling circuitry. Broadcasters will have until June 30, 1994, to eliminate all non-GCR signals from line 19. However, broadcasters may transmit GCR signals immediately if they wish. The use of lines 10-16 for VIR signals, at limited modulation levels will continue to be permitted as long as there is no degradation of visual or aural signals.

RF evaluation guidelines to be amended

In a Notice of Rulemaking issued in April, the FCC proposed to amend and update the guidelines it uses for evaluating the environmental effects of radio frequency (RF) radiation. If the proposal is adopted, it will affect all broadcast services as well as common carrier, land mobile and private radio land-mobile services.

The initiative stems from an action of the American National Standards Institute (ANSI) and the Institute of Electrical and Electronic Engineers (IEEE), which adopted new and more restrictive standards for RF exposure on Nov. 18, 1992. The commission's rules will be amended to incorporate these new standards later this year.

• *New guidelines.* The guidelines specify two sets of exposure recommendations, one for controlled environments, which involve workers, and another for uncontrolled environments, which involve the public. The 1982 guidelines specified only a single set of exposure limits for workers and the public. The 1992 guidelines also include restrictions on currents induced in the human body by RF fields. It also effects changes in allowable exclusions as well as the power levels permitted for low-power devices.

• *Categorical exclusions.* The FCC is deciding whether to continue or to change the existing categorical exclusions that have exempted many low-power, intermittent or normally inaccessible RF transmitters and facilities from environmental evaluation. The exclusions were based on data that indicated that certain facilities and transmitters would not cause RF exposure levels that violate the 1982 ANSI/IEEE guidelines. The FCC plans to revise the categorical exclusions to conform to the new guidelines.

• *Effective date.* The commission is proposing to make the RF standards applicable to all applications for construction permit, license renewal or other commission authorizations that are submitted after the date of the new standards.

• *Measurement procedures.* The FCC is proposing to specify new guidelines for the measurement of RF fields as well as procedures for quantitative determination of exposure. ANSI and IEEE have issued joint measurement guidelines and suggested procedures for hazard assessment purposes.

EEO Review uses 1990 census data

In April, the FCC announced that the EEO branch of its Mass Media Bureau has started using 1990 U.S. Census labor force data in evaluating the EEO performance of broadcast stations and cable TV systems. All broadcast renewal EEO programs filed after May 31, and the 1993 cable and broadcast Annual Employment Reports will be evaluated using the new statistics.

Copies of the 1990 labor force data are available from International Transcription Services Inc. at 202-857-3800.

Cable TV rate regulation timetable

In May, the FCC released a 532-page Report and Order containing rules, forms and procedures for implementing the subscriber and access rate regulation provisions of the 1992 Cable Act. The rules became effective June 21, 1993. Following are some important dates of the FCC's program:

- On April 5, 1993, cable systems were ordered to stop all rate increases for 120 days.
- On May 3, 1993, the FCC released its rules along with its *Report and Order.*
- On June 21, 1993, the rules became effective.
- Since June 21, cable franchises have been able to apply for certification to begin the basic tier rate regulation process.
- The FCC must receive a subscriber complaint in order for it to enforce the rules. ■

Renewals and annual ownership reports due

On Aug. 1, annual ownership reports (or certifications) are due for all radio and TV stations licensed to communities in North Carolina, South Carolina, Illinois, Wisconsin and California. TV stations in California and LPTVs and TV translators in Kansas and Nebraska must file their renewal applications by Aug. 2. The TV stations in the following states and territories must file their renewals by Oct. 1: Alaska, Guam, Hawaii, Oregon, Samoa and Washington. Iowa and South Dakota LPTVs and TV translators also must file their renewals by Oct. 1.

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

EVER WONDER WHAT HAPPENS TO THE OTHER LAYERS WHEN YOU HAVE TO CHANGE THE 15TH?

Real-time disk recorders were revolutionary when they were introduced. They allowed you, for the first time, to produce multilayered video without picture degradation. And since then, they've spawned a new generation of non-linear real-time editing recorders of great power.

Yet for the original task of multilayering, that first generation of disk recorders is limited to very specific applications. Most can hold only about 1 *minute* of program material, so they're constrained to short elements, such as commercials.

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Ampex takes a different approach to multilayering. We looked at how you actually *want* to work in a digital component post-production environment. And while we could have developed a disk-based solution, we chose instead to create a system that goes far *beyond* disk technology.

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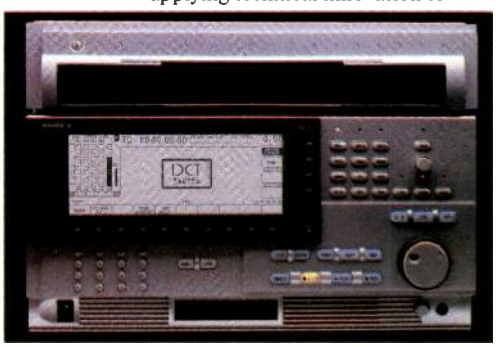
The DCT 700d gives you all the creative freedom of a transparent multilayering environment combined with the speed, flexibility, and efficiency of a sophisticated editing tape drive. So when the drive is done with that complex commercial, you can put it to work editing that long documentary. That just can't be done with any other component system currently available, due to the limitations of high cost, high maintenance, and low editability.



In fact, the DCT 700d is simply the best digital editing tape drive in the world. We say that because it is built on the technical foundation of the best *analog* editing tape recorder ever made, the Ampex VPR-3, and the best video signal system, the Ampex Zeus. VPR-3/Zeus is the fastest, gentlest, most accurate, most transparent system ever designed for the analog environment—which may explain why you'll see them in almost every premier post-production house in the world. It truly set the analog recording standard. And now the DCT 700d Tape Drive sets the *digital* recording standard.

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DCT from Ampex is actually a *system.* A system conceived and optimized for post production in the digital component environment. And the first complete digital component system available from one manufacturer. In addition to the DCT 700d drive, it includes new tape cartridges, a new production switcher, new computerized edit controllers, ADO® digital special effects, and interconnect equipment.

It is a compact, sophisticated, practical digital component system that unlocks a whole new world of creative—and competitive—possibilities.

It's not where you are, it's where you're going.

DCT is the digital component system from Ampex, the company that has been creating video solutions longer than anyone in the world. The company that has been the leader in applying technical innovation to solve practical problems.

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Strictly HDTV

The Grand Alliance

By Curtis Chan

In late May, the FCC's Advisory Committee on Advanced Television Service (ACATS) reviewed and agreed on a business and technical merged system proposal on a single digital high-definition TV system proposed by the newly formed Grand Alliance. With the elimination of NHK, the remaining members of the Grand Alliance are AT&T, the David Sarnoff Research Center, GI, MIT, North American Phillips, Thomson Consumer Electronics and Zenith Electronics. According to Advisory Committee chairman Richard E. Wiley, the Grand Alliance proposal, which is subject to Advisory Committee and FCC approval, will help to conclude a process that has fostered the development of highly advanced digital HDTV technology. The benefits of the alliance include development of a digital system incorporating the best elements of the systems as well as accelerating HDTV service implementation.

Benefits of the alliance include development of a digital system incorporating the best elements of the four systems.

The Technical Subgroup, started around November 1992 and co-chaired by Joe Flaherty and Irwin Dorros, has been asked to reconvene. The subgroup will review and resolve the technical issues of the proposal, and then return it to the committee.

The issues

The technology issues to be resolved can be broken into five areas:

1. *Scanning format.*

The final system will incorporate a scaled approach to ease the transition to HDTV. Initially, the system will provide multiple formats to support practical implementations during start-up. The system also will work toward the eventual exclusive use of a progressive scan format and the use of square pixels where dots on a screen are arranged in equally spaced rows and columns. The goal will be to facilitate interoperability of HDTV with computers, telecommunications and other media and applications.

To ensure practical modes exist for live video, the system initially will provide progressive and interlaced formats. The 787-line progressive modes at 60fps, 30fps and 24fps will be supported, as well as 1,050 line interlaced at 60fps.

The long-term standard will be built around a family of 1,050-line progressive formats, at frame rates of 60fps, 30fps and 24fps. Today's video and film needs of 30fps and 24fps progressive will be supported in the initial system. In the near term, 60fps isn't practical, but as technology evolves, this format will be supported with backward compatibility to existing HDTV receivers.

The proponents agree that all large screen HDTV receivers (34 inches diagonal and larger) will incorporate a 60fps 787.5-line or higher progressive scan display mode. Progressive display would be optional initially for smaller screen receivers. Furthermore, all transmission of film will be in a progressive scan format that will begin when HDTV service commences.

2. *Compression.*

The video compression technology used in the combined system will incorporate features from each of the digital HDTV proposals. The resulting system would share many components from the ISO MPEG-2 proposals, but would not be identical. The parties agreed to work with the industry to seek support for the combined system in the ISO forum as the MPEG-2 HDTV profile.

3. *Transmission.*

The merged system will feature source-adaptive processing to support multiple transmission formats. The four remaining transmission approaches will be evaluated further before a decision is made. The four are 4VSB and 6VSB (vestigial sideband), 32 and 32SS quadrature amplitude modulation (QAM).

4. *Audio.*

Dolby AC-3, Musicam 5.1 and MIT-AC are under consideration, and most likely will be evaluated further.

Dolby AC-3 is a composite coded 5.1 channel surround sound system that offers a variety of operation modes. Musicam is related to standards endorsed by the ISO in conjunction with MPEG, and accepts 16-bit audio samples at 48kHz. The MIT-AC (audio coder) also accepts the 16-bit/48kHz, with each channel-coded independently, unused audio capacity is used to carry additional video data.

5. *Communications protocol*

The merged system will feature a packetized, prioritized data transport format with universal headers and descriptors to support system flexibility and extensibility.

1. Scanning format
2. Compression
3. Transmission
4. Audio
5. Communication protocol

Table 1. *Technology issues still to be resolved.*

The Advisory Committee will review the technical merits of the proposal, which will include procedures for deciding on the remaining designs based on the results of specified tests.

In the coming months, the Advisory Committee will review the technical merits of the proposal, which will include procedures for deciding on the remaining designs based on the results of specified tests. The committee may then recommend the systems to the FCC as the basis for an HDTV standard. The timetable has been pushed back to the end of 1994. ■

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

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Circle (9) on Reply Card

Re: radio

More radio work in LPTV

By John Battison, P.E.

The May 1993 column addressed low-power television (LPTV) from the perspective of the radio engineer. The LPTV field can offer interesting work to radio engineers, and provide an opportunity to expand horizons and add versatility. Becoming familiar with LPTV operations also may be valuable, because many LPTV stations use existing radio towers (especially FM) for their transmit antennas.

This month, we'll explore the process of LPTV channel searches. Summarizing the pertinent rule, a 45dB difference must exist between the desired and undesired signals (D/U ratio) if offset isn't used. But if offset is used, a 28dB D/U ratio can be used. (These values are derived by using 74dBu protected and 29dBu interfering contours without offset, and a 46dBu interfering contour with offset.)

A sample channel search

Table 1 shows an example of a channel study for Channel 60 (obtained from a commercial database service). Line A of the printout shows short spacing between the proposed station (labeled "Prop") and an existing construction permit for station K60EU. This is based on the use of no offset on the proposed station, which puts its 29dBu interfering contour at 153.9km distance from its transmitter. This distance, plus K60EU's 74dBu protected contour of 12.17km, means that the two stations' transmitters must be 166.07km apart (as noted in the upper lefthand corner of the printout). In fact, the two stations' transmitters are only separated by 119.7km (also noted in the upper left), and are short-spaced by 46.37km without offset, so the potential new station is blocked.

Line B shows the situation if offset is used. Now the applicant's 46dBu interfering contour can be used, which extends only to 67.48km from the proposed station's transmitter. K60EU's protected contour remains at 12.17km, meaning that with offset, the stations need only be separated by 79.65km. The actual 119.7km spacing between sites provides 40km of clearance, allowing the new application to be filed with offset. K60EU uses offset of zero, as indicated by the lower case "o" on the top line of the printout. This means that the new applicant can select either minus or plus offset.

K60EU	CP		60	o	9.80		72	37-10-50		119.7	42.7	166.0
Springfield, MO				<Zero offset>			461	93-15-58		223.3	-46.4	SHORT
CP granted 07/23/92												
A	Prop	F (50,10)	29dBu	153.9km;	K60EU	F (50,50)	74dBu			12.17km	-46.4	166.0
B	Prop	F (50,10)	46dBu	67.48km;	K60EU	F (50,50)	74dBu			12.17km	40.0	79.7
New-T	App		60		6.39		45	36-42-10		285.2	134.9	162.6
Nowata, OK				<No offset>			262	95-38-24		104.4	-27.7	SHORT
Tendered per FCC release No. 15203 dated 2/28/92												
C	Prop	F (50,10)	29dBu	153.9km;	New-T	F (50,50)	74dBu			8.724km	-27.7	162.6
D	Prop	F (50,10)	46dBu	67.48km;	New-T	F (50,50	74dBu			8.724km	58.7	76.2

Table 1. *Excerpts from an LPTV channel study. Note that F (50,10) curves are used for interfering contours, and F (50,50) curves for protected contours.*

The bottom half of the table shows another co-channel application at Nowata, OK, (New-T) that has to be considered because it's a pre-existing application and must be protected by the prospective new applicant. In this case, New-T uses no offset, which complicates the situation.

The LPTV field can offer interesting work to radio engineers.

Line C again shows that the proposed station's 29dBu contour extends to 153.9km, and that NEW-T's 74dBu protected contour is 8.724km. Adding these two determines that a spacing of 162.6km is required, 27.7km more than the actual 134.9km distance between transmitter sites. The label SHORT appears on the printout as it did in the first case. However, offset cannot be used to solve the problem because of New-T's no-offset status. If New-T had used offset, the printout shows that the proposed station could be accommodated (see Line D), because the 46dBu interfering contour (at 67.48km) would provide 58.7km clearance beyond the required 162.6km spacing. Without offset, however, the new applicant can consider channel 60 only with a directional antenna (DA).

The FCC hasn't established the rigorous requirements for LPTV DAs that it has for FM DA use. Checking the patterns offered by various antenna companies reveals an array of options. There is likely to be a pattern to fit this (or almost any) situation.

The maximum transmitter power for LPTV stations (an increase is currently under consideration) is only 1kW for UHF and 10W for VHF. Although high antenna/pattern gains can be obtained, with such power limitations, there is no substitute for proximity to the target area. LPTV operators in rural areas are better off because their viewers are accustomed to using exterior-mounted receive antennas (often on tall masts), with high-gain performance and perhaps RF pre-amplifiers. This can allow good LPTV reception out to 50 miles or more from the transmitter. Urban areas can work as well. For example, an LPTV station in the New York City area has an ERP of more than 150kW in an extremely narrow beam that serves a highly concentrated ethnic area.

A radio engineer's move into LPTV can be fairly easy, particularly when working to establish new stations. LPTV protection requirements aren't too tough, and the application form is easy to complete. The LPTV section of the FCC works hard to help its applicants through the process. ■

Battison, *BE's* consultant on antennas and radiation, owns John H. Battison and Associates, a consulting engineering company in Loudonville, near Columbus, OH.

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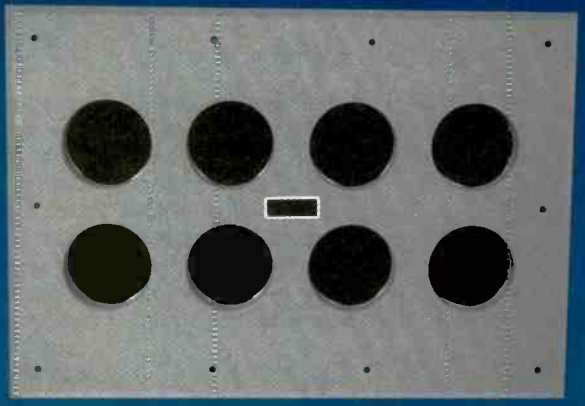

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Part 2

Management for Engineers

The thinking worker

Breaking through the myths of supervision and power

By Judith E.A. Perkinson

We all know overprotective parents. The mother is so afraid that something bad will happen to her child that she smothers the child with love. The father is so bent on making sure that his child does not make the same mistakes he did that he tries to run the child's life. When these children grow up, they may not be able to adjust to the responsibilities of adulthood.

The autocratic manager

The autocratic manager is comparable to the overprotective parent. This management style is guaranteed to create a workforce that doesn't think. Like an overprotective parent, the autocratic manager makes all of the decisions and tries to control every situation. Then, he wonders why his staff isn't creative or responsible.

Many of us expect managers to be autocratic. It's even worse in a technical field, such as broadcast engineering, where engineers are promoted because of their technical expertise, not because of management experience. Bosses are expected to be expert managers who know more than their subordinates.

The change to a participative management style may not be natural or comfortable. It's fraught with doubts and fears that are bred out of myths about what it means to be a manager.

Before workers can become thinking workers, it's necessary for managers to give their subordinates permission to think. As a supervisor, you are responsible for creating this participative work environment. However, it's essential to know and understand the myths and misconceptions of managing. You need to determine what type of manager you want to be, and take steps to free yourself from the autocratic style of leadership. Only then will you be able to build a work environment that will foster, develop, use and appreciate thinking workers.

Myths and misconceptions

From childhood on, we learned about power and authority from parents, teachers and work supervisors. During this process, issues of control, authority, success, power and strength became equated with each other. Many of these misconceptions stem from insecurity. Others are generated from cliches, such as, "If you want a job done right, you have to do it yourself." Let's examine some more common myths.

• *"I'm the boss, I'm supposed to have the answers."*

Bad decisions are made because managers pretend to know something in order to save face. This myth is a direct result of the concept of the manager as an expert.

Smart and effective managers will use the resources of their staff to find the information to make an informed decision. It's better to say, "I don't know, but let me see if I can find out."

Enlist help from your employees by asking them what they think, and trust their judgment.

Before workers can become thinking workers, it's necessary for managers to give their subordinates permission to think.

• *"If I don't appear knowledgeable, people won't respect me."*

Think about the people you respect. Do they know everything? Of course not. We respect honesty and hard work. We want people to tell us what we need to hear, not what we may want to hear. We don't trust people who act like they know everything. We don't want people to lie in order to cover up something they didn't do or know how to do. Honesty gains more respect than bravado or a false front.

• *"If I don't act tough, people will think I'm ineffective or a pushover."*

This attitude has no place in the workforce or in a management situation. Managers should not be bullies. Managing people takes leadership. As a manager, the value of tapping into the knowledge and experience of your workers can help you be more effective and productive. Taking advantage of the knowledge of others is not a sign of weakness, it's common sense.

• *"I don't have to explain my decisions to my subordinates. They work for me, I don't have to answer to them."*

One reason why people work to get ahead is to gain power and control. Being a boss gives a person status and a position of honor. So, a supervisor doesn't answer to the subordinate; the parent doesn't answer to the child. These are long-standing principles.

Today, the modern manager is told to discuss decision-making with subordinates and to include them in the decision process and empower them. It's easy to see why people wonder if there is any value in being the supervisor if they don't have the authority.

You're not relinquishing your responsibility or your authority, nor are you taking orders from your staff. What you're doing is using valuable resources — your employees. No one knows more about a job than the person hired to do it, so take advantage of your employees' training and knowledge. If you want good suggestions from your subordinates, give them enough information to formulate a rational suggestion.

Ultimately, the decision still rests in the supervisor's hands. But when employees are included in the decision-making, they are more willing to make the changes because they have an investment in making that decision turn out to be a good one. That makes your job as a supervisor much easier. You can stop policing behavior and enjoy a responsible, thinking staff.

Becoming a participative manager

It's not easy to change from being an autocratic manager to a participative manager. It challenges much of what we think we should be as a boss. But if you make the change, you'll find that it's easier to lead people than to dictate to them. Participative management works because it brings out the best in your workforce. Best of all, it's less work and stress for you as a manager.

■

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

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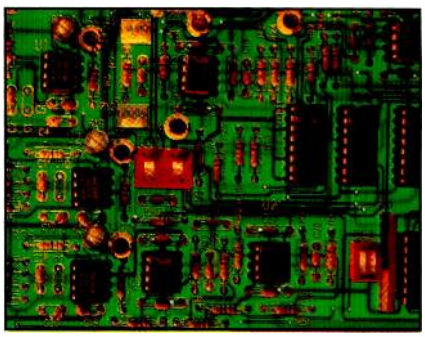
Part 1

Circuits

Serial communications

RS-232



By Rodney W. DeMay

Serial communication standards, including RS-232, have been around for some time. Despite this, many questions still exist about how to connect serial ports. RS-232, RS-422 and RS-485 are serial communications standards used throughout the broadcast industry. Over the next three months, these communication standards will be explored.

The RS-232 Standard is a set of guidelines specifying how two pieces of computer equipment are cabled together to communicate with each other. The latest version is RS-232-E.

Basics

Each signal in an RS-232 system appears on the interface connector as a voltage referenced to one ground. *Signal ground* (SG) is the common ground for all signals and must be connected. *Frame ground* (FG) is the connection to the chassis. The voltage of the signal varies between two distinct states — a negative and a positive value. The magnitude of the signal will vary from 3V to 25V. When the signal goes below -3V, it represents a binary 1, MARK or an OFF condition. When the signal is above +3V, it represents a binary 0, SPACE or an ON condition. The signal is undefined between -3V and 3V. Typical drivers produce voltages of +/-5V to +/-15V.

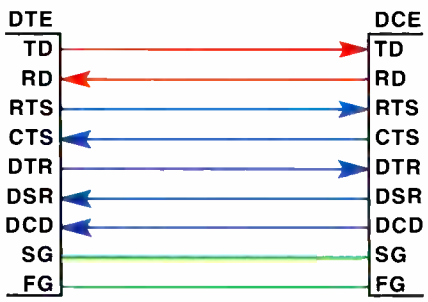


Figure 1. *Typical connection between DTE and DCE equipment. Arrows indicate standard input and output connections.*

RS-232 ports have two data lines, transmit data (TD) and receive data (RD). Some devices will operate properly using only TD and RD (and SG). Other devices require handshake lines. The most common handshake lines are request to send (RTS), clear to send (CTS), data terminal ready (DTR), data set ready (DSR) and data carrier detect (DCD). The handshake lines indicate when a device is present, and whether the device is ready. Typically, they are controlled by software.

DeMay is an R&D engineer for B & B Electronics, Ottawa IL.

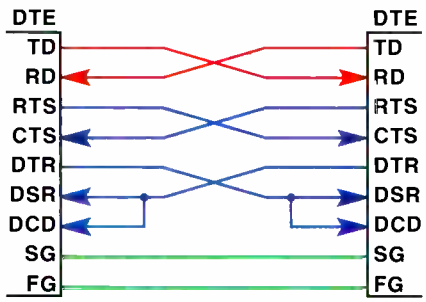


Figure 2. *Connections used when connecting two similar devices. Note that TD and RD are cross-connected, as are the handshake lines. Depending on the devices, not all of the connections are always used.*

DCE vs. DTE

A confusing aspect of RS-232 is the naming of ports as data communications equipment (DCE) or data terminal equipment (DTE). Computers and printers are DTE devices, and modems are DCE devices. All RS-232 ports are set up as DTE or DCE. Some are user-definable. The standard defines which signal lines are inputs and which are outputs for both DTE and DCE devices. The outputs on a DTE port correspond to the inputs on a DCE port and vice versa. Therefore, a DTE port and a DCE port can be connected directly. (See Figure 1.)

When connecting a DTE device to a DCE device, the function of the handshake lines are reasonably simple. DTR on the DTE device and DSR on the DCE device indicate that the device is present . The DCD line signals a carrier is present. The RTS and CTS lines control data flow.

When connecting two similar devices, such as a DTE to a DTE, there are two basic rules: connect outputs to their corresponding inputs and make sure the handshake lines are satisfied. Figure 2 shows the connection between two DTE devices. Note that TD is connected to RD of the other device. Remember that a DTE device transmits data on the TD line and receives data on the RD line, so you connect the output (TD) to its corresponding input (RD). The same idea applies to the handshake lines. This type of connection normally is referred to as a null modem.

Handshaking

Once the devices have been connected, the handshaking must match. Most programs allow you to choose handshaking types. Sometimes loopback connections can solve the problem. (See Figure 3.)

With RTS handshaking, device A turns on the RTS line when it's ready to transmit data. Device B will turn on the CTS line when it's ready to receive. Data can then be transmitted from device A to B. If the RTS and CTS on device A are looped-back, device B always appears ready to receive data. Before using a loopback connection, consider the consequences. If device A transmits data when device B is not ready, data will be lost.

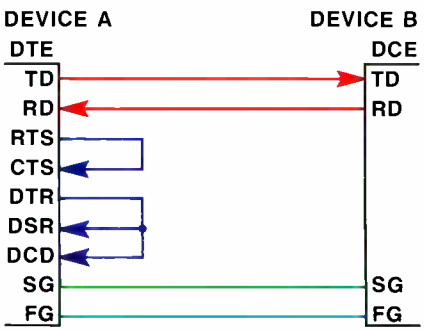


Figure 3. *Connection of devices using loopbacks. Loopbacks are used to satisfy handshaking requirements.*

Connecting RS-232 devices sometimes requires more work than just plugging them in. Knowing the difference between a DTE and a DCE device, and understanding the different types of handshaking, can help solve many of the problems associated with RS-232 devices.

➡ *For more information, circle (300) on Reply Card.* ■

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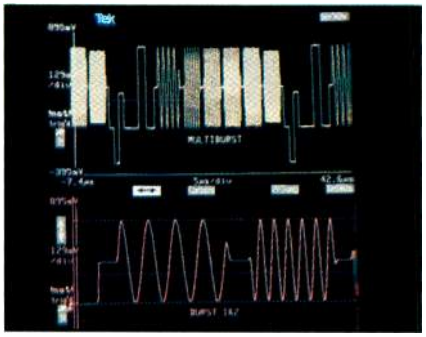
Part 5

Troubleshooting



Care and feeding of coaxial transmission lines

Document your system

By Dean W. Sargent

Parts 1-4 have dealt with the different ways coax is built and how they fit together, power-handling, attenuation and new installations.

But what about existing systems? The first step to operating a reliable transmission system is to carefully document it. You should have drawings with all the details about line locations, sizes, connections and special fittings. Examine your current system. Are the flanges the same or different? Are all of the components the same impedance or is there a mixture of different impedances and manufacturers?

This last point needs careful attention. Nowhere are you more likely to make a mistake than with an old system that used different impedance lines and connectors.

Common impedances

At one time, 51.5Ω was a common impedance used extensively by RCA. Because the inner conductor was slightly smaller in diameter than a 50Ω interconductor, an adapter, often called a "whiskey cup," was used to interconnect different impedance (and therefore different-sized) lines. (See photo.) When used with a 50Ω interconductor and a 51.5Ω bullet it was possible to mix different impedances. Most of this transmission line used a Radio Electronic Television Manufacturers Association (RETMA) flange. It did not use an insulator at the flange and was not grooved for one. Air pressure was maintained by an O ring mounted in a groove.

RCA made a variety of components with various ways of connecting the different impedances. The company did manufacture a 50Ω elbow. However, the inner conductor had a thick wall inner, which required a 51.5Ω bullet.

When using any of these bullets, there is no need to cut back the inner conductor, except for a small amount to allow for expansion because there is no shoulder or insulator at the flange.

The 51.5Ω history

For a short time, a 3⅛-inch 51.5Ω line was made. It relied on Teflon insulators. During the manufacturing process, the insulator was rolled into the inner conductor, much like a steatite insulator.

However, problems developed because the insulators began moving within the transmission line. This line used the RETMA flange and the same bullet as the steatite insulator line. This series of line was soon discontinued.

Ever wonder why early lines used a 51.5Ω impedance? Originally, rigid coax was made with copper tubing. The impedance just happened to work out to 51.5Ω. Later, companies developed specific manufacturing methods and standardized on 50Ω and later, 75Ω lines.

The bullets at the left and center are for 51.5Ω interconductors. At right is a "whiskey cup," which can be inserted inside a 50Ω interconductor to allow the use of 51.5Ω bullets. The bullet shown in front allows the connection of a 50Ω interconductor to a 51.5Ω interconductor.

Unflanged line

Several manufacturers make unflanged line that uses the same inner connector as their flanged line. This requires that the inner conductor be cut back shorter than the outer when making connections. This is because of the shoulder on the connector, which requires a small amount of space. The insulator has the same outside diameter as the outer conductor of the coax. This prevents electrical contact from one piece to another. The electrical connection from one outer conductor to the next is provided by the sleeve that mounts across the insulator. This sleeve also provides the mechanical connection that holds the two sections together.

Helping prevent failures

Failure prevention is the golden rule of any RF engineer. The first step is documentation. The second is eliminating minor problems before they become major.

After documenting the system, eliminate anything that might contribute to a high VSWR and burn-ups. Because the 51.5Ω components are only available as special-order items and are expensive, there is little reason to maintain such a transmission line system. If you have an old antenna that uses a 51.5Ω feed system, consider replacing it. Use 50Ω line and a transformer at the antenna to perform the impedance conversion. This is better than using an adapter bullet and taking the mismatch. If you are planning on reharnessing your antenna, this would be the time to update everything 50Ω.

Inspecting the system

The documentation process should involve a thorough inspection. One approach is to open the line at several points and check the condition of the inner conductor and the bullet. If you have a watchband spring expansion connector, remove the bullet and check the spring. Check the bottom of the vertical run and one or two places in the horizontal run. A horizontal run gets the most abuse because it has the most power, and heat transfer is worse than in the vertical run.

When documenting the system, you may find your system comprised of one manufacturer's outer conductors and another's interconductors. Some systems have inner conductors that have the bullet as a permanent part of the inner conductor and use a watchband spring. (See "Troubleshooting," March 1993.)

Even though your system has been operating trouble-free for years, it may be a good time to do an inspection. When it comes to transmission lines, a little prevention is worth the time — and money.

➡ *For more information on transmission lines, circle (312) on Reply Card.* ■

Sargent is president of D.W. Sargent Broadcast Service Inc., Cherry Hill, NJ.

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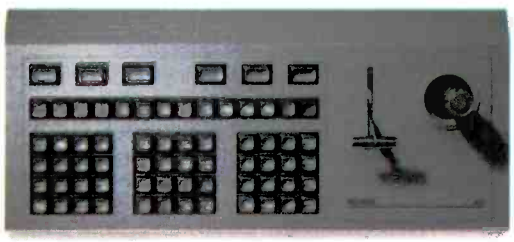

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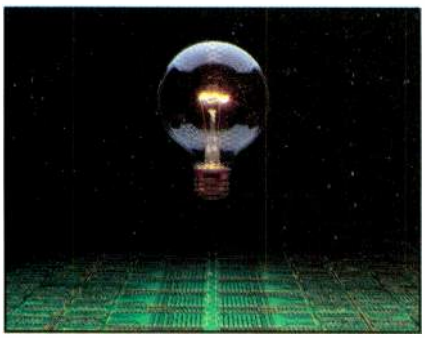
Broadcast weather graphics



By Curtis Chan

Broadcast weather graphics systems haven't changed much within the last half decade. With news and sports departments using sophisticated effects and animation, newer graphics systems coming on the market have taken the approach of basing systems from a presentation display graphics point-of-view. One newcomer is the TDS1000 with MagicTRAK based on the Amiga.

The newer platforms integrate existing video technology into a seamless operating graphics display system capable of enhancing information delivery. Most systems have four components, which include a paint system, still-store, character generator and switcher.

Existing limitations

One weakness of traditional systems is an inability to significantly modify maps downloaded from the various national or private weather service bureaus. Although the maps are quite good, they may have insufficient detail for the coverage area. The capability to directly modify maps is important. Second, in most cases, maps along with their symbols (clouds, rain, thunderstorms and sun) are displayed simultaneously rather than having the capability for each symbol or group of symbols to be individually timed to the announcer. Third, the graphic quality is a far cry from what is available from today's video post arena.

Solutions

The first improvement is in video quality. Weather graphics systems support four main graphic attributes: objects (text and symbols), text, symbols and backgrounds. How they are displayed and at what quality level are what differentiates current systems. With the TDS1000 system, object handling is real time with 24-bit precision and true software keying. This makes possible real time soft shadow, transparency and anti-aliasing, with multiple level stacking for each map layer. Another innovation is the ability to edit/move/delete any object on any background at any time. Instead of having to rebuild a map from start to finish, a new symbol or groups of symbols can be easily cut/pasted or dragged and dropped without disturbing the rest of the picture.

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

Text and symbol graphics

In recent years, Adobe Postscript and True Type fonts have become popular. Newer systems incorporate and support scalable, bitmapped fonts and oversampling with 24-bit precision and an 8-bit alpha key. For image modification, systems offer real time XY scaling, color control, eight blur levels, 8-bit transparency levels and 16 levels of outline. Symbol generation also is 24-bit precision with 8-bit key channel. Another feature is 24-bit 2-D and 3-D animations. Frame-by-frame control, using point and click, is possible with access to shadow and image libraries.

Background graphics

Today's systems can mimic post graphic systems in video quality, fast loading and video effects. The TDS1000 is able to load 10 768x482, 24-bit per pixel maps in less than three seconds using a proprietary chunky compression system. External backgrounds can be imported for live video underlays or graphics can be imported for overlays. Each background map or group of symbols is treated as a separate layer (much like a compositing switcher), existing layers can be modified or new layers can be added easily.

Today's systems can mimic post graphic systems in video quality, fast loading and video effects.

Thermal graphics

Another area that enhances the look of weather graphics is the drawing of thermals and thermal temperature bands. The system uses stencil maps to define the specific map areas. Thermal temperature bands can then be painted with various opacity and colors to outline specific areas. The system can support 255 levels of rub-out and transparency. Thermal moves can be drawn and overlaid onto maps.

Tracking wand

One of the most innovative features of the system is MagicTRAK. With this system, the weathercaster can remotely control the sequence editor to output individual or combined maps, animated symbols and overlays. Unlike other weather systems, real time thermals can be composited over existing maps.

The MagicTRAK hardware consists of an RF transmitter, receiver and an interface. The transmitter includes a hand-held wand with two function switches and changeable colored ball wand tips (red, green, blue). The switches control symbols and graphics in the computer, and the chosen colored ball is used as a position detector in front of the screen. Tip color selection depends on the screen color and wardrobe. The receiver is usually located next to the screen to detect wand switch closures and relay them to the main unit. The main unit receives the RGB signals from the foreground camera that is pointed at the talent and can track the colored wand tip. A key signal is then generated as a pulse that represents the wand's position and is input to the computer. An X,Y detection system calculates the position of the wand, and along with switch closure information, the computer and software react accordingly.

Look to the future

As weather graphics systems evolve, they will be able to handle needs unique to local broadcasters. Systems will be able to perform more 3-D animation and map downloading. Still-stores will be able to capture and display more information and the user interface will become more user-friendly. They also could be interfaced throughout the newscast in news, sports or weather.

➡ *For more information, circle (301) on Reply Card. See also Weather Displays on p. 16 of the BE Buyers Guide.*

Author's note: We would like to thank Dave Janney, president of AWA-TV, MagicTRAK Division; Andrew Welch, president of AWA-TV, Arpag Dadourian of Ultimatte and Stephan Schaem for their contributions. ■

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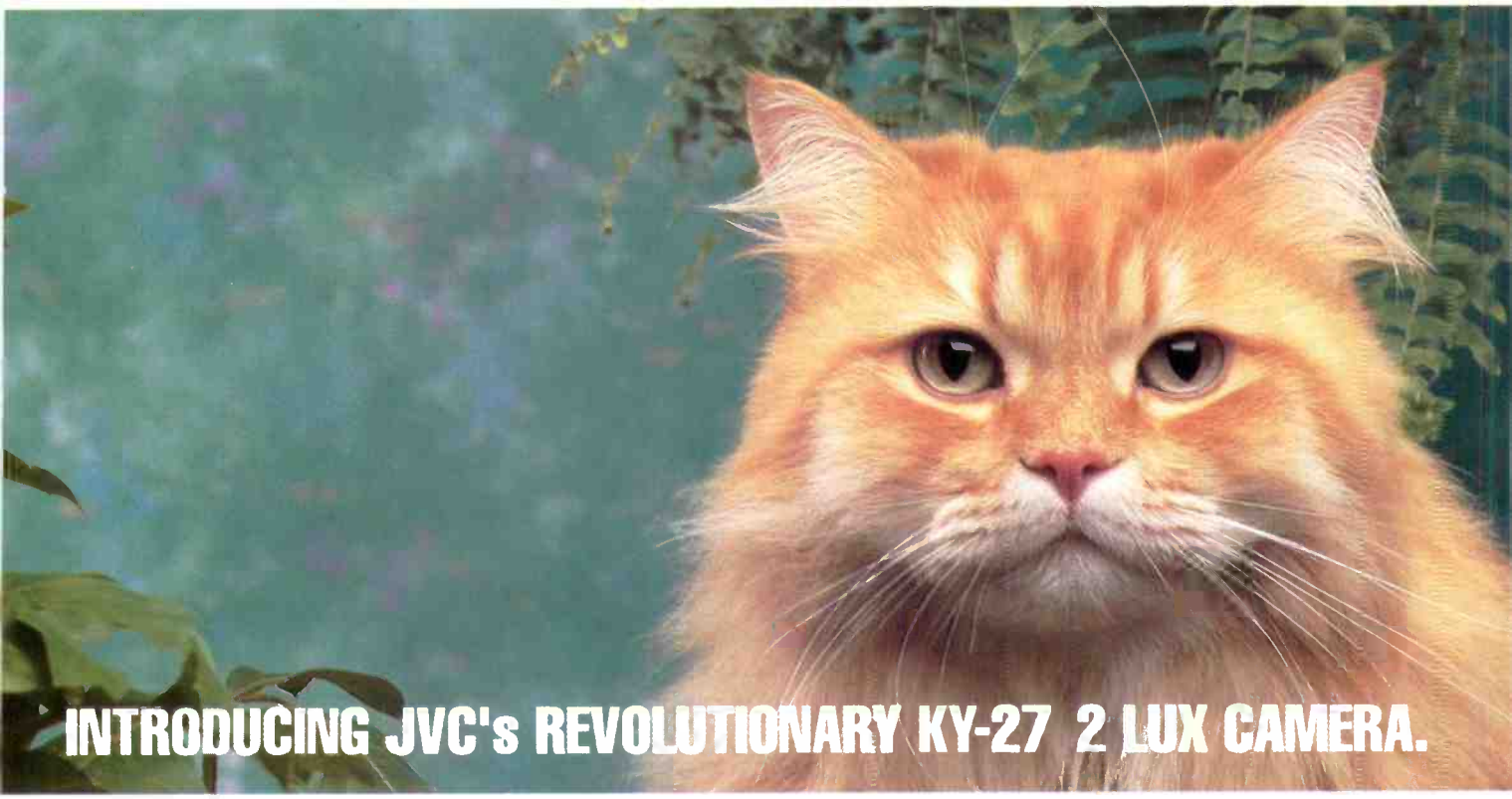

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Video technology update

Video technology never matures, it just evolves into even more complex and powerful forms.

Illustration by Jason Hungate, Kansas City, Missouri.

Image courtesy of Erik Holsinger, San Francisco.

A high-school student recently asked me for advice on her career choices. She had a background in production and broadcasting from a university, but wasn't sure where to best apply her skills. Her first thought was to be a news producer. She wanted to be able to use the latest video equipment.

While mulling how to answer the question, I recalled some of the events and products I had viewed at the June International Television Symposium in Montreux. At the exhibition, I had the opportunity to visit with a wide range of international companies that produce many of the products used to create today's TV programming. Everything you can imagine needed to produce video programming was on hand.

Three areas received much emphasis at the show: CCD cameras, satellite-delivered programming and desktop video systems. It's no coincidence that this issue provides in-depth coverage of all of these areas.

This month, BE closely examines the real quality issues behind CCD cameras. As you will learn, CCD cameras are not all alike, and image quality is highly dependent on optical as well as electrical performance. We'll also look at how DBS technology is going to provide strong competition to cable and offer viewers even more choices.

Finally, we'll examine the fast-changing area of desktop video (DTV). From PC/MAC to proprietary-based systems, a wide range of features, options and prices are available. Learn how your facility can take advantage of the latest in these DTV digital production tools. After all, if they were good enough for Jurassic Park, they'll probably be able to handle your 6:00 news.

Brad Dick

Brad Dick, editor

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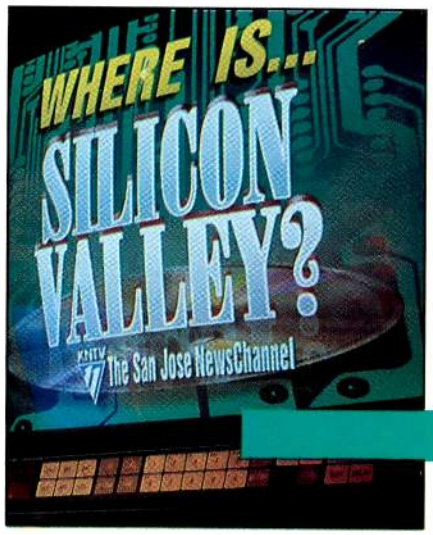

Specification sheets do not always tell the whole story.

By Jerry Cohen

The Bottom Line

Despite similar printed specifications, today's cameras do not always produce comparable results. The most expensive camera is not always the best in all situations. Buyers should test products and make side-by-side comparisons to determine the best model for a given purpose.

$

Today, CCDs are used almost exclusively for the pickup elements in professional cameras. The advantages are overwhelming. They are impervious to image burn, have near-perfect permanent registration, uniform focus from corner to corner, higher sensitivity with better signal-to-noise ratio and, perhaps best of all, solid-state with no mechanism for aging other than random component failure.

Specification sheets show little difference, regardless of whether the cameras cost $7,500 or $35,000. Cameras with resolution of 700 or 750 TV lines, signal-to-noise ratio of 62dB and sensitivity of f8, at least on the printed specification sheets, are available. As a result, many customers mistakenly assume there is not much difference and it doesn't matter which camera is chosen. This article will discuss CCD and camera technology to help users better understand how today's technology relates to actual picture performance.

Fundamentals

When an image is focused on a CCD, only individual points of the image are picked up. The optical image picked up by the CCD sensor is unacceptable for use because of the limited number and the significant gaps between individual elements. Various techniques are applied to make the image appear continuous. The degree of success in applying these techniques is one area that separates today's cameras.

Based on the number of pixels in a CCD, how is resolution determined? Using standard methods, including the Nyquist sampling theory and the EIA definition of TV resolution, a CCD with 728 pixels per horizontal line has a resolution of 546 TV lines. Another method, sometimes referred to as the depth of modulation, is to plot the output response as a function of TV lines. The theoretical response characteristic of a 728-pixel per horizontal line CCD chip shows a limiting resolution capability of nearly 1,100 TV lines. This is quite different from the 546 TV lines indicated previously.

Which is correct? Actually neither, because sampling causes some unfortunate picture distortions, known as aliasing, to be introduced along with the true picture information. Figure 1 (curve A, B) shows the energy from the alias or false information, and the true picture information. The high-frequency or fine-detailed picture information causes the low-frequency or coarse-looking alias information. The point where the alias energy exceeds the true picture information energy is exactly at 546 TV lines. This is the essence of the Nyquist theory. Although resolution is generated out to nearly 1,100 TV lines, the information above 546 TV lines cannot be seen because the alias information covers it up.

Techniques to increase resolution

Two techniques attempt to eliminate the alias information and retain the picture information. One is to apply an optical low-

Cohen is the manager of cameras and teleproduction products, JVC professional products, Elmwood Park, NJ.

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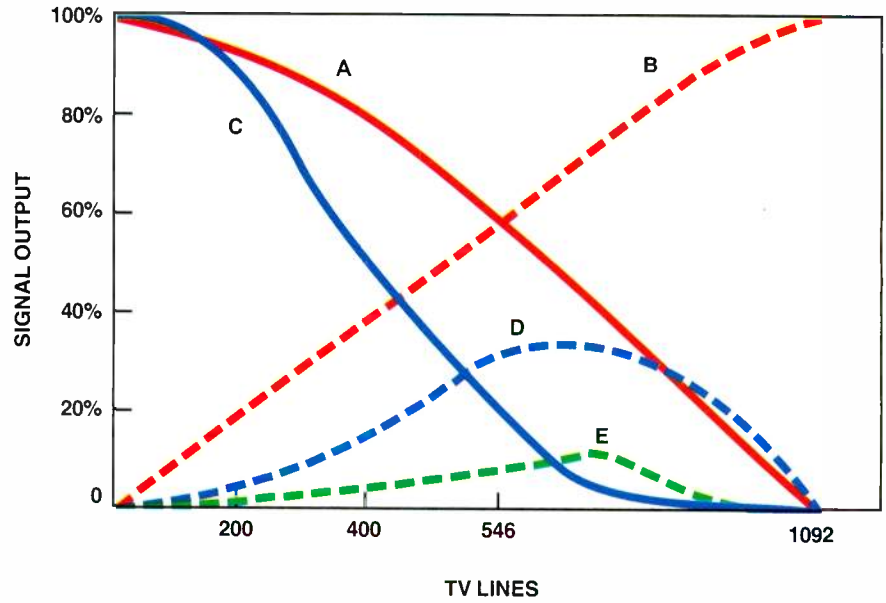

Figure 1. *Signal and alias information vs. resolution for a 728-pixel per line CCD chip. Curve A shows picture information based on theoretical limits, with (B) depicting resultant alias information. Curve (C) shows picture information achieved by using alias reduction techniques. Curve (D) shows reduced aliasing using an optical low-pass filter. Curve (E) shows additional alias reduction by combining an optical low-pass filter with spatial offset.*

pass filter, the other is *spatial offset.*

• ***The optical low-pass filter.***

Fine detail information causes the aliasing to be generated optically right at the surface of the CCD. It can be removed by inserting a filter in front of the prism. The filter reduces fine detail information before it is focused on the CCD surface. One compromise in optical filter design is how much resolution to filter vs. aliasing to suppress. Figure 1 (curve C, D) shows a compromise.

Some cameras provide filters that work in the horizontal direction only, while others filter in the horizontal and vertical directions. A few high-end production cameras filter not only horizontally and vertically, but also along two 45° angles. (See photos on page 31.)

• ***Spatial offset.***

This is the second technique, which involves mounting the red and blue CCDs inline with each other, and the green CCD offset horizontally by half of a pixel. This technique causes picture information to be in-phase, but the alias information is out-of-phase. When mixed, the true picture information remains but the alias information is canceled. Despite the near-perfect appearance of spatial offset, there are two reasons why we must still depend on the optical low-pass filter for suppression of aliasing. First, to completely suppress aliasing, spatial offset requires an equal mix of green information with the sum of red and blue.

In NTSC, $Y = 0.59G + 0.30R + 0.11B$.

Although the ratio is not 50/50, it is effective.

Colored objects present a more serious problem for spatial offset. When pure red, blue or green objects are considered, there is no suppression of aliasing. Spatial offset effectiveness is constantly changing based on picture information. Fortunately, most colors in nature have some green and a little red or blue.

Colorimetry is affected if the mixing ratio changes. However, colors are derived from the low-frequency spectrum of the signals, those below approximately 1.5MHz. Recently, several cameras have applied a technique that alters the mixing ratio so that it becomes 50% green and 50% the sum of the red and blue, but only for the high-frequency portions (above 1.5MHz). Colorimetry is not affected, but resolution is increased because aliasing has been better suppressed without having to increase the amount of filtering from the optical low-pass filter.

Gamma correction

Most engineers simply understand gamma as the place where the crossover point is set on a gray scale chart. This is unfortunate because of the tremendous effect it has on the quality of picture reproduction. Cameras incorporate gamma correction circuitry to compensate for the non-linear characteristics of CRTs.

The camera starts out at a particular gain (determined by its sensitivity) at the brightest point, and gain continually increases as it approaches black. The camera designer must select the maximum amount of gain that will exist at black and then spread the curve throughout the rest of the range. Because the gain of the camera is greatest in the dark portions, the camera also pro-

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duces more noise there. That is why engineers usually look in the dark areas for noise problems when evaluating cameras. By providing a good gamma characteristic, i.e., extremely large gain in the dark areas, the camera designer must contend with maintaining good temperature stability amongst the R,G,B channels, good random noise characteristic, minimize fixed pattern and clock noise inherent in CCDs, maintain accurate flare correction, and minimize shading problems. The gamma curve accentuates these problems, the extra gain amplifies small differences between the channels.

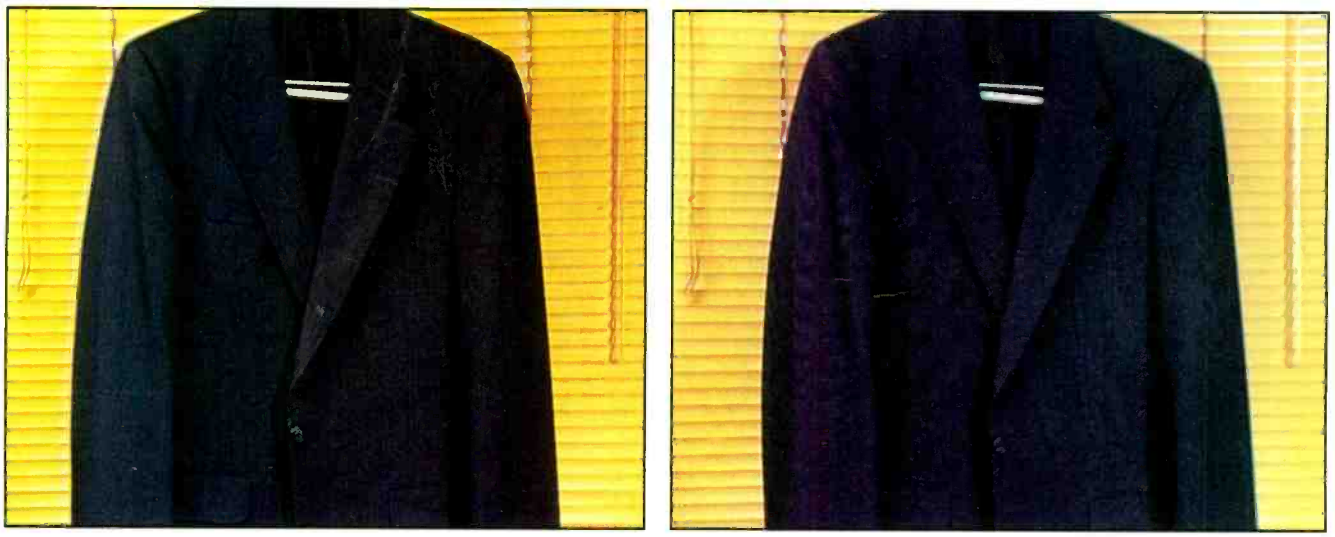
Black compression

Some camera engineers alleviate some of these problems by incorporating a technique called *black compression*. With black compression, a proper gamma curve is followed from the white area down into the grays, and at some point in the dark area they stop increasing and actually decrease gain. (See Figure 2.) Incorporating such a curve makes the design of the camera far easier, because there is less concern about shielding for clock noise, temperature stability, shading errors, flare compensation, and even the overall noise characteristic does not have to be as good. This saves the manufacturer a great deal of money, so watch for it when selecting a camera.

Cameras incorporate gamma correction circuitry to compensate for the non-linear characteristics of CRTs.

Suppose a typical scene with good overall contrast is being shot. A camera without black compression will have a natural look from light to dark, with good detail visible everywhere. The camera with black compression will look fine in the brighter portions but in the darker portions, such as in shadow areas, the shadows will be accentuated and lose the ability to reproduce information in that area. Shooting with such cameras requires much greater care in the setup of lights, and shadow areas need to be carefully filled. This wastes time and also produces less natural results.

Another, perhaps more serious, problem with black compression is what happens to reproduction of colored objects. Skin tone under normal illumination consists of red, green and blue energies in the proportions shown in Figure 2. Gamma curves, both with and without black compression, are displayed simultaneously. In this case, the red and green signals have almost no blue change as a result of black compression.



Pictures from two different cameras using essentially the same CCD chip. Camera on left has optical filtering in horizontal, vertical and both diagonal directions. Camera on right employs optical filtering in the horizontal direction only. (Note moire pattern in jacket on right.)

Only the blue is slightly attenuated, but for the sake of simplicity, assume that skin tone reproduction under normal illumination is identical for cameras with and without black compression.

Now, suppose this same person's face is reproduced, but with less light. The red channel is only slightly attenuated from where it should be, but green is tremendously reduced in level relative to red, and blue is almost entirely gone. This causes a hue shift toward red, as shown on the vectorscope. The skin takes on a ruddy complexion. The bright portions of the face are reproduced with a different hue than the darker portions. The amount of shift is never consistent because it depends upon how much the light is reduced. Again, more time is spent setting up lights, which makes it uncomfortable for the talent and wastes time.

Another word of caution. Cameras with black compression will often appear impressively quiet when you check for noise by capping the lens. This is a meaningless test, because of the black compression there is little gain in this portion. Therefore, there's not much noise either.

Sensitivity

Micro lens technology is a recent technique that significantly improves sensitivity in CCD imagers. (Editor's note: JVC was the first to use micro lens technology in a professional 3-CCD camera.) The front surface of a CCD imager consists of a number of light sensors with significant gaps between each sensor. If you look at the surface area devoted to one pixel (see Figure 3), the photo sensor within that pixel occupies approximately one-third of the surface area. Light is focused everywhere on the surface, not just where the photo sensor exists. Approximately two-thirds of the total light falling on the CCD imager is not being picked up by the photo sensor. Other elements, such as vertical shift registers, transfer gates, control lines and channel stops, also must vie for this valuable real estate within each pixel.

A micro lens, which is a small lens mounted over each pixel, is used to redirect light into the CCD's photo sensor area and significantly increase sensitivity. It focuses some of the light that falls outside of the photo sensor area into the photo sensor and approximately doubles the sensitivity of the imager.

Sensitivity is measured as follows:

1. Illuminate an 89.9% reflectance chart with 2,000lux of light.
2. Set the camera gain at 0dB.
3. Open the lens iris until 100IRE units are achieved on the waveform monitor.
4. Read the lens iris setting, which becomes the sensitivity.

The measurement is made with a fixed amount of light (2,000lux), the variable or specification is the lens setting required to reach 100IRE units of video. The smaller the iris opening (higher numerical number), the more sensitive the camera. If sensitivity is important to you, check potential cameras side-by-side.

Minimum illumination, which is directly related to sensitivity, is measured slightly differently:

1. Aim the camera at an 89.9% reflectance chart.
2. Set camera gain to its maximum.
3. Open the lens iris to its maximum.
4. Raise or lower the illumination to achieve 100IRE units of video, but do not use a dimmer.

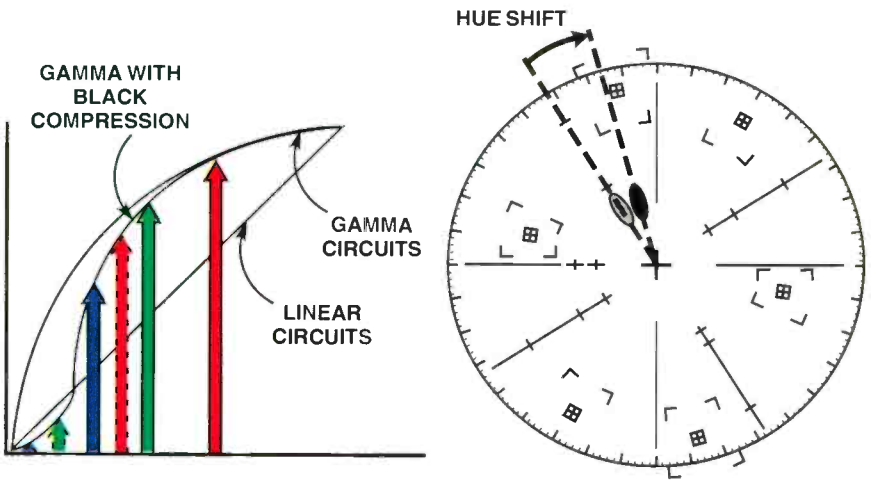
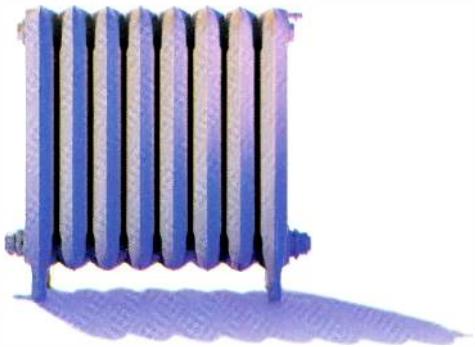


Figure 2. *Camera output vs. incoming light is shown for camera pre-amp linear and gamma circuits (with and without black compression). Relative RGB levels for skin tones indicated for normal (solid lines) and reduced light (dotted lines). Vector display indicates hue shift because of black compression.*



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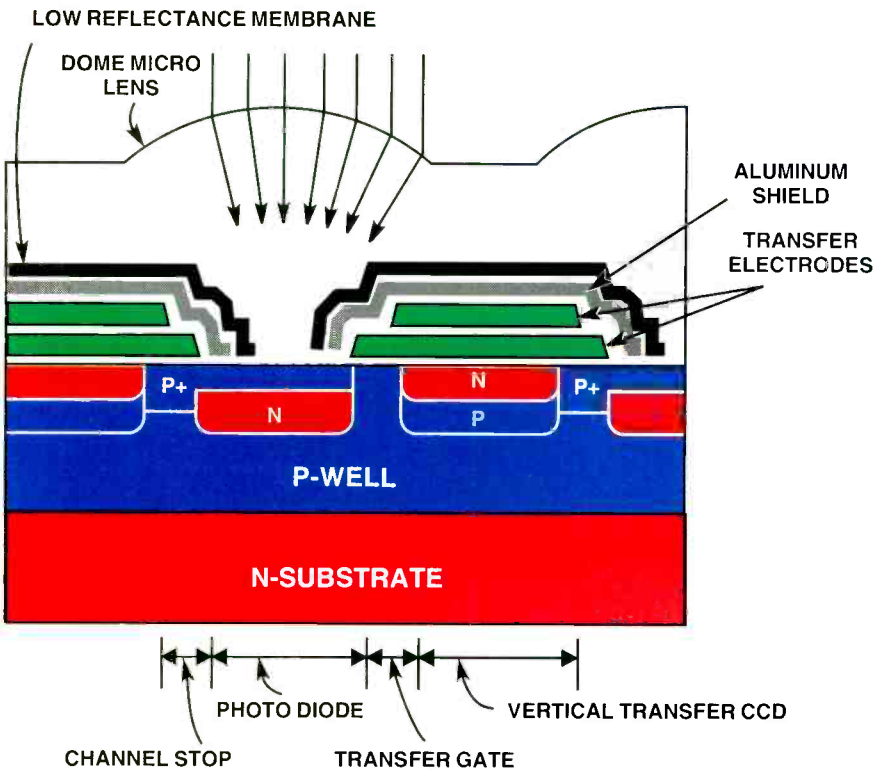


Figure 3. *Sectional view of the pixel area on a CCD chip showing relative size of components and photo sensor area. Notice how the micro lens directs additional light into the photo sensor area. Aluminum shield protects elements outside the photo sensor from stray light. Bottom rule shows space allotted to individual elements of CCD.*

5. Measure the incident light on the chart, which is the minimum illumination.

Just as the sensitivity varies from camera to camera, so does the minimum illumination. If low-light shooting is important to you, check the camera's actual performance before you buy it.

LOLUX is a new technique used to shoot in extremely low-light level conditions. It combines a high degree of electrical gain (24dB) with a proprietary system for mixing adjacent pixels together, which increases the sensitivity another 6dB without increasing noise. In fact, because the noise between adjacent pixels is random, this method reduces noise approximately 3dB. LOLUX allows shooting down to a level as low as 2lux for 100 units of video and full color reproduction.

Last word

Although it seems that camera technology has gone about as far as it can go, don't worry, engineers aren't resting on their laurels. New levels of performance and convenience features are still in the works. This can mean great things for those who live with these products day in and day out.

➡ *For more information on CCD camera technology, circle (302) on Reply Card. See also video cameras on p. 12 of the BE Buyers Guide.*

■

CCD camera testing

By Jeff Noah

CCDs can be thought of as both analog and digital. They are analog in that the energy from each pixel is continuously variable over a given range, and digital because the device comprises an array of discrete pixels in rows and columns. The output of each pixel also can be thought of as an analog sample.

With these points in mind, it can be concluded that the most appropriate type of measurement device would be analog in nature. However, several common types of CCD distortions are buried in the noise and can be uncovered only by eliminating the noise with averaging. Digital signal processing (DSP) techniques increase the number of ways in which distortions can be analyzed and displayed. What follows is a discussion of CCD-camera-specific distortions.

Defective pixels

Measuring defective CCD pixels is probably the most commonly performed measurement on CCD cameras. Defective pixels emit a charge that exceeds or falls short of an expected value based on the energy of the light source. Defective pixels on a picture monitor might appear as dark spots on a light background or as light spots on a dark background. They can be observed on a waveform monitor or general-purpose oscilloscope as well. Using either of these tools requires a painstaking, line-by-line search through the entire field to discover amplitude variations not perceptible on a picture monitor but still outside an acceptable threshold.

An automatic measurement set that applies DSP techniques to the process offers several advantages. Evaluation of all pixels in the device takes far less time and can be done more reliably. (The actual measurement process is a digital version of the line-by-line search for amplitude variations.) Averaging more than 32 frames reduces random noise by 15dB, or 80%. Eliminating random noise in the signal in turn makes possible the detection of significantly smaller amplitude variations, allowing earlier detection of pixel failure. A shading filter, another benefit of the automated approach, removes low-frequency variations caused by non-uniform lighting or lens imperfections. These variations might appear as tilt or curvature on a waveform monitor, which can further complicate manual amplitude measurements.

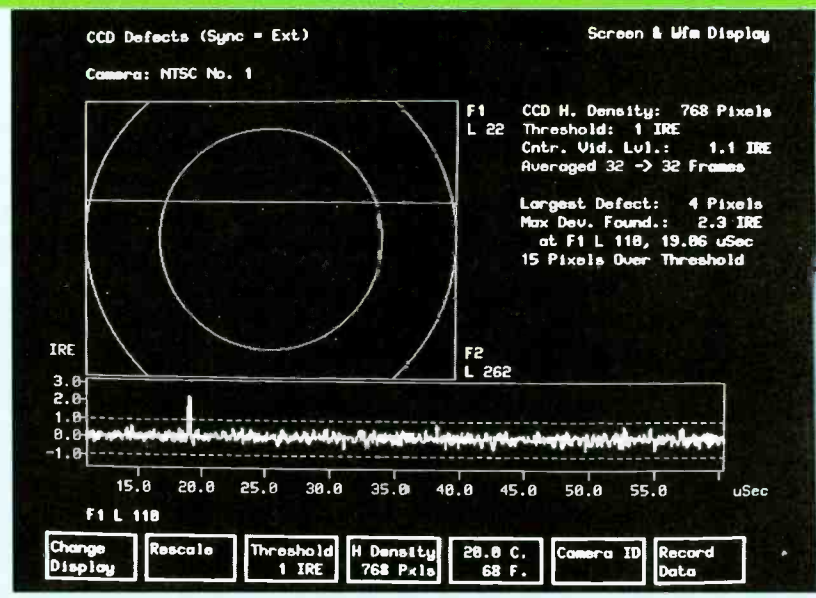
The flexibility of digital devices also expands the possibilities for displaying the processed signal. As shown in Figure 1, the instrument offers users the choice of a map of the relative position of defective pixels on the CCD and the familiar single horizontal line waveform display (tied to a horizontal cursor on the CCD map), or a bar graph showing the quantity of defective pixel clusters as a function of cluster size (how many adjacent pixels are defective).

Fixed pattern noise

When some pixels emit consistently higher levels of noise than the average pixel, they create fixed patterns on the display device. The patterns might appear as "vertical blinds" or snow superimposed on the displayed image. The pattern, whatever its appearance, does not change from frame to frame.

Because a certain amount of ran-

Noah is a technical writer for Tektronix Television Division, Beaverton, OR.



Test instrument display of defective pixels providing a map of defect locations and the waveform view with a variable threshold cursor. Horizontal line display is tied to a cursor on the CCD map.

dom noise is always present on a pixel's output, sifting out the persistent noise is possible only with averaging. Averaging over 64 frames reduces random noise by 18dB. The DSP-based instrument calculates an rms noise level from the remaining noise to quantify the distortion and simplify camera-to-camera comparisons. Displays similar to those of the defective pixel measurement, as well as a spectrum display, provide additional information about the persistent noise.

Aliasing

Aliasing is a phenomenon of the CCD image sampling process. Whenever frequencies in the picture exceed one-half of the sampling frequency, aliasing occurs. One possible visual implication of aliasing is amplitude modulation of the in-band (<6MHz) signal.

By examining only the areas outside of a camera's bandwidth on a multiburst sine wave chart, any energy found in-band must be due to aliasing in the camera. (This assumes the measurement device has an efficient anti-aliasing filter.) An analog device could detect small amplitude variations because of aliasing, but only a digital instrument employing an FFT can determine the frequency and amplitude of aliased components.

Vertical smear

Vertical smearing is a display artifact related to the construction of interline transfer CCDs. It is most often brought on by bright images against a dark background. Thus, a black card with a small, square aperture provides a realistic test image.

Interline transfer CCDs consist of photosensitive cells interlaced with transfer cells that make up vertical shift registers. The charge in the photosensitive cells shifts to the transfer cells during vertical blanking. As the image is shifted through the registers at a horizontal rate, excess charge from overloaded photosensitive cells can leak into the registers, ultimately smearing the image.

Averaging over 64 frames reduces random noise by 18dB.

To quantify this distortion, the camera's iris is opened until the white area reaches a reference level, typically 100IRE. The iris is then opened further until the amplitude of the black area above or below the aperture rises to a user-defined threshold. Next, both iris settings are entered into the measurement set, which then calculates the difference, in decibels, between the settings. Although an analog device can measure the peak and threshold amplitudes, it cannot display both simultaneously or automate the decibel measurement result calculation.

Conclusion

Although CCD camera measurements are possible with general-purpose test equipment, automated digital signal processing equipment reduces measurement times, increases accuracy and provides repeatability. Whether comparing CCD cameras or trying to keep them running at peak performance, an automated measurement set using DSP techniques can simplify and improve your efforts. ❑

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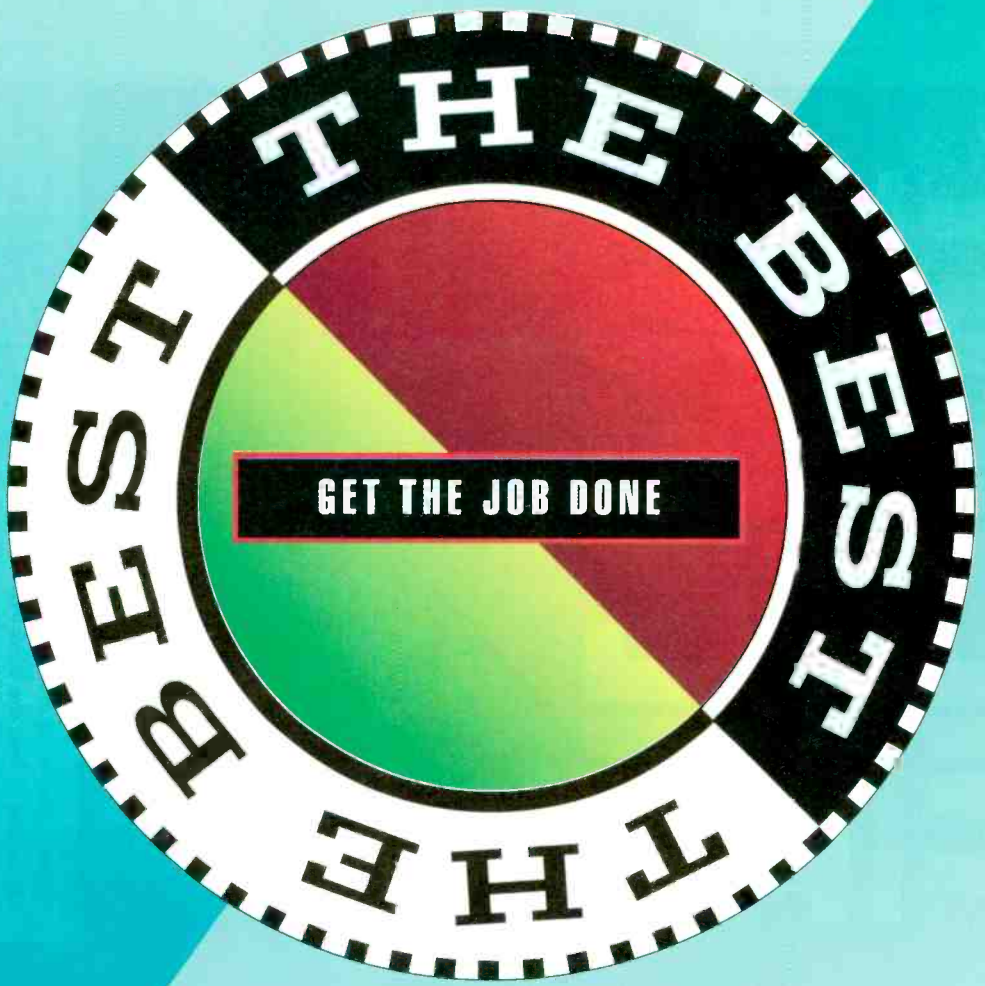

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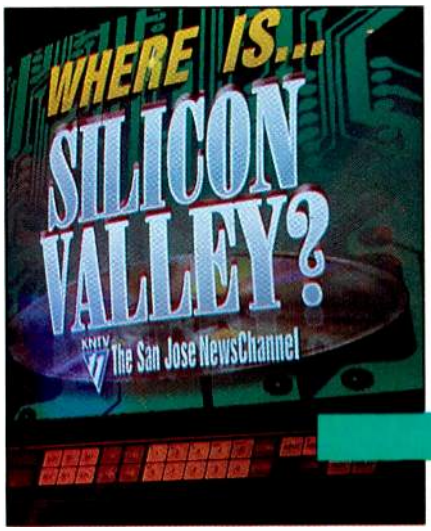
DBS: Tomorrow's opportunity



DBS television will finally become real next year.

By Skip Pizzi, technical editor

The Bottom Line

Another highway to the American home will be opened next spring when two direct broadcast satellite (DBS) TV services mark their debut. How this will alter the competitive landscape of the industry is the subject of much debate, but its impact will surely be felt, particularly by cable television. When assessing any new potential competition, however, understanding its operation is an important first step. This knowledge can help turn enmity into alliance, and perceived threat into powerful opportunity. $

After more than a decade of false starts, DBS television at last appears ready for prime time in the U.S. TV marketplace. The United States' first two "real" DBS TV services expect to be on line by March 1994, pending a successful December 1993 launch of a Hughes HS601 satellite via an Ariane rocket. A second similar satellite will be launched in mid-1994 to complete these services' offerings.

When fully operational, the two operations — Hughes Communications' *DirecTV* and Hubbard Broadcasting's *United States Satellite Broadcasting (USSB)* — will deliver more than 150 channels of TV programming to the continental United States from a pair of satellites co-located in the prime geosynchronous parking spot of 101° west longitude.

These services may rewrite the story of U.S. DBS, which until now has been littered with the corpses of previous ventures, such as *Comsat DBS*, *USCI*, *Sky Cable* and *Skypix*. The current proponents are banking on a number of new developments in their systems to help them avoid a fate similar to their predecessors. Among these differences are higher-power satellites, improved low-noise amplifier (LNA) technology in receivers, different frequencies, wider orbital spacing of satellites and, most important, digital video and data compression technology.

All of this allows the use of 18-inch dishes to receive 150 channels. The consumer cost will be $700 for hardware (dish, addressable set-top receiver/decoder and remote control), plus subscription or pay-per-view (PPV) fees comparable to that of cable TV service. Receivers will be made by Thomson Consumer Electronics and sold under its RCA brand name at consumer electronics stores and satellite equipment vendors. (Thomson has exclusive rights to the receivers during the first 18 months of service or until one million units are sold, whichever comes first.) The same receiver, properly authorized, can accept *DirecTV* and *USSB* services. Smart-card technology will be incorporated in the receiver's design for access control, and the receiver's addressability will allow personal on-screen text messages to be delivered through the system.

Smart-card technology will be incorporated in the receiver's design for access control.

With this menu of services and costs, *DirecTV* and *USSB* expect to find success where others have failed. Proponents of these systems point out that the expense in launching a DBS service is deceptively

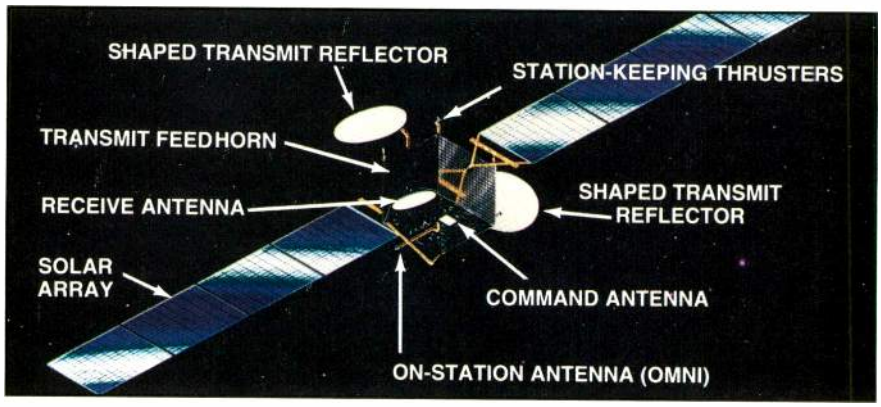


Figure 1. *The Hughes HS601 satellite will deliver the first true U.S. DBS TV services.*

high. The hundreds of millions of dollars invested up front in a DBS system average out to an access cost of only a few dollars per U.S. TV household (of which there are approximately 100 million). Contrast this to the typical figure used by cable operators of $200 to $300 per new household passed. The majority of existing U.S. homes are already wired for cable, however, and the DBS marketplace will have to be populated from scratch with $700 receivers. Nevertheless, hardware costs may drop dramatically (especially after Thomson's exclusivity expires) and the cost/quality/choices of service may equal or exceed many existing cable subscribers' current fare. Most notably, the affinity grouping that a national aggregation of niche audiences allows may make otherwise non-viable narrowcast services possible. DBS service therefore is expected to have its greatest impact on cable rather than broadcast services.

System overview

Each of the two HS601 satellites to be used by these services holds 16 Ku-band transponders, each 24MHz in bandwidth and operating at 120W. (A typical Ku-band communications satellite uses 50W transponders.) On the first satellite, *DirecTV* will operate 11 transponders while *USSB* will use the remaining five. *DirecTV* will operate all 16 transponders on the second satellite.

The hundreds of millions of dollars invested up front in a DBS system average out to an access cost of a few dollars per U.S. TV household.

Unlike earlier attempts that used a single video channel on each transponder, these systems squeeze in four to eight video channels per transponder, using data rates as low as 2.5Mbit/s. The actual number depends on the quality required — the high motion content of sports video, for example, might only tolerate 4:1 compression, while movies might handle 8:1. The system architecture al-

lows this compression to be adjusted to the needs of each channel. Using a conservative average of 5:1 compression, *DirecTV* can therefore offer at least 135 video channels on its 27 transponders, and *USSB* at least 25 channels on its five transponders. (Maximum capacities are 216 channels and 40 channels, respectively.) The system is expected to implement the MPEG-2 video compression algorithm.

DBS TV systems operate in a portion of the Ku-band set aside for such service, with earth-to-space (uplink) transmissions at 17.3-17.8GHz and space-to-earth (downlink) transmissions at 12.2-12.7GHz. The FCC has allocated eight orbital locations (slots) for DBS television, with 32 transponder channels at each location. All 32 channels at the 101°W location — the most central U.S. slot available — are held by these two licensees. Their two spacecraft will be stationed approximately 185 miles apart, straddling the 101°W orbital slot.

The 24MHz-wide channels are spaced on 29.16MHz center frequencies, but cross-polarization (left-hand and right-hand circular polarizations) allows reuse of the spectrum with a half-channel (14.58MHz) offset. Adjacent channels appear at alternating polarizations, with center frequencies 14.58MHz apart. This provides an efficient division of the 500MHz allocation into 32 transponders. The addition of digital video data compression then permits more than 150 channels of video to originate from each available orbital slot, implying an eventual capacity of more than 1,200 channels (with all eight slots active) in the U.S. DBS TV service.

The HS601 satellites feature high reliability and redundancy. Each of the 16 120W transmitters is powered by two traditional and well-tested 60W traveling wave tubes (TWTs) operating in tandem. A full set of 16 additional backup transmitters is on-board, and the receiver sections are backed up on a 1-for-every-2 basis.

Roof-mounted receive dish for the Thomson/RCA DSS system. A rooftop location is not mandatory. Any location with unobstructed line-of-sight to the satellite can be used.

The encoding and modulation scheme also is robust. After data compression of NTSC video signals, the video channels that are assigned to a given transponder are encrypted, encoded with block (Reed-Solomon) and convolutional forward error correction, and time-division multiplexed into a 20Mbit/s datastream. This is then QPSK-modulated on to the transponder's 24MHz-wide carrier. Such an approach allows for flexibility in trading off data and power parameters on the system. The transponder arrangement also is flexible, which allows for eventual ganging of the 16 standard 120W devices into eight transponders of 240W each, should smaller receive-dish sizes be required.

The satellites use a unique downlink antenna design for feeding programming to the continental United States. Unlike most communications satellites that use parabolic reflectors with multiple feedhorns to achieve the desired

coverage, the HS601s use a single feedhorn with a shaped reflector. (Each satellite actually has two such assemblies, one for each circular polarization direction.) The shaped reflectors are designed to provide good continental U.S. coverage, higher power in rain-fade prone areas (such as the Southeast) and high attenuation outside the coverage area. The designers claim equivalent coverage and superior signal performance to a 60-feedhorn parabolic system, but with lower cost and less weight. The downlink antennas each measure seven feet in diameter, while each satellite's single parabolic receive antenna is 40 inches across. A 14-inch tracking command antenna and an omni on-station antenna complete each satellite's antenna complement. (See Figure 1.)

Receiver and programming details

The receivers will be marketed first under an RCA product line called *DSS* (Digital Satellite System). Video quality is described as superior to standard broadcast, or roughly equivalent to SuperVHS. Digital audio signals, also compressed, are described as CD quality.

From the start, the system will be compatible with future 16x9 NTSC transmissions, allowing pan and scan control for viewing widescreen images selectively on 4x3 screens. An on-screen program guide feature is included, programmable by the user for display by program type. Channel up/down buttons on the remote control also can be programmed to skip or include any channel, and two separate "favorite channel" lists of 10 channels each can be stored. In addition to smart card access control, the receiver is equipped with user locks that can limit access to certain features, select spending limits and provide password protection if desired. The receiver also provides user instruction screens for hardware hookup and software setup, dish-positioning, system diagnostics and context-sensitive operational help.

A few channels will be offered free-of-charge at all times, while others will be subscription channels or packages, and some channels used for PPV programs. Home-shopping services may be included. Currently, most of the major basic and premium cable channels have signed on with either *DirecTV* or *USSB*. (Recently passed cable regulations essentially mandate that programmers offer their services to all multichannel carriers, regardless of their delivery methods.)

A few channels will be offered free-of-charge at all times, while many others will be subscription channels or packages.

Major professional and collegiate sports events that are not generally available nationally also will be offered, on either a subscription or PPV basis. The same PPV movie may be offered on multiple channels with staggered start times for a pseudo-on-demand service. Other channels or dayparts may be dedicated to educational, special interest, foreign language or other niche services.

DirecTV also will provide a 20-channel package of cable programming for the National Rural Telecommunications Cooperative (NRTC). The package will be sold to rural customers by the NRTC in similar fashion to its current sale of electricity in these areas. DBS proponents have long held that the rural marketplace would be critical to initial development of the service, so this seems a worthwhile venture.

The master uplink and program-origination facility for DirecTV, under construction in Castle Rock, CO.

Master uplink facility

Hughes is currently building a large uplink facility adjacent to its existing satellite control hub in Castle Rock, CO, (approximately 30 miles south of Denver). The new 55,000 square-foot site will serve as the uplink and program-origination point for *DirecTV's* services, while *USSB's* services will originate from an uplink facility in Oakdale, MN, just east of St. Paul. Construction of the Oakdale facility is scheduled to begin soon, while the larger Castle Rock site was begun in August 1992.

Initially, the Castle Rock facility will use two 13-meter transmit dishes to feed the satellites, with plans for two more to follow. Eight 6.1-meter receive-only dishes will be used for downlinking program feeds from other locations into the master uplink center.

Program origination at the Castle Rock site will come from a highly automated, fully component digital video system incorporating more than 300 digital VCRs. The facility will employ a staff of approximately 150, working in three shifts to provide around-the-clock operation. Three 1MW emergency generators fitted with noise-suppression systems will provide backup power.

Physical construction at Castle Rock is scheduled for completion late this summer, followed by several months of equipment installation and testing. Full operation of the Castle Rock and Oakdale facilities is expected before the March 1994 inauguration of commercial service.

The future for DBS

The exclusive attention surrounding the launch of *DirecTV* and *USSB* will probably not last long, because other DBS TV services may soon follow. Space Systems/Loral recently announced its intention to launch a higher-powered system capable of offering up to 480 channels, perhaps using smaller dishes. The system would use its higher transmit power to pack as many as 24 video channels into each transponder. Unlike Hughes and Hubbard, Loral does not hold a DBS license, but is negotiating with one of the nine other current licensees to obtain an orbital slot. Loral has a similar high-power satellite already in service for Japanese DBS TV broadcasts, called the FS-1300. It allows receive-dish diameters as small as 14 inches.

Meanwhile, development continues on a flat plate antenna for consumer DBS TV use, and plans are under way for DBS HDTV, including possible conversion of some transponders on the HS601 satellites for HDTV application.

Whatever happens, the launch of DBS service next year will mark an important technological milestone. It also may change the nature of American television. ■

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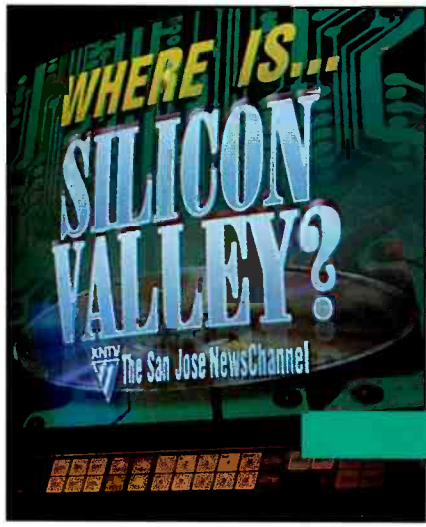


Desktop video for broadcasters

Desktop video is no longer just for amateurs.

By Curtis Chan

The Bottom Line

Desktop video production is maturing. Improvements in computer hardware and software have brought more power to the desktop than ever before. Output quality has vastly improved, but costs have not skyrocketed. Professional editing packages are available for much less than the cost of a traditional edit suite. Although desktop video is not perfect, it cannot be ignored, and should be considered when upgrading or replacing current editing facilities.

$

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

Desktop publishing was the buzz word of the 1980s. Now, a decade later, desktop video production could have the same effect on corporate communications as desktop publishing had in the 1980s. Desktop video is an emerging technology that integrates video, audio, text and graphics into a single seamless system. System quality and performance can range from low-end multimedia to broadcast quality. The term "system" ranges from a board set and software to a truly integrated system encompassing all of the hardware, software and audio/video interconnects. The following is a look at desktop video, its capabilities and its future.

The market

The market for desktop video falls somewhere between the high-end *prosumer* market, the corporate and institutional video production markets and, to some extent, the broadcast market. The prosumer market overlaps the multimedia market and has users who dabble in video without the stringent quality requirements for video and audio of professional broadcasters. On the other hand, the corporate and institutional market includes corporate audio-video (AV) professionals, independent designers and communication services professionals.

Vertical markets also exist, which include hospitals, universities, government organizations, law enforcement agencies and videographers. Typical applications include training videos, corporate communications, human resource and product information, wedding and music videos and infomercials. Broadcasters might even consider this technology for off-line production and post work.

Advantages over traditional systems

Desktop video systems have several advantages over their traditional analog cousins. Most desktop systems use some type of random-access medium (hard disk drive) to access file footage or audio information. This can save significant time over shuttling tape. The digital editing environment of desktop systems allows non-destructive, cut-and-paste, video and audio editing. This increased flexibility aids creativity by letting the editor make multiple or custom versions quickly. Seamless integration of video, audio, graphics and effects is part of these new systems. Another advantage is the use of a single recording deck, as opposed to two or more, for a comparable linear editing system. Finally, desktop computer video systems can incorporate easy-to-learn, software-based user interfaces that can be updated easily.

The common element in most of these platforms is the integration of devices into a computer. In most cases, the computer is either a PC, Mac or Amiga. In addition, some high-end systems use proprietary computer designs.

Low-end solutions

Low-end desktop solutions offer the

user the ability to get into presentation solutions ($250-$5,000) and semi-pro video production for under $10,000. Numerous companies make plug-in products for PCs and Macs that conform to Microsoft Video for Windows and QuickTime specs, as well as offerings for the Amiga. Be aware that there is a performance catch, and usually you get what you pay for. Certain basic requirements must be met by these products to produce NTSC (756 x 486 pixels) and PAL (768 x 576 pixels) compatible video to an interlaced monitor and provide some level of audio support.

The basics

Requirements for desktop video center on 1) capturing composite or S-video (NTSC, PAL) as digital data; 2) passing image data through a digital video bus to other digital video processors; 3) displaying video on a progressive scan computer monitor in a scalable window; 4) outputting video and computer graphics as analog signals properly conditioned for display on an interlaced NTSC or PAL monitor; 5) performing NTSC/PAL standards conversion; and 6) supporting a minimum of a stereo audio pair with some form of digital audio processing.

First, the seamless integration of audio, text and video will depend upon your understanding of how the various hardware and software modules interlink. Make sure that the system software's intent is to produce complete videos, not just portions of a production. The editor, switcher, character generator, audio mixer and machine control modules should be integrated into a package. This requirement should be understood in balancing performance level vs. budget.

Desktop on a shoestring

As this issue goes to press, QuickTime 1.5 should be out, and the MAC- and Amiga-based systems are on the rise. For the sake of space and the installed base of approximately 150 million PCs, we will use Video for Windows (VfW) as a starting point on how to enter desktop production economically.

- *System requirements.*

Video for Windows requires at least a 386SX/16MHz CPU, 8-bit or greater VGA, 2Mb RAM, DOS 3.3 and Windows 3.1. A large hard disk drive is recommended, because a minute of video can take up 10Mb of hard disk space. If you have an external video source, consider a time base corrector card, because VfW's Media Control Interface (MCI) can instruct the video source to step through frames at a rate driven by the speed of the compression algorithm.

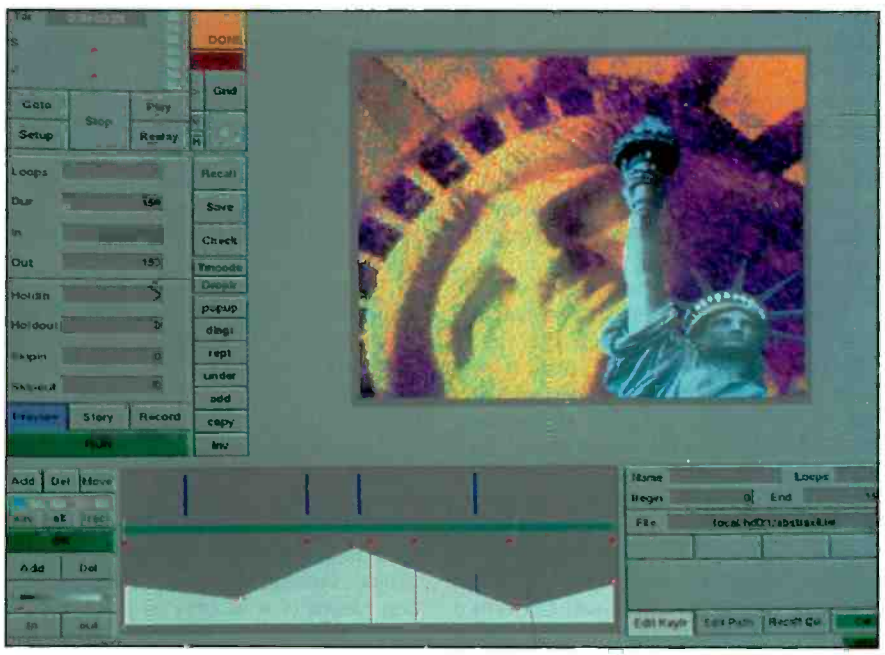
- *Video capture.*

The next major component worth considering is a video capture board. Prices vary from $500 to $1,300. Primarily, it must capture and process real time video at 30fps and full resolution (756 x 486 for NTSC). Next, the system must be able to capture and process at full color depth. An 8-bit (256 colors) board may be suitable for low-end desktop publishing, but for true NTSC-compatible color, a 24- or 32-bits/pixel (16.7 million colors plus) system is better. Some new boards allow you to capture single frames, successive frames or video on the fly. Most video capture hardware has the bonus of improving playback of media clips. Although 160 x 120 pixels ($^1/_{10}$ screen size) is the typical capture size, video capture hardware allows you to play back full-screen VGA screen, 24-bit 30fps video. Many of these devices also offer gen-lock.

Screen shot of a PC-based editing system showing machine controls, video and edit points. (Photo courtesy of Matrox.)

- *Audio.*

An MPC-compatible audio board and monitoring system is needed to capture and hear synchronized sound. The WavEdit utility in VfW is a simple cut-and-paste editor that supports Apple AIFF, Microsoft WAV and PCM waveform files in mono or stereo, 8- or 16-bit, at 11kHz-44.1kHz. In WavEdit, audio tracks cannot be overlapped and mixed. How-



Screen shot of a high-end 32-bit graphics software package. The package includes paint and 2.5D animation tools plus machine control. (Image courtesy of Aurora Systems.)

The effects mode available on a Mac-based non-linear editor. Pictures along time lines indicate shots used and relative lengths. Pull-down menus allow quick setup of parameters and options. (Photo courtesy of AVID.)

ever, it is possible by using third-party software. Earlier versions of QuickTime processed audio at 11kHz or 22kHz with 8-bit precision. Today, many multimedia boards can support 16-bit/48kHz recording. In addition, look for boards able to perform true lip sync to video instead of loose lock.

Once video and audio are captured, the resulting AVI (VfW file format) file can be edited in VidEdit, a cut-and-paste editor that displays one frame at a time in selectable magnifications from 0.5x to 4x. Key frame information plus the ability to crop, resize and compress are standard. In addition, frame rate conversion, palette generation, synchronization and defining the format for audio and video are included. To further touch up the clip, VfW offers the use of PalEdit and BitEdit. PalEdit optimizes, remaps and colorizes the palette used by the media clip. BitEdit is a basic bit-mapped graphic editor.

• *Compression and decompression.*

Time spent compressing/decompressing files must be considered. File size is determined by image size, pixel depth, frame rate, audio characteristics, frequency of fully encoded key frames, video palettes and the compression algorithm used. A 486/66 CPU, for example, could take up to 10 minutes to compress a 24-bit, 60-second video clip. Low-end systems usually do not offer instant full-screen, full-motion playback at 60 fields. In many cases, the user must perform a compilation. A 1-minute sequence could take up to 30 minutes to compile for display at 30fps.

• *Undo/redo.*

Another area that differentiates the pro models from their plug-in cousins is the ability to undo and redo operations. This is an arguable point, but a system that allows the user to undo or redo the last 40 operations has its benefits. One of these advantages is permitting creative experimentation without penalty. Imagine having one level of undo that requires manual retracing of each step if you decide to perform a variation on your project.

• *One step up.*

Approximately two years ago, NewTek's Video Toaster dazzled the industry. Now, thanks to VLSI chip technology, several companies are offering a single-solution studio. This includes a video switcher, audio mixer, TBC, DVE and CG. Features include A/B roll, frame grabber, seamless graphical interface and broadcast-quality video processing. Systems start at under $4,000 (under $10,000 with a computer).

These mid-ground solutions offer S-video, composite I/Os, unbalanced and balanced audio I/Os, RS-232/422 capability and CTL/LTC/VITC recognition. For the money, you also get full-field, 24-bit frame buffers that digitize incoming video in real time and are externally locked for output.

• *The process.*

As with professional systems, multiple time lines are used to compose the project. Adding video and audio production elements is as easy as placing them onto their respective time lines. For detailed editing, you can zoom in and out of the time lines. Most graphical interfaces help organize raw elements by iconizing data. When needed, they are popped open and inserted into the appropriate time line. Stills can be stored and retrieved in TIFF, GIF, PCX, BMP, TARGA, RLE and other file formats. In order to switch between video clips and stills, these products can perform sophisticated switcher and DVE moves. A recent innovation also gives the user the ability to fine tune factory preset effects. Titles can be created in a text editor and imported onto the desktop with programmable roll and crawl rates. Because internal decoding of input signals is usually handled in YUV and then encoded into the selected output, H-sync, SC phase, hue, saturation and luminance can be adjusted. Several companies offer plug-ins to monitor and superimpose a digitally synthesized waveform and vectorscope display on any selected video signal.

• *Limitations.*

Although these low-end systems are impressive, some limitations do exist. Currently, they cannot output YUV directly to a component format, such as Betacam. The switching of various sources and the routing of their respective inputs could be simplified. Other areas that could be improved include adding LTC support, providing 4:2:2 digital video capability, and supporting XLR-balanced audio and AES/EBU.

Mid-level desktops

The next level of desktops varies from $7,500 to $12,000, excluding computer. At this price range, most systems allow users to create videos incorporating graphics, DVE moves, animation, audio and titles. The editing is done in a non-linear fashion with the ability to do A/B roll editing. Because such systems are gen-lockable, they have built-in TBCs. Graphics support can be up to 32 bits, with three DVEs and two keyer channels able to do five layers of video and graphic mix effects. Audio is supported with systems offering up to 12 channels or six stereo pairs. Files can be previewed on QuickTime or VfW, output as YUV/D1/RGB or composite, or printed directly from computer to videotape in real time. They play back full screen images at 30 frames/30 fields, which makes them acceptable for corporate work.

• *Requirements.*

Typically, the computers are either Macs, which require a Quadra (700/850/900) running System 7, 16Mb RAM and a 2Gb drive, or PC-386s or better ISA/EISA/VESA platforms with comparable RAM and drive specs. Because the price difference between 386- and 486-based systems is not significant, a minimum configuration of a 486/33 (486/66 preferred) EISA or VESA PC with at least seven or

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eight open slots is recommended. (A non-linear editor capable of A/B/C roll can take up six slots plus one slot for each 3-D channel.) Expect to find a common set of plug-in boards comprising a video accelerator, JPEG codec, 16-bit audio board (two to four channels), SCSI controller and software. For this price, some companies offer a 4:4:4:4 digital processing path with I/O modules available in RGB and D-1, with Betacam SP/MII available soon.

See Desktop Video Glossary on page 84.

Other options can include video frame grabbers, DVEs, TBCs, I/O controllers and appropriate software. Most companies in this price range offer VTR control via an RS-422 or RS-232 card. The RS-422 supports frame-accurate VTRs that use VITC or LTC. However, a generator/reader must be present, and time code must be accessible via the serial ports. For RS-232, control track is used to synchronize edits and can be accurate to within +/-1 frame. A pair of monitor speakers, cabling and mixer round out the system.

• *Integrated production.*

Along with the impressive array of hardware comes comparable performance in software integration. Systems usually are able to perform real time, non-linear editing of audio and video. Editing generally is accomplished by creating bins of storyboarded, digitized audio and video. Each selection is dragged to the appropriate time line to create edited sequences. The time line layout provides a proportional display of audio, video, graphics and titling segments, as well as where and when transitions occur. Expect standard features, such as dissolves, wipes and special effects transitions, including freeze frame. Some systems do not offer the ability to do rotation or skip frame. Others may support effects only on the X and Y axes, but not on the Z. Most systems offer up to 32 levels of undo and redo for worry-free experimentation.

• *Audio.*

Many systems provide up to four channels of 16-bit, 44kHz audio that allow you to combine music, voice-over and sound effects in sync with picture. These systems often have a reasonable graphical audio mixer for full mix-down capabilities. Features can include 4-band parametric EQ, 3-D FFT, mixing of multiple sound files, crossfading, gain adjustment and muting. Many systems also support

Desktop test equipment

By Brad Nogar

Broadcast and post-production facilities rely on waveform monitors and vectorscopes to ensure proper video signal levels. Typically these devices use conventional oscilloscope-type CRTs. During the past few years, a crop of test equipment has emerged. Unlike their radiant green cousins, these waveform monitors and vectorscopes use a standard video monitor for their display. Although conceived for the desktop video marketplace, this non-traditional test equipment also can prove invaluable in broadcast and post-production facilities.

The benefits of desktop test equipment

Traditional waveform monitors and vectorscopes offer a wide range of features, capabilities and costs. Simple side-by-side combinations are available in the $3,000-$4,000 price range. Features, such as line select and SCH phase measurement, can add another $1,000. Integrated waveform/vectorscope units, which use a single CRT, also are available and, depending on features, prices range from less than $3,500 to more than $6,000. With the variety of CRT-based products on the market, why consider using non-traditional test equipment? Price, size and ease of use are a few reasons. Like traditional models, desktop video waveform monitors come in many types.

At the low end of the spectrum are combination units on a single PC card that sell for less than $1,000. Accurate to within 1% of full scale, display modes include full screen waveform, full screen vectorscope and split waveform/vectorscope. The output can be keyed over program video, or viewed on a separate color or monochrome monitor. Both 1H and 2H waveform displays can be viewed in flat or low-pass modes. External reference and/or expanded vertical or horizontal display modes usually are not provided. Waveform and vector display information is updated in real time.

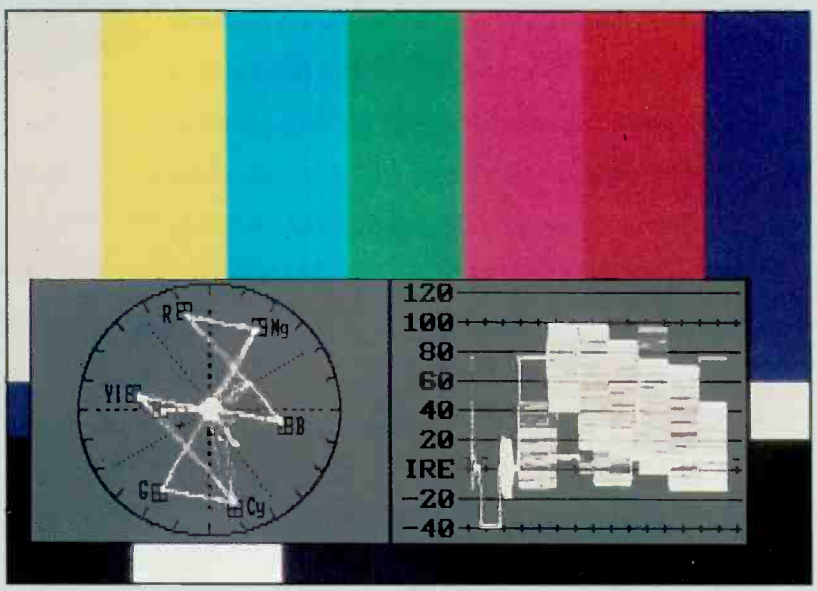
Another type of waveform/vectorscope card, which runs under Microsoft Windows, was introduced recently. The unit offers powerful diagnostics for less than $1,500, but requires a 25MHz or faster 80386 host computer. With its VGA waveform display and non-real time update rate, it may be better suited for use in the maintenance shop.

Moving up the price scale, a variety of non-CRT rack-mount waveform monitor/vectorscope units are available. Prices start around $1,200 and climb to more than $2,000. These models can be outfitted with additional features, including line select, vertical display rates, S-video inputs, SCH phase measurement and dual filter displays. Even fully loaded, such models are less expensive than similarly equipped CRT units.

Broadcast applications for video test equipment

Given the availability of this new video test equipment, you may wonder how can it be used in the broadcast or post-production environment. Because synthesized waveform displays have a slightly different look than an oscillo-

Nogar is vice president of sales and marketing for Digital Processing Systems Inc., Florence, KY.



Vector and waveform traces keyed over video and displayed on a color video monitor. Traces can be displayed full screen or as shown in a split configuration.

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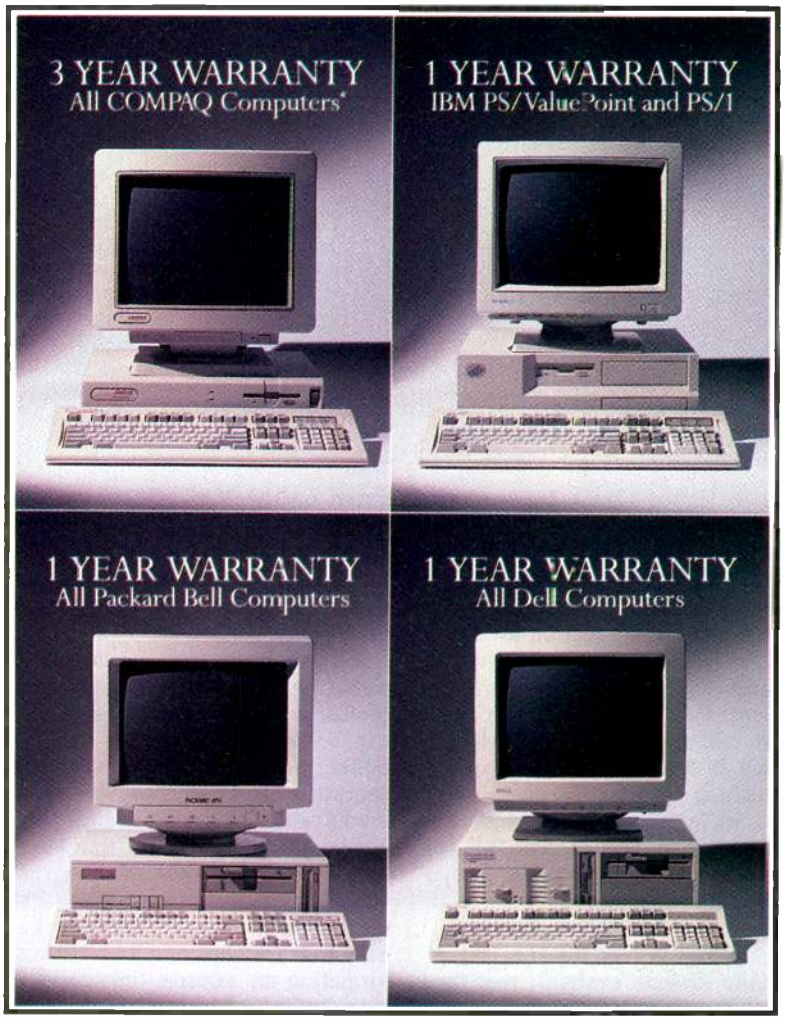

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scope, some operations may best be performed using traditional products. For most monitoring duties, however, the non-CRT units are fine. Three 1-rack units can fit in the space of a regular waveform monitor. Although the need for a video monitor to view waveform images may seem to defeat any space savings, waveform video can be superimposed over program or routed to the B-input of any existing monitor.

The ability to route the output of non-CRT waveform/vectorscope units is one of their most useful attributes. A video router can be used in many places to deliver waveform information, including the chief engineer's office, the return feed to studio cameras, or even from the transmitter to the station via a TSL.

What about the less-expensive desktop video waveform cards? Because of the lack of an external reference input, it might be assumed that they have no use in a sophisticated facility. This is not the case, however, because many locations in a typical broadcast facility only require a way to accurately monitor video levels and color phase.

Consider the many computer-based video systems already found in most production facilities. IBM PC-compatible and Amiga computers are being used as paint systems, 3-D graphics and animation stations, still-stores, production switchers, non-linear editors, character generators and facility controllers. These waveform/vectorscope cards easily could be placed in an unused slot in one of these computers. Taking only power from the computer's bus, these cards will not create interrupt conflicts or other nasty side effects. Why spend $2,000-$4,000 for a standard waveform monitor when you can provide the functionality for a fraction of the cost? There is no reason why every editing system, paint system and automation control point can't contain an internal waveform/vector card. It's possible that some traditional CRT units could be freed and redistributed.

One popular rack-mount package, which retails for less than $3,000, combines a full-bandwidth frame synchronizer with a waveform monitor/vectorscope.

Of course, not all of the sources in a broadcast facility originate in a PC, but low-cost rack-mount frames are available to convert PC waveform cards into stand-alone units. Waveform cards can be combined with other PC-based video processing devices, including frame synchronizers and time base correctors. With many video products offered in a PC card form factor, this is easy to do. One popular rack-mount package, which retails for less than $3,000, combines a full-bandwidth frame synchronizer with a waveform monitor/vectorscope.

Key to consistency

Correct and consistent video levels are a necessary element for maintaining high production quality. The key to consistency is the routine use of calibrated test instruments, such as waveform monitors and vectorscopes. No longer relegated to the exclusive domain of CRT-based systems, low-cost desktop units can provide cost-effective benefits in all types of video production and transmission environments. ❑

time reversal and amplitude inversion, time compression and expansion.

• *Character generator.*

Many mid-range systems also possess an integrated title generator capable of overlaying titles and graphics over video. Often, PostScript and True Type fonts are used. These fonts can be enhanced with drop shadows, layering and text kerning. Menus include a full NTSC/PAL color palette along with anti-alias font generation.

• *Import and export.*

Because we're still dealing with the computer world, multiple formats may be pulled in from the outside, including PICT, TIFF, PCX, TGA, VII, BMP, animations (PICS), QuickTime Movies, VfW, audio (AIFF) and Kodak Photo CD. Similarly, export capabilities include PICT images of still frames, PICS animations of video segments, AIFF audio, QuickTime and VfW formats. Real time JPEG compression and decompression at around 25:1 keeps video data rates at approximately 1.2MB/s sustained, allowing about 30 minutes of video plus stereo audio per 2Gb drive.

High-end and beyond

Those willing to spend more than $12,000, excluding the computer and peripherals, (which, when added to the cost of a computer, can exceed $25,000) will be rewarded with a true blending of video and computer technology that promises broadcast-quality and on-line performance. These desktops can be appropriately called affordable workstations, with a performance level offering the user disk-based, non-linear editing of on-line quality video.

These systems offer 30 frames/60 fields video, real time DVE creation with little or no wait time for rendering, high-resolution, anti-aliased character generation, and at least four CD-quality audio channels with real time DSP for on-the-fly adjustments. In essence, they are true on-line finishing systems. As such, these systems can output an EDL, negative cut lists, change lists and optical lists, or programs can be finished within the system and dumped to tape.

What is real time?

For many low-end systems, real time operation means as fast as it can be rendered. In other words, playback of an effect or segment is in real time only after it has been compiled and rendered to disk. For premium systems, real time processing is as fast as you can push the button, thanks to sophisticated processing and disk-streaming techniques.

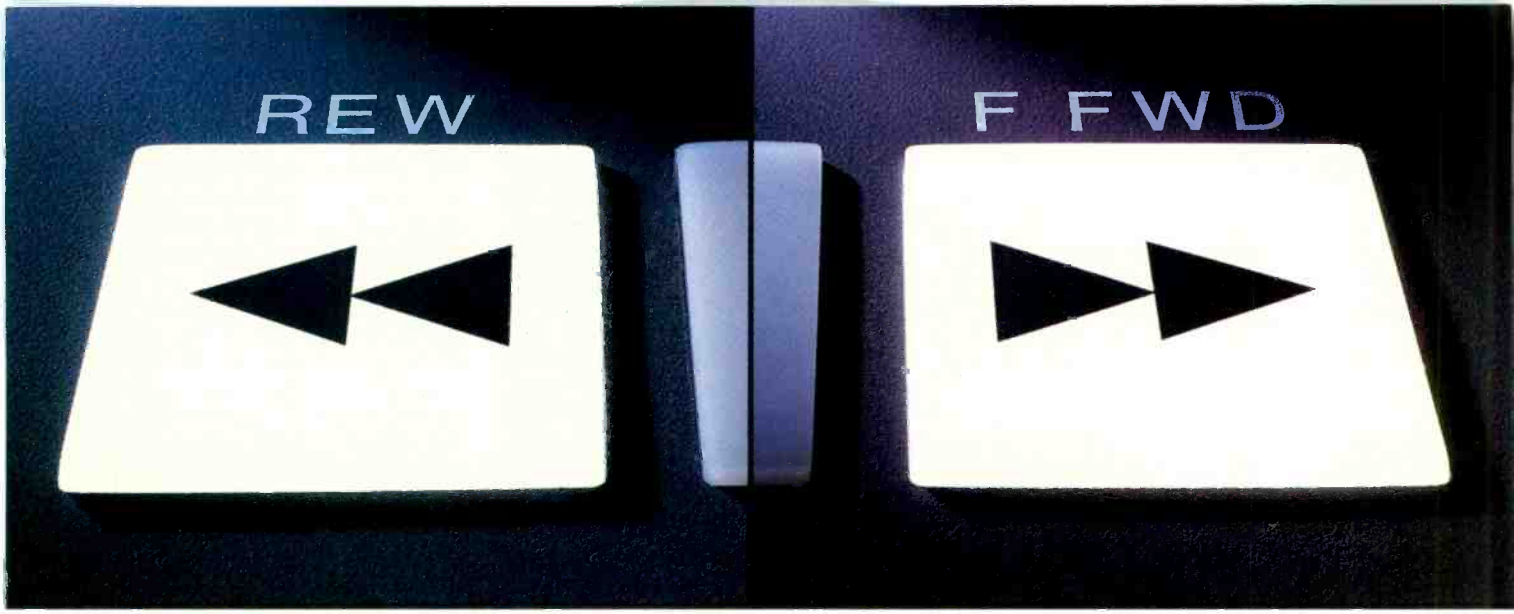
• *User interface.*

If the system can perform in real time, the user interface must provide a fast and efficient means of communicating with the end user. Graphical interfaces seem to be the norm. However, some companies offer custom-designed editing controllers, which provide jog/shuttle and audio fader controls that editors like to have at their fingertips. Many of the high-end companies are offering systems based on the MAC (Quadra) series to take advantage of extensive graphics and animation applications. Some manufacturers are complementing this with their own external processor for real time processing.

Software-based systems are unique because they offer users the option of customizing their own configurations and can be updated easily by the factory. Editing time lines provide visual representation of sequences, allowing the modification of transitions, effects and clip lengths directly in the time line. Multiple and split transitions can be trimmed visually by clicking and dragging. Project management database features make it easy to track clips and jobs because information on source, time code, durations audio and frame rate are captured automatically. Because it is a database, clips can be displayed in text or frame mode for automatic sorting, sifting and storyboarding.

Editing made easy

Looking closely at how these systems produce a finished product is impressive. For most systems, the first step is using the various clip editors to identify and catalog the video and audio segments, graphic elements and titling sequences, called *clips*. The name of the clip, its location based on SMPTE time code, and other information pertaining to the clip are stored in a database along with an optional picture icon. Once the source material is cataloged, the next



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step is usually storyboarding.

• *Storyboarding.*

Typically, the storyboard is the main workspace for desktop systems. The user can control the video, audio, graphics and M/E attributes, as well as visually monitor how the composition of the production is to take place. Multiple time lines representing the various media are displayed along with pull-down menus that allow for complete modification of the clips. Using point, click and drag operations, the entire production can be arranged by positioning clip icons along time lines in the storyboard.

• *Cut editor.*

Some systems offer a separate cuts editor to accelerate the task of performing cuts-only editing. The outputs of source and record decks are displayed simultaneously to match scenes, or the clips can be pulled from hard disk. A clip collection and storyboard are created automatically as the cut list is formed. During each cut, effects, keying and multilayer compositing can be done to enhance the production.

• *Effects generation.*

Users won't be disappointed with such capabilities as separate video and graphics keyers, 3-axis rotational DVE, compositing switchers, character and titling generation, and sophisticated audio tools.

Low-end systems may have multiple effects, but they may not all work in tandem and, in some cases, may require offloading and uploading modules as needed. High-end systems offer a seamless integration of effects generation. For example, flexibility may be offered by providing two separate keyers: one for video and one for graphics so that a video or luminance key and a graphics title key can be done simultaneously. The priority of the key layers is completely programmable. Many systems offer high-end operations in their keyers. For instance, a graphics keyer would provide alpha channel keying that could perform blending and soft keying of graphics and anti-aliased text over video. Additionally, it could be used for luminance-based keying to generate a soft key when graphics are processed through a DVE channel, or digital chroma-keying and overlay bit hard keying.

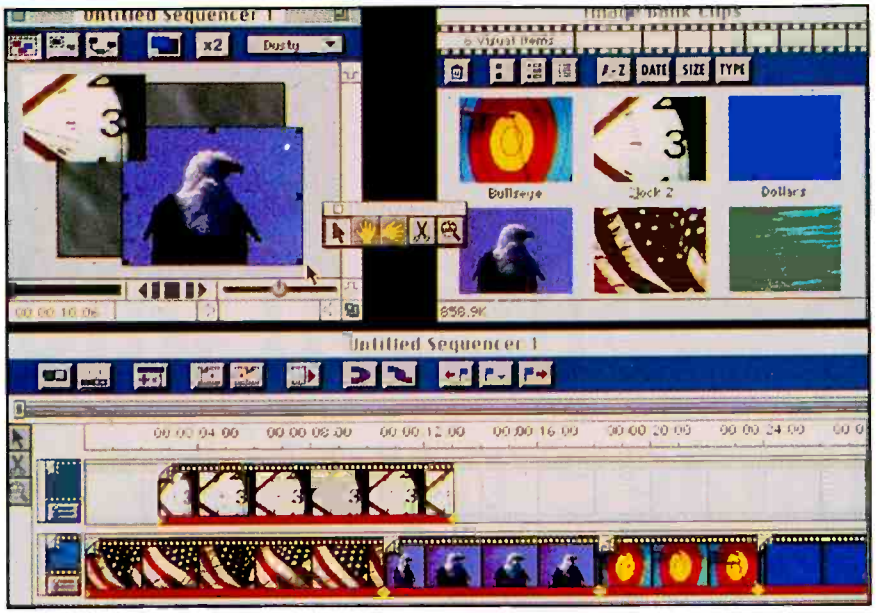
Newer M/E additions include hundreds of traditional transition effects, plus recent desktop innovations, such as pattern position and hold, wipe modulation, aspect ratio, variable softness and border modifiers. Many of these systems treat the video and graphics layers independently so that any layer or combination of layers can be changed by a transition without affecting the other layers. In addition, multilayer compositing can give users enormous flexibility.

Image compression realities

The merits of JPEG, MPEG or DVI can be argued. According to rumor, in Japan, a consortium of companies is trying to standardize a common scalable compression set. One company has already taken a leap of faith and committed to integrating a new form of compression called Discrete Wavelet Transform (DWT), which is supposed to eliminate the artifacts that are produced by DCT-based compression schemes and allow for more efficient data storage. Although JPEG is a standard, JPEG standard images can be played back only on the particular platform where they were initially compressed. Surprisingly, JPEG images from different software and hardware platforms are not always compatible with each other. Ultimately, quantity makes a de facto standard. Currently, there are many JPEG-based systems, and they appear to be doing just fine.

Final thoughts

Evolution is inevitable and with change comes progress. The progress made in



Screen shot of a Mac-based editor for creating digital movies. Operators can cut, copy and paste sequences together. Software supports multiple file formats and special effects. (Photo courtesy of DiVA.)

the computer and software industries, complemented by advances in VLSI ASIC design, have spawned a new desktop production era. The system concepts discussed are a sampling of what is available. With higher computing thresholds and overlapping of the computer, telecommunications and TV markets, tomorrow is sure to bring more advances.

Author's note: Thanks to Marcie Lascher of Avid, Maureen McConnell of Matrox, Bill Trainer of Bronson Leigh Weeks, Magni and ImMIX for providing materials. ■

New Jersey Network

By Fred Ehmann

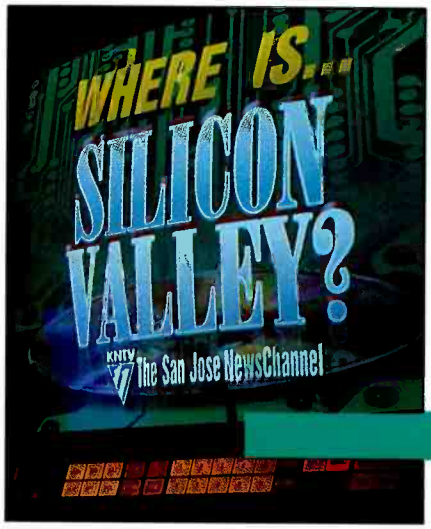
As a graphics designer for New Jersey Network, one problem has been the inability to use PC-based graphics software tools in the production of video material. The videoDesigner from the Graphics Systems Division of the Grass Valley Group provides a solution to that problem. The system is a hardware (two boards) and software package that turns an IBM PC or clone platform into a high-quality paint and graphics system. This approach allows even a small production house to provide its clients with quality graphics inexpensively.

Enhanced capabilities

In the early days of desktop computer graphics, it really wasn't possible to grab video, paint it and then output the result as a video image. Today, such capability is taken for granted. The videoDesigner provides a full range of graphics and paint capability. In addition, the wide range of third-party fonts available for the PC can be used. It is now a simple process to grab

Continued on page 83

Ehmann is a graphic designer for New Jersey Network, Trenton, NJ.



Resolution and image quality

One key factor is bandwidth.

By Rick Seaman

The Bottom Line

Sharpness, definition, resolution – achieving the highest possible degree of detail – is a constant goal of any imaging medium. That is why equipment with the highest number of lines of resolution is preferred for video. Yet, sometimes an original crisp image turns to mush after four or five generations of tape. To understand resolution, we must look between the lines.

$

Seaman is director of engineering for Omni Video, Portland, OR.

TV systems break images into slices of time, then re-create rasters from lines or, in digital devices, such as TBCs, from mosaics of numerical samples. Within a standard like NTSC, the number of scan lines in an image (defining vertical resolution) is fixed. The main variable controlling horizontal resolution is the upper frequency response of the equipment.

Video resolution test patterns

One way to determine the upper limit in lines of resolution of video equipment is with a resolution test pattern. Such patterns are available as charts for cameras and from signal generators. When the pattern fills the camera's frame, vertical wedges in the center and corner groups of the chart allow the resolution to be determined. Look for the point where individual lines can no longer be distinguished. The resolution at that position is read or interpolated from the scale beside the wedge.

Unlike optical measurements that refer to line pairs (one black and one white), TV lines can be single lines, black or white. Thus, the number must be cut in half to convert lines to cycles at a particular frequency. To keep horizontal and vertical resolution measurements equivalent and independent of aspect ratio, horizontal resolution is specified for an area as wide as the picture is high. Because the picture height is 75% of its width, the horizontal lines of resolution occur within 75% of the real 52.5µs active line time or 39.4µs. A camera that displays 600 lines maximum at the center produces a frequency of 7.6MHz or 1/(39.4µs/(600/2 cycles)). Therefore, each megahertz of bandwidth is equal to approximately 80 lines of resolution.

Limiting horizontal resolution is the measure of the limit where all detail disappears. Keep in mind, when viewing patterns for resolution, that the picture can only be as good as the video monitor used for viewing. A high-resolution (>600 line) B&W monitor is recommended, because the chroma filter and CRT dot structure of a color monitor interfere with higher frequency. One problem with a resolution test pattern is the difficulty of examining frequencies other than the cutoff limit.

Keep in mind, when viewing patterns for resolution, that the picture can only be as good as the video monitor used for viewing.

Sweep signals

For a more complete frequency response of any device that passes or processes video, a video sweep signal can be applied to the input and the resulting output can be viewed on a waveform monitor.

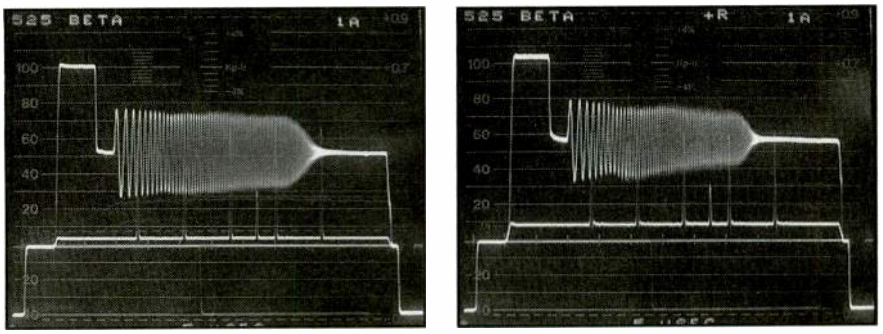


Figure 1. *(a) A first-generation sweep signal through the luminance channel of a Betacam SP VCR is shown at left. Major markers occur at lMHz intervals. The -3dB point occurs at 4.5MHz; limiting resolution occurs at 5MHz. (b) On the right, a third-generation sweep signal through the same VCR shows limiting resolution has decreased from 5MHz to around 4.6MHz, or from 400 lines to 370 lines.*

A sweep is preferable over a multiburst signal because it includes the in-between frequencies that may betray peaks or dips in the response missed by the multiple bursts. Sweep signals often include frequency markers, usually at lMHz intervals.

Bandwidth is normally specified at the -3dB (70.7% amplitude) or half-power point. Figure 1a shows a first-generation sweep of the luminance channel from a Betacam SP VCR. Notice the difference between the -3dB point (about 4.5MHz) and the frequency of limiting resolution (about 5MHz), where the signal disappears into noise.

Response curves of subsequent tape generations are additive, like sections of a low-pass filter, each increasing the slope and decreasing the cutoff frequency. A point at -6dB on first generation becomes -12dB on the second and -18dB on the third. In Figure 1b, a third-generation recording of the sweep shows limiting resolution decreased from 5MHz (or 400 TV lines) to 4.6MHz (370 lines). Image quality drops rapidly with each generation unless the VTR frequency response is flat to the highest frequency of interest, or 4MHz.

Measuring frequency sweeps at full amplitude on most small-format VCRs results in little useful information. The increased signal packing density on the tape and the resulting lack of headroom causes clipping or slew-rate limiting on high-amplitude high frequencies.

An edge in time

Although video resolution and frequency response are related, resolution also can be viewed in terms of edges. In a practical system with limited bandwidth, a signal cannot change from 0% to 100% instantly. The time required to respond to an amplitude change from 10% to 90% defines the rise time (RT) and is related to system bandwidth (BW) by the formula: BW=0.35/RT.

The rise time of a single cycle of 4MHz sine wave (T pulse) is 74ns. This requires a bandwidth (at the -3dB point) of 0.35/0.074µs or 4.73MHz. Systems with a lower bandwidth or sharp frequency cutoffs, such as transmitters, will not pass a pulse this short without attenuation or ringing.

Bandwidth can be figured for a single circuit or as a resultant bandwidth of a series of systems. When the spacing of picture details gets closer than the combined rise and fall times of the system, individual elements cannot be resolved.

Digital resolution

Digital video brings another dimension to the question – spatial resolution. One method of specifying the resolution of a character generator indicates nanoseconds per pixel. A pixel resolution of 70ns would be fairly coarse, yet even the highest resolution titling appears unchanged when recorded to videotape and played back through TBCs with a 70ns sample rate. Is there a difference between one 70ns and another?

When the spacing of picture details gets closer than the combined rise and fall times of the system, individual elements cannot be resolved.

"We don't do pixels," one video engineer said when trying to explain digitized video to a computer user. Digitally sampled video exists within definite bandwidth restrictions about what enters and leaves the digital realm. And it exists in two dimensions.

Picture an image with the left half black and the right half white, split in the middle by a nearly, but not quite, vertical line. The sharpness of the edge (or rise time) on any scan line is limited by the bandwidth of the system, although the position of the edge from line to line can move in a continuously variable fashion. (See Figure 2.) Its positional or spatial resolution is higher than its horizontal resolution. The same image drawn on a simple computer graphic system may have edges appearing as a series of stair steps. This occurs, partly because the positional resolution is the same as its horizontal resolution. (See Figure 3.)

In a sampled system, the sample rate must be greater than twice the maximum frequency to be sampled (it is usually three times or more). Thus, analog video applied to a digital device is often bandwidth-limited to less than half the sample rate. A black-to-white edge (from 0% to 100%) of the fastest allowable rise time could occupy two or three samples, depending on its position. A positional shift of only a few nanoseconds can affect the numeric values of the samples. A conversion back to analog through an output reconstruction filter restores the continuous shape and position of the edge.

Subpixel resolution

Sampled video has an advantage over a simple computer graphic image because it uses a 2-D grid of time and amplitude to define position. More sophisticated computer graphic systems make use of mul-

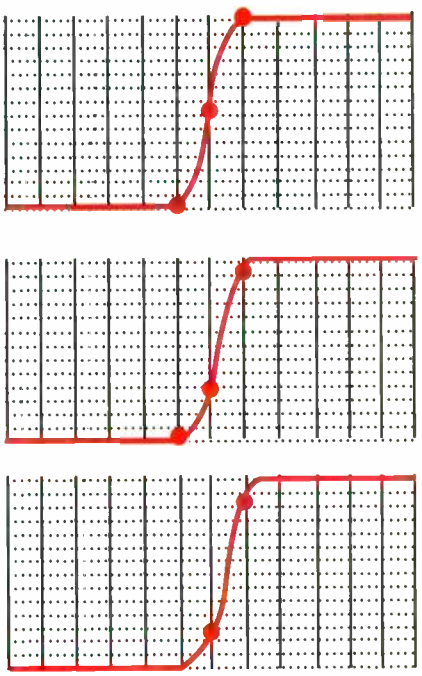


Figure 2. *Although limited in sharpness by the video bandwidth, an analog edge can occur at any position. Slight shifts of even a few nanoseconds will produce different values when the signal is sampled digitally (at the dots).*

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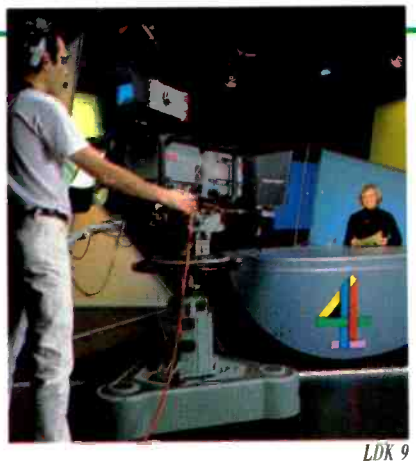

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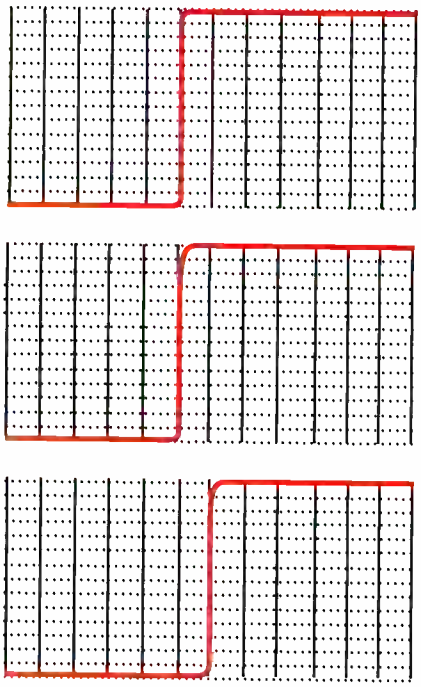

Figure 3. *The output of a computer graphic system may produce a sharp edge, but the edge can only fall on a pixel boundary. Positional resolution is the same as the number of pixels.*

tiple bit color scales and controlled rise times to increase the spatial resolution of their output. Because a diagonal edge in such systems need not jump from pixel to pixel, creating the perception of a false position or spatial alias, their outputs are termed *anti-aliased.*

The amount of subpixel resolution (SPR) is related to the number of levels of anti-aliasing (N) by:

SPR = pixel resolution/(N-1)

For a character generator with 70ns pixels, a single intermediate level between the character and background (three total) allows 35ns of spatial resolution. Such digital graphics systems require more memory to store the extra bit levels, but they have an edge over their competition.

VTRs and resolution

VTRs degrade video more than any other piece of equipment. They add noise, jitter, moire, dropouts, distortion and reduce resolution. To achieve the best resolution, the bandwidth of video equipment must exceed that of the highest frequency of interest. However, the shape of the response is as important as the endpoints. Specifications of professional video equipment commonly note bandwidths flat to 6MHz for TBCs, to 10MHz for production switchers and to 30MHz for routers. Many analog videotape recorders are only flat to about 4MHz.

The video recorder performs a complex job. It must mechanically scan a tape, writing a magnetic version of the video signal into the magnetic particles, and then reverse the process, extracting that pattern from noise and media imperfections to reconstruct a video signal. As tape formats have become smaller, the magnetic packing densities on the tapes have increased. Simultaneously, writing speeds and minimum recorded wavelengths also have decreased. As a result, manufacturers have started to use non-linear processing of the luminance signal.

Non-linear signal processing

One common non-linear process used with video is clipping. Analog videotape recorders use FM recording for the luminance portion of the signal. Because the noise level of FM increases with frequency, VTRs pre-emphasize the high frequencies during recording. Complementary de-emphasis during playback improves the signal-to-noise ratio.

When high frequencies have high amplitudes, the safe recording limits can be exceeded. For example, the S-VHS peak white frequency is 7MHz. The pre-emphasized leading edge of a peak white bar will record several megahertz higher. To the extent the peak goes beyond the frequency limit of the record head, it will cause a loss of signal upon playback. Spikes that are too negative intrude into the spectrum of hi-fi audio and color-under signals. White and black clip circuits are used to prevent these occurrences. However, both of them are non-linear and irreversible.

Coring, a form of noise reduction, also affects resolution. During playback, luminance is separated by frequency into main and detail signal. Because most tape noise exists as low-amplitude high frequencies, the low-level noisy "core" of the signal can be removed, leaving only the stronger signals. This imposes a level-dependent hurdle that high frequencies must jump to make it into the detail signal. The frequency response and horizontal resolution of the recorder drops at low signal levels as a result.

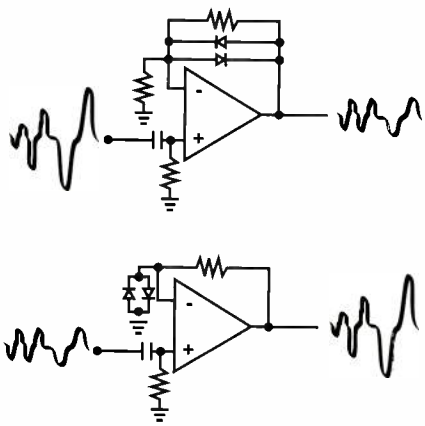

Figure 4. *Non-linear pre-emphasis overcomes tape noise and avoids overmodulation by boosting low-level high frequencies more than high-level signals. Complementary de-emphasis restores the original relationships.*

The S-VHS, Betacam SP and MII formats implement various forms of non-linear pre-emphasis and de-emphasis to overcome tape noise without coring. In Figure 4, during recording, a non-linear amplifier processes detail signals, changing the slope (gain) with amplitude, similar to a soft-clipper. Low-level detail is pre-emphasized the most, high level the least. However, because detail information remains in the signal, the process can be reversed at playback, restoring the original levels. As a backup, white and black clip circuits are employed to limit unusual signals.

VTRs degrade video more than any other piece of equipment. They add noise, jitter, moire, dropouts, distortion and reduce resolution.

Solutions

Recording technologies have made great strides in achieving wider recoverable information bandwidths. Even with advanced systems used to record HDTV, the recording-reproduce process places the greatest restriction on signal bandwidths.

Is there a way to curb resolution loss in analog VCRs? Not entirely, but a preferred approach is to bump it up. If you acquire footage on a small, portable format, such as S-VHS or Hi-8, dub or edit to a larger format as the first step. Although going to a lossless digital format, such as D-1, D-2 or D-3, would be ideal, Type C, Betacam SP and MII are all good analog choices. Barring that, the only other option is to minimize the number of generations.

➡ *For more information on video image quality, circle Reader Service Number 307.* ■

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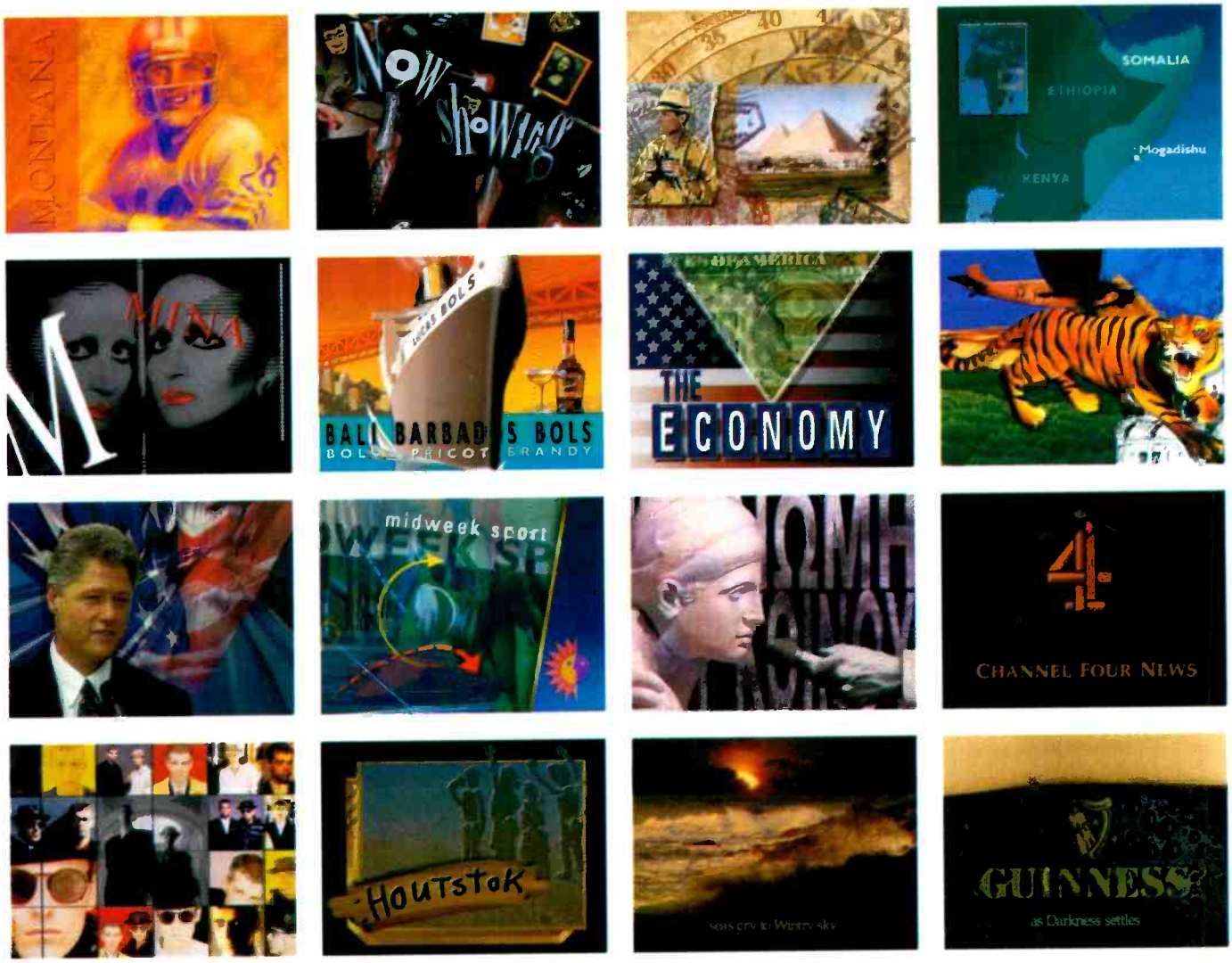

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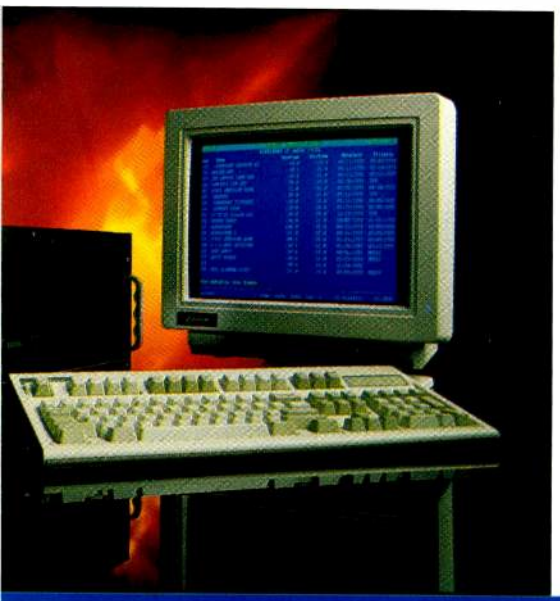
Radio in transition



Program automation systems

PC-based automation is rapidly changing the way radio works.

By Kelly Hannig

The Bottom Line

Today's radio automation systems provide flexible, reliable and cost-effective programming management. They can take over routine operational duties at the station and allow the staff to focus on more creative work. Automation systems capable of multiple simultaneous functions also play a major role in making LMA and duopoly operations more successful. Meanwhile, the reach of these systems continues to expand into further areas of station operations, approaching an eventual full integration of all station functions into a single computer platform.

Hannig is product manager for digital storage and retrieval systems at Gentner Communications Corporation, Salt Lake City.

Most of today's radio program automation systems are digital audio storage/retrieval/automation systems based on powerful personal computers with extremely large capacity, hard drive storage.

The first successful, complete, low-cost, high-quality automation systems based on PC platforms appeared around 1988, and were generally greeted with skepticism. Most station owners were hesitant to trust their operations to PC-based systems because their office PCs were considered finicky and unreliable.

By 1991, however, the concept had proved to be a genuine benefit to pioneering stations' bottom lines, and the radio broadcast industry began to see a rapid increase in the number of companies that sold personal computer/hard disk-based automation systems. Regarding reliability, manufacturers of automation system components now produce products with mean time between failure (MTBF) ratings exceeding 150,000 hours (over 17 years).

Nevertheless, if you haven't yet acquired one of the many PC-based automation systems available, you're still in good company. Market estimates indicate that less than one-third of the domestic radio station market is currently using these new systems.

Current applications

Program automation functions typically fall into three general areas:

1. local,
2. satellite, and
3. live-assist.

In (1), locally produced programming is automatically assembled and sequentially delivered. In (2), commercials and other inserts originate from the local station, but satellite services provide the bulk of programming. In (3), programming originates from the local station, but the system relies on an operator to start the next sequence of events. (See "Radio Automation Techniques," April 1993.)

Figure 1 illustrates a common implementation in automated radio stations, with the ability to accommodate all three of the aforementioned functions.

Diving in: feet first or head first?

In a recent survey of stations using PC-based automation systems for more than one year, the following were cited as the most important factors to consider during the evaluation process: reliability, customer support from the manufacturer, good documentation and ease of use. Interestingly, all of these parameters outranked any specific operational feature.

Regarding operational functions, however, the same survey indicated the desirability of audio editing capabilities, audio overlap on playback, spot rotation (equivalent to multicut carts), real time command capability, time compression/expansion and interfacing to CD jukebox or multi-CD player systems. Another useful feature is the ability to control an auto-

mation system from a remote site using DTMF tones (telco touch-tones) or with a laptop computer.

Automation systems come in two styles — either as complete, factory assembled and tested systems, or as do-it-yourself kits. The assembled systems are easier and quicker to bring on-line, and are generally better supported by the factory. They make the most sense for a station with limited engineering resources. The do-it-yourself kits usually include a software package and an audio card. The station then buys the rest of the required hardware and software, and puts it all together.

Although the do-it-yourself approach may save some direct costs, the indirect costs of acquiring, assembling, troubleshooting and supporting the system's platform may outweigh the savings. You also may experience compatibility problems that will not happen with the complete systems.

Also consider how the automation system handles CD players or juke boxes. For example, is 2-way communication supported? Without it, the computer can only issue the CD player commands and cannot monitor its status. Increasingly, the computer system's hard drives are used instead of CD players for many radio formats. Recent price drops in large-capacity hard drives and the use of high-quality audio data compression systems have made this approach economically competitive. A single hard drive can store more than 25 hours of 15kHz stereo audio (e.g., more than 500 3-minute songs). Music storage on hard drives also offers greater reliability than CDs, both in greatly increased hardware MTBF and elimination of CD skipping risks. Cuing and cut timing data also can be more accurate with hard drive storage.

If you are concerned about using data compression, consider an automation system that allows you to select linear or compressed data storage (see "Understanding Audio Data Compression," p. 64). To put the entire library on hard drive using exclusively linear storage implies spending four to six times more for hard drives than with compressed storage.

Although computer platforms offer future upgradability, remember that this is essentially limited to software. Hardware cannot stay abreast of all improvements that technology will likely bring with time. Make your decision based on the needs you have now, not on some vague future capabilities that might be required.

Many stations are now pondering the question of which to buy first — a new automation system or a digital audio workstation? New automation systems have increasingly sophisticated audio editing capabilities. Many go well beyond basic cut-and-splice editing (which is all that most stations really need), and have moved into multitrack editing. This means that a station can probably get all of the audio editing capabilities it needs, plus an automation system, for less than what some stand-alone digital audio workstations cost. Furthermore, the evolution path for today's automation systems includes more digital audio workstation capabilities, but there is no clear path that envisions digital audio workstations adding substantial automation capabilities.

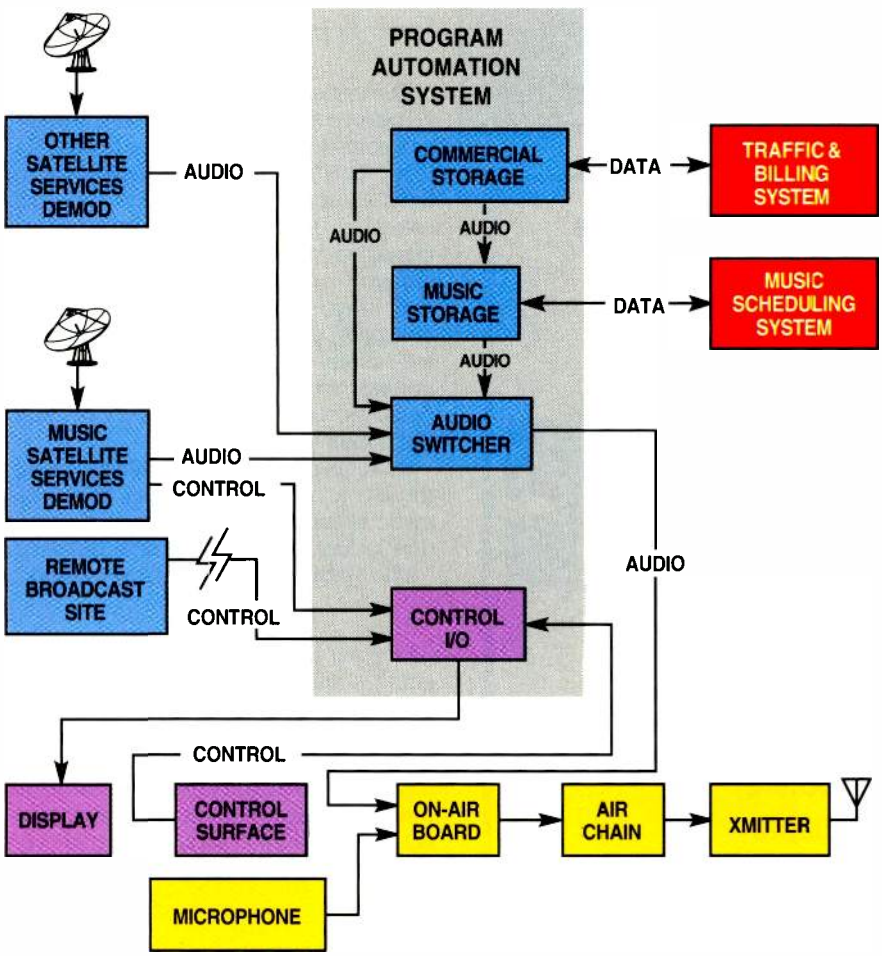


Figure 1. *Block diagram of a current automation system capable of satellite, local and live-assist operations. Only playback functions are shown. System also may be capable of recording audio from incoming sources for later playback. Future designs may incorporate more of the functions shown outside the automation system box in this diagram.*

New games: LMAs, duopolies and mini-networks

PC-based automation systems can play a major beneficial role in the consolidations taking place among radio stations today. Centralizing commercial production/distribution, music libraries/scheduling and traffic operations onto a single platform for two or more stations can only add to the efficiencies and economies that such busines s ventures seek to bring about.

For example, starting with a traffic/scheduling system that can generate multiple logs from the same database, unique schedules for each station are created. These logs are downloaded to an automation system that can handle multiple, simultaneous audio outputs. Each output channel is assigned to a separate air chain and transmitter, providing multicasting from a single platform. In addition, all audio production for the stations is done at a single location, and a single stored copy of each spot or music cut can be accessed by any or all of the stations at any time.

A glimpse into the crystal ball

The natural path for automation systems built around today's technology leads to a "radio station in a box" reality. Automation systems based on PCs and hard drives had to provide a way to record audio onto magnetic disks. Once

they could that. It was natural to add cut-and-splice editing, and then multitrack editing. The desirability of time expansion/compression added digital signal processing (DSP), which leads to the incorporation of other digital audio workstation functions.

The on-board DSP also allows high-quality audio data compression, as well as the eventual integration of all on-air audio signal processing. Meanwhile, the natural extension of an automation system's internal switching and mixing abilities leads to the eventual inclusion of full audio routing and distribution functions for a station.

Automation systems will continue their evolution toward eventual replacement of the entire conventional audio chain.

The system's machine control also can generate commands for outboard devices and communicate via serial or other data links. This implies a natural migration to full station operational control from the computer. Such control also could include management of the station's telephone system, for office and on-air uses. In addition, usage tracking and incoming caller-ID logging allows such a system to generate helpful reports. Future automation systems for ancillary broadcast functions (such as today's SCA data services and RBDS data.)

By adding the traffic and billing system, the music scheduling system and automatic client invoicing onto the automation package, the complete, self-contained "radio station in box" becomes a reality.

Summary

Program automation systems have become popular at many radio stations. Their reliability and operational benefits have brought significant improvement to stations' on-air and bottom line performance. Automation systems will continue their evolution toward replacement of the entire conventional audio chain and control system at the radio station.

➡ *For more information on PC-based radio automation systems, circle (308) on Reply Card. See also Automation Systems, pp. 22-24 of the BE Buyers Guide.* ■

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There are a lot of multitrack digital audio workstations out there, but only one with Otari's name on it.

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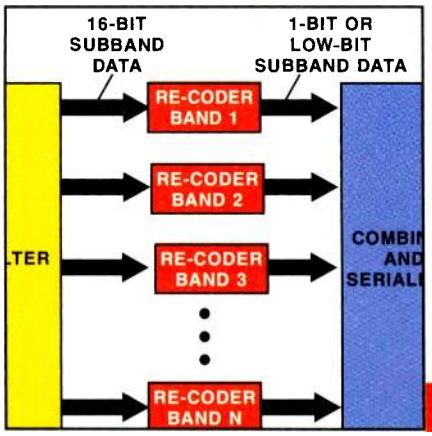
Understanding audio data compression



Choosing the proper algorithm for the job is an essential new skill for broadcasters.

By Steven Smyth

The Bottom Line

Not all digital audio data compression systems are created equal. Numerous trade-offs are made by every algorithm, as its designers seek to optimize certain parameters of its operation. Depending on the system's application, some of these compromises can go unnoticed while others may become blatantly apparent. It therefore behooves the broadcaster to understand the strengths and weaknesses of each system's design, so that it can be most appropriately used.

Smyth is president of Audio Processing Technology, Belfast, Northern Ireland, UK.

Digital audio data reduction technologies seek to combine the allure of digital audio with the economic advantages of reducing the bandwidth it requires. The compact disc has set the quality standard for consumer audio, but the extravagant bandwidth needed for transmission of linear 16-bit PCM has been economically prohibitive. A solution applies real time bit-rate reduction to the digital audio signal, a process commonly but confusingly termed audio *data compression*. (A more appropriate term is *data reduction*.)

Several techniques are now available to reduce bit rates for CD-quality audio transmissions. Most of these schemes do not reproduce bit-for-bit the original 16-bit audio. Their primary aim is to make such corruption of the data inaudible. The main difficulty with these systems is not, as is commonly expected, a simple loss of audio quality. Indeed, the aural performance of most compression systems is acceptable under most conditions. It is instead the more subtle, application-related limitations of these systems that are of current concern to the professional (and typically not to the consumer). Examples include an increase in coding delay, a reduced ability to equalize or otherwise post-process the signal, reduced editing resolution and, most importantly, a reduction in the ability to make multigeneration copies. (For more details on the basic workings of bit-rate reduction systems, see "Digital Audio Data Compression," February 1992.)

Applications of digital audio compression

This technology has found application in the broadcasting, communications and entertainment industries, as detailed below. Most implementations for data compression exploit its lower operating bandwidth for real time transmission, or the resultant lower storage costs.

- *Radio.* The radio industry has been at the forefront of the recent debates on the merits of audio data compression. It has already witnessed the introduction of such products into several successive links in the production and transmission chain. This has prompted heated discussion on the problems associated with *tandem coding* (the sequential cascading of multiple generations of data compression on an audio program), in cases of a single compression system's use throughout and when employing multiple systems. With compression likely to be used in remote pickup links, field-acquisition recorders, editing workstations, satellite links and STLs, the artifacts of tandem coding may have some impact on the audio ultimately delivered to the consumer. An additional layer of compression will probably be added when digital radio broadcasting is instituted. Stations should exercise care in the application of compression systems and consider their eventual, cumulative effects.
- *Digital STLs.* Digital STLs typically take

the form of a dedicated digital phone line of 1.5Mbit/s (T-1 or DS1 service), or a 950MHz RF link. Using audio data compression, each direction of the T-1 path can accommodate six 15kHz stereo channels, plus auxiliary data links (for remote control or datacasting). Aural STL links in the 950MHz band are limited to 500kHz bandwidth or less. Digital transmission on these paths is only possible with data compression. (Transmission of uncompressed digital 15kHz stereo signals typically requires more than 1MHz of bandwidth). Digital STLs have already won widespread acceptance in urban areas where noise and interference are common. Digital STLs also may permit use of smaller microwave antennas, and multiple hops can be performed without signal degradation.

Digital STLs have already won widespread acceptance in urban areas where noise and interference are common.

• *Disk-based audio recorders and workstations.* Over recent years, many products have been introduced that are designed to store audio on computer disks and (among other applications) replace the analog cart machine. Employing data compression in these devices can increase their storage capacity, which becomes particularly advantageous in systems using relatively low-capacity, removable media, such as floppy diskettes.

Successfully editing such compressed audio is more difficult than editing linear PCM data, however. The two main reasons for this are an inability for the editing software to "see" the normal PCM waveform and the lower time-domain resolution provided by some compression algorithms. One solution involves the recording of an averaged, low-resolution energy profile of the audio data, which can then be used to locate editing points. Another approach decompresses the file to view the reconstructed linear PCM waveform only around editing points. In either case, the audio file is non-destructively edited. The loss of time-domain resolution only becomes a problem in some transform-based coders. These devices perform operations on blocks of data, made by accumulating a number of successive audio samples in a buffer. The size of this block (which can extend to as long as 20ms in some coders) becomes the minimum audio sample that can be removed or edited.

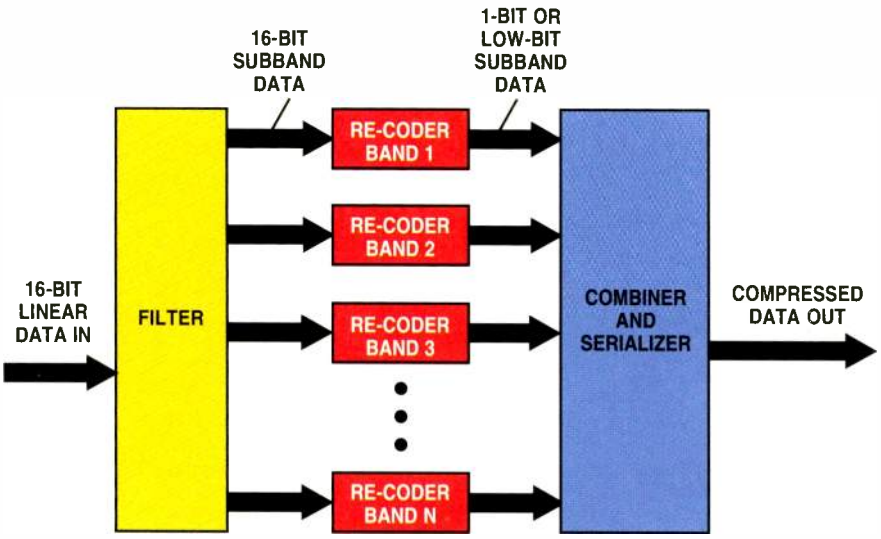


Figure 1. *Block diagram of a digital audio compression system encoder. Filter divides 16-bit linear samples into frequency subbands, and re-coder sections use adaptive/floating-point PCM (or delta-modulation) to reduce each sample's resolution to a few bits (or a single bit). Typical subband coders use from four to 32 subbands. Typical transform coders combine filter and re-coding sections' functions in a frequency-domain transform process, providing the equivalent of up to 512 subbands. Decoder simply reverses procedure.*

• *Wired remote links.* News/sports commentary links are gradually improving in quality as the transition to digital telephone lines occurs. These systems typically use compression systems that provide approximately 7.5kHz mono audio on 56kbit/s or 64kbit/s paths. If an inverse multiplexer is used to aggregate six such circuits, the audio bandwidth can be increased to 22.5kHz in stereo. This approach has been used in relaying orchestral concert performances around the world for live radio broadcasts.

• *TV audio.* NICAM is a relatively mature 14-bit to 10-bit digital audio data compression algorithm developed by the BBC, now in service in the United Kingdom and elsewhere. Even though it uses a conservative compression ratio compared to more recent algorithms, NICAM's audio quality is considered inferior to these. This confirms the advances achieved in the latest algorithms' design, and more particularly the increases in speed of DSP hardware on which they run.

High-definition television (HDTV) will use audio compression in some form. It will be used principally to increase the number of channels in an attempt to match the quality and depth of audio found in film theaters. No particular audio compression algorithm has been chosen, but several multichannel schemes have been proposed.

• *Point-to-multipoint satellite.* To date, this application has been primarily aimed at supplying background music to national chain stores, and to distributing audio to radio stations. Future applications may include direct broadcast to fixed and mobile listeners. In either case, data compression allows greater numbers of services to be carried within a given satellite transponder, making the services more economically viable.

• *Communications.* In contrast to the broadcast applications that are not greatly concerned with the coding delay (digital STLs excluded), the field of telecommunications is interactive and relies on a short delay for its effectiveness. Other qualities, such as robustness, also are important. However, because the primary signal to be transmitted is the human voice, the actual audio bandwidth is of lesser importance. Therefore, high compression ratios (which typically require longer coding delays and produce higher fidelities) are not encountered in this field.

• *Telephony.* Many of the current techniques for high-quality audio compression can be traced to fundamental research conducted over many years by the major telephone companies into low-bandwidth, toll-quality digital voice compression algorithms. Further work has led to the development of a wideband (7.5kHz) standard for voice audio that has been implemented commercially, referred to as CCITT G.722. The widespread deployment of Switched-56 and ISDN services should see an increase in wider-bandwidth (15kHz) codecs as an alternative to the telephone.

• *Video/audio conferencing.* Video conferencing is still not popular at present. The combination of poor quality video, telephone-grade audio, painfully long delay times and expensive equipment has weakened demand. Recent attention has moved toward increasing the audio quality at the expense of the video. This would shorten the delay times with the aim of increasing the overall perceived quality.

• *Motion picture soundtracks:* Various digital audio playback systems have been proposed and installed in theaters. Some of these systems have encountered reliability problems, and may require expensive hardware and print production techniques. A recent entry to this market has been made by MCA/Universal Pictures for the release of the film "Jurassic Park." It uses a CD-ROM disk to store and play compressed audio, which is synchronized to a modified SMPTE time-code optical track on the film. Up to six fully discrete 20kHz audio channels are available.

• *Remote audio post.* High-quality audio transmission over switched or dedicated digital networks allows creative decisions to be made remotely. For example, a TV commercial producer in New York can listen interactively to an audio session taking place in a Los Angeles studio. The audio feed can carry time-code information, allowing a previously edited videotape to play on a VCR in the New York producer's office, synchronized to the incoming audio feed.

Similarly, a voice talent can read copy in his/her own home (or a local studio) while being recorded in a production facility thousands of miles away. Finished spots also can be delivered to broadcast outlets via this method.

Conclusion

No single audio data compression system can optimally cover all the possible applications today. All coders are ideally suited for specific applications, and are compromised in others. For example, higher compression ratios inevitably demand a longer coding delay, and exhibit reduced ability to undergo tandem coding. This implies that broadcast engineers must be conversant with the overall parameters of audio data compression in order to select the appropriate algorithm for the task at hand.

➡ *For more information on audio data compression systems, circle (309) on Reply Card. See also Audio Digital Coders, Decoders on p. 6 of the BE Buyers Guide.* ■

Industry Briefs

BUSINESS SCENE

TSM Inc., a Valley Cottage, NY, manufacturer of TV camera automation systems, has merged with the Vinten Group. The Vinten Group now includes TSM, Vinten Broadcast Ltd., Manfrotto, Gitzo, Internet, Bexel, Bogen Photo and W. Vinten Ltd.

Led by founder and president Bob Gonnelli, TSM will design and manufacture all TSM and Vinten Broadcast camera remote-control systems in its Valley Cottage location for the world market. TSM also will exclusively sell and service all TSM and Vinten Broadcast products in North and South America.

Vinten Broadcast Ltd., based in the United Kingdom, will design and manufacture all Vinten Broadcast camera-support systems, and exclusively sell and service TSM and Vinten Broadcast products throughout the remaining global market.

TSM and Vinten have been world leaders in camera remote control and robotic systems for more than a decade. According to Gonnelli, "Future TSM products will use the combined strengths of the companies to build the ultimate camera remote system."

Pro-Bel, Dunwoody, GA, has sold a routing system to Post Perfect, New York. The company also has delivered a serial digital video system to Kao Company, Japan. CEE, a Portuguese production company, has purchased Pro-Bel routing and control equipment. In addition, Scottish Television has ordered a custom-designed Pro-Bel master control and automation system. Also, London-based Videotime has purchased a Pro-Bel switching and control system.

Panasonic, Secaucus, NJ, has delivered and installed D-3 edit suites at Ostankino TV, Moscow, and Czech TV.

In addition, the South African Broadcasting Corporation has chosen Panasonic cameras for the production of a new soap opera, "Die Glaskasteel." Tele Monte Carlo, Rome, has chosen D-3 -inch digital VTRs and a Marc 400 system for its transmission facility, making it the first network to broadcast from Monte Carlo to Italy and to Monte Carlo itself using digital VTRs.

Also, Mangos Christos SA, Athens, Greece, has bought a 3-camera AQ-20D system.

Sony, Montvale, NJ, has sold an 18th BVC-400A LMS multicassette system to Turner Broadcasting System (TBS).

Also, Sony has delivered PCM-3348 digital multitrack systems to London-based Abbey Road Studios and BBC Television. BOP Studios, South Africa, has purchased a PCM-3348 as well. A Flexicart automation system also has been ordered by BBC Newcastle.

Avid, Tewksbury, MA, has delivered two AudioVision systems to the Mix Place, New York. Also, BBC, London, ITN, London and YLE-TV2, Finland, have used Avid's NewsCutter digital non-linear newsroom editing system.

Lakeside Associates, Irvine, CA, has been retained to design a remix control room and overdub booth for Los Angeles-based Mad Hatter Studios.

BEC Technologies, Orlando, FL, has installed a ProLine series digital fiber-optic audio system to link production studios to the satellite uplink of the Eternal Work Radio Network, Birmingham, AL.

Pesa Electronica, S.A., Madrid, Spain, has been awarded a contract for 67 TV transmitters and turnkey installations from Televisa (Mexico) for its new TV network, Channel 9.

AVS Broadcast, Surrey, England, has taken delivery of a Cyrus standards converter to German-based Wagner Television.

Acrodyne Industries, Blue Bell, PA, has received an order for a VHF TV broadcast system from KTN, Kenya.

Solid State Logic, Oxford, England, has delivered its second Scenaria digital audio/video post-production system to Avenue Edit, Chicago. NBC, New York, has purchased an SSL console and ScreenSound. Solid State also has sold a GB on-air production console and G Plus console to CBS, New York.

Thomson Tubes Electroniques, Cedex, France, has equipped the Spanish National Radio's MW network with transmitters using Thomson's high-power RF tetrodes.

In addition, Swedish Television and a private channel in Portugal have purchased TV transmitters equipped with TH 563 high-power UHF tetrodes.

Chyron, Melville, NY, has delivered a CODI text and graphics generator to Morrow Technologies, Largo, FL. Also, Chyron has sold 22 CODIs to France 3, France.

Quantel, Darien, CT, has sold a Hal digital composer to Fox Tape, the promo/post-production arm of Fox Broadcasting, Los Angeles.

Ramko Research, Rancho Cordova, CA, has sold ACS/RS1601 modular routing systems to Digital Cable Radio's transmission station, Staten Island, NY.

Ampex, Redwood City, CA, has installed four DCT 700d tape drives and five D-2 digital tape recorders at Post Edge, Miami, FL.

In addition, Crest National Film Labs, Los Angeles, has purchased a complete DCT system. Tape House, New York, has added two DCT 700d tape drives to its facility as well. The Post Group, Los Angeles, also has purchased eight DCT 700d tape drives and a DCT700s post-production switcher.

Matsushita Electric Industrial Company, Osaka, Japan, has signed a technical cooperation contract with Samsung Electronics, Republic of Korea, to lend technical support for broadcast and professional/industrial video equipment. Under the agreement, Samsung will manufacture and sell the NTSC models of D-3, MII and S-VHS VTRs for the Korean market under the Samsung name.

Larcan, Mississauga, Ontario, Canada, has entered into an agreement with Television Nacional de Chile for the purchase and installation of 32 M series VHF TV transmitters.

BTS Broadcast Television Systems, Salt Lake City, **Sony**, Montvale, NJ, and **Thomson Broadcast**, Englewood, NJ, have announced that they will fully support the digital betacam format.

Cold Regions, a research and engineering laboratory based in Hanover, NH, would like to speak with people who have had a tower collapse, either partially or totally, because of icing. For more information, contact Nathan Mulherin, Cold Regions Research and Engineering Laboratory, Hanover, NH 03755-1290; phone 603-646-4259; fax 603-646-4644.

KUB Systems, Foster City, CA, has been founded by three video industry veterans: Yeshwant Kamath, Dan Beaulier and George Uibel. The initial focus of the company is on the digital video equipment market for the broadcast, cable and corporate industrial TV markets, with emphasis on post-production applications that require image processing and video storage.

Ampex, Redwood City, CA, has formed Ampex Digital Media, which will concentrate on developing and supplying specialized high-performance magnetic media for use with the company's current digital video and mass data storage recorders.

BTS Broadcast Television Systems GmbH, Salt Lake City, and **Toshiba**, Tokyo, have unified their digital HDTV cassette recording formats into a universal digital recording format capable of handling the HDTV standards in use today. Both companies will manufacture and sell HDTV recorders under their own brand name.

Comtronix Systems Inc., Springfield, MA, has been formed. It specializes in the design and manufacture of solid-state RF amplifiers for broadcast communications, military, laboratory and education. The address is 220 Brookdale Drive, Springfield, MA 01104; phone 413-785-1313; fax 413-739-1352.

Energy-Onix, Hudson, NY, has received the "Exporter of the Year" award for the Syracuse, NY, district from the U.S. Small Business Administration.

Vyvx, Tulsa, OK, has entered into a 5-year agreement with IDB Broadcast to provide IDB with fiber-optic TV transmission services. Vyvx also signed an agreement with Cox Cable, Oklahoma City, whereby Cox will provide first- and last-mile service connections for Vyvx's nationwide fiber-optic TV transmission system within the Oklahoma City area.

Accom, Menlo Park, CA, and **Grass Valley Group**, Grass Valley, CA, have entered into an agreement to cooperatively market Accom's line of digital video disk recorders along with Grass Valley's post-production systems.

Pesa, Melville, NY, has acquired Micro Communications, Manchester, NH.

A.F. Associates, Northvale, NJ, has celebrated its 25th anniversary.

Vinten Broadcast, Suffolk, England, has been appointed the exclusive UK distributor for Anton/Bauer battery and lighting products, Shelton, CT.

Vinten also has been chosen by Grupo Televisa, SA de C.V. in Mexico, together with BTS Broadcast TV Systems, Salt Lake City, to supply camera-mounting equipment to support the BTS LDK9 and LDK91 cameras and the Panasonic AJ-D310 ENG cameras for Televisa's expansion program.

Avid, Tewksbury, MA, has been awarded an Emmy for outstanding achievement in engineering and development of the Media Composer digital non-linear editing system.

Ultimatte, Chatsworth, CA, has been chosen to supply Memory Head and Memory Head Utilities on a new pilot series called "Viper."

Also, Ultimatte's CINEFUSION software has been used to help develop special effects for the movies "The Last Action Hero," "Cliffhanger," "In the Line of Fire," "Super Mario Brothers" and "Hocus Pocus."

PEOPLE

David Nicholas, Paul Dempsey and **Robert Bennett** have been promoted to positions with Pioneer New Media Technologies, Upper Saddle River, NJ. Nicholas is senior vice president. Dempsey is vice president of marketing and technology, and Bennett is manager of sales.

Paul M. Yarmolich has been named vice president of engineering for Chyron Corporation, Melville, NY.

Robert Donnelly has been promoted to vice president of engineering for ABC Radio Networks, New York.

Paul E. Wright, chairman of Chrysler Technologies Corporation, has been appointed to the Odetics board of directors, Anaheim, CA.

Annette Sardelich, Stephen Sedoff, John Miller and **Alan Schoenberg** have been appointed to positions with Pro-Bel, Dunwoody, GA. Sardelich is chief financial officer. Sedoff is Western regional manager. Miller is Northeastern regional manager. Schoenberg is Southeastern regional manager.

Tom Makofske and **Herb Clann** have been appointed to positions with BEC Technologies, Seattle. Makofske is chief financial officer and Clann is the company's production manager.

Bill Beckner has been promoted to chief engineer for WUSA-TV, Washington, DC.

Wataru Ogawa, Tom Evans and **Mike McMahon** have been appointed to positions with Sony, Montvale, NJ. Ogawa is president of the Recording Media Products Group for Sony Sales and Marketing of America, Park Ridge, NJ. Evans is promotions manager for Sony Professional Tape, a division of Sony Recording Media of America. McMahon is Southwest district sales manager for Sony Professional Tape.

Geoffrey N. Mendenhall and **Joseph A. Huie** have been named to positions with Harris Allied Broadcast Division, Quincy, IL. Mendenhall is president and radio product line manager. Huie is vice president/general manager.

Bill Boxill has been appointed sales manager for Tektronix's Television Products Division, Beaverton, OR.

Roger C. Cady has been named vice president of business development for Dynatech Corporation, Burlington, MA.

Haruo Murase has been named president and CEO of Canon U.S.A., Lake Success, NY.

Ken Ellis and **Gordon Banta** have been named to positions with Quantel, Darien, CT. Ellis has been elected to the board of directors. He also has assumed the title of executive vice president/chief operating officer of the company. Banta is West Coast district sales manager/broadcast products.

Joe Lantowski has been named director of marketing for Vinten Broadcast's (Towaco, NJ) MICROSWIFT camera robotics system.

Bernard (Ben) M. VanBenthem has been appointed vice president of engineering for PESA Switching Systems, Huntsville, AL, a member of the PESA Chyron Group. ■

Field Report

ENCO Systems DAD486x

By Joey Ryan

WJBK-TV, Detroit, recently acquired a new production tool—the ENCO Systems DAD486x digital audio delivery system. It is configured as a stand-alone workstation built on an 486/50 PC platform that stores digitized audio on a 660Mbyte (or larger) internal hard drive. The system is designed to be a direct replacement for existing tape-based record/playback systems. In WJBK's application, it plugged into existing audio and remote-control connections.

Before acquiring this system, WJBK followed the typical TV station tradition of producing and storing audio on cart and reel-to-reel tape. Most of the station's audio work involves the creation and storage of daily announcements, tags and voice-overs used on-air. The digital audio delivery system's value to these processes was first recognized in its considerable reduction of what might be called "prep work."

Previously, this function included locating the required cart(s) of the proper length (often scattered between several different areas of the building), typing all labels and bulk erasing/splice finding each cart. For reel-to-reel projects, preparation included bulk erasing a reel of tape, threading it onto the tape machine, and laying down 20 seconds of 1,000Hz tone at 0VU.

A quick timing of these duties indicated that preparation took more than a minute per cart, and approximately two minutes for a reel-to-reel project. Similar preparation on the digital system takes 30 seconds or less. This includes entering the "electronic label" for the cut and engaging the record mode. After multiplying these figures by an average of 10 to 20 carts per weekday and 45 to 75 carts per weekend, the prep time savings were considerable.

Regarding the time required to actually record a spot, time savings were again noted. Because many spots are not recorded or dubbed to cart perfectly on the first take, re-recording often is necessary. With an audio cart, that means removing the cart from the record machine, inserting it into the bulk eraser/splice finder and waiting for it to recue. This process was timed at 44 to 52 seconds per retake. For reel-to-reel, the required rewinding and recuing time ran 30 to 50 seconds, depending on the length of the spot. With the digital audio system, hitting STOP, then RECORD, is all that is required. Again, for a session with multiple spots and multiple takes, the time savings can quickly add up.

The reduction in maintenance and media costs that the system offers adds to its value, especially considering the six hours of fully indexed, CD-quality audio that the device holds on its internal hard drive.

Ryan is a writer/producer and announcer for radio and television in Detroit.

Performance at a glance:

- *Combines automation system and audio workstation features*
- *Intuitive interface resembles standard cart machine*
- *Touchscreen minimizes learning curve*
- *High-capacity, random-access audio storage on SCSI-2 hard disk(s)*
- *Supports multiple data compression systems and linear PCM*
- *Controls or slaves to external devices*
- *Options available for networked operation, script display and traffic system interfacing*

The DAD486x's design is based on intensive research with broadcasters.

Intuitive operation

The digital audio delivery system's design is based on intensive research with broadcasters. The device also is friendly to users who are not familiar with computers. The visual image displayed on the system's primary screen looks like two cart machines side by side. On the left is the "record" machine and on the right is the "playback" machine. This screen contains 3-D images of all the familiar buttons: RECORD, PLAY, PAUSE, EDIT and STOP.

Control is accomplished with either a mouse or a touchscreen. For most functions it isn't necessary to use the QWERTY keyboard. This is perhaps the most inviting feature to those users of the system who are not computer enthusiasts. The touchscreen interface is enhanced by animation that makes these buttons appear to move when touched, followed by a change in their shadowing to indicate that they have been engaged.

For most functions it isn't necessary to use the QWERTY keyboard. This is an inviting feature to those who aren't computer enthusiasts.

The video display also provides bar graph audio-level metering that emulates a row of LEDs, and slide controls to adjust the input and output levels.

The system manual is easy to follow and gives clear explanations of the unit's features and functions. The intuitive design of the system allows most users to learn its operation by just using it, however. The emulation of the extremely familiar cart machine keeps the learning curve simple, but the similarity to the cart machine does not extend to the system's audio quality. In that area, comparisons to the CD are more appropriate, such as frequency response of 20Hz to 20kHz ±0.1dB, dynamic range of 92dB, unmeasurable wow and flutter, distortion of 0.02% and interchannel phase error of <0.1° at 15kHz.

The system also provides functionality well beyond carts, such as graphically displayed, touchscreen-controlled audio editing. By touching and sliding two graphical pointers, an operator can set start and end points, embed secondary and tertiary cues, and perform cosmetic editing, such as breath/pause addition or removal and rearrangement of words and phrases. Editing is non-destructive, allowing instant

return to the original audio if necessary. A cut's running time is continuously displayed and automatically updated throughout the editing process.

The digital audio system allows creation of unlimited lists of cuts that can be arranged for sequential playback. These playlists may contain any cut from the library, and can be set to play cuts back-to-back without operator intervention. This allows a station to create playlists of daily announcements that automatically sequence the next cut into the ready mode as each preceding cut is played to air. (Alternatively, complete programming streams can be programmed for continuous, automatic and unattended playback operation, as might be used in a radio application.) These playlists can be updated at any time, allowing the master control operator to insert, delete or even re-edit any cut before putting it on air.

Given the device's numerous features, it's hard to find anything negative about it.

The system also has some powerful random-access playback features. Six buttons along the bottom of the screen may be assigned to instantly play any six cuts from the library. These buttons are present and active on every display screen, keeping important announcements, such as station IDs or "Please Standby" emergency announcements literally at the operator's fingertips.

A selectable extension of this feature is the *array* mode. This turns the entire screen into an array of 48 additional buttons, each of which may be assigned to instantly play any cut from the library. Assignment also is accomplished via the touchscreen, by selecting *assign* mode, touching the button on the array to be programmed, then touching the desired audio cut on the library listing. This programs the button and inserts the cut's title into the button's face. The operator can even choose a color for the button. Three such pages can be stored in a user setup file, allowing each operator to have a custom color-coded collection of 148 instant play buttons. WJBK has used this feature to create panels of program disclaimers, generic voice-overs, program openings/closings and test signals. This feature could be useful in sound effects applications.

The DAD486x on air from the WJBK-TV master control room. (Photo by Jim Mackey.)

Issues to consider

Given the device's numerous features, it's hard to find anything negative to say about the system. Nevertheless, there are a few items worth mentioning that WJBK has noted after its installation. The first issue concerns the touchscreen monitor. It provides a welcome user-interface design, but it takes up considerable space and generates a lot of heat. If this system's

use is established before a control room is designed, it can be easily accommodated. However, retrofitting the system in an ideal fashion into existing spaces may be a bit challenging.

The level faders' operation also could be improved. At present, there are two separate controls for left and right channels, and it would be helpful to be able to gang them together. The record machine also could use a few more features, such as the ability to append more audio onto the end of an existing cut. In addition, it would be useful if the cut-number auto-assignment feature were able to create an incremental sequence from a given starting-cut number. Currently, this feature only provides *lowest available* and *next available* start-number modes. Finally, when using a mouse, many of the buttons seem a bit sensitive and react too quickly.

In terms of reliability, the DAD486x's performance has been impeccable.

These are clearly minor points, and because most concern software-based matters, the factory is likely to address them in the next release. (Editor's note: The latest version of the system's software incorporates all of these suggested features, in response to this user's comments.)

WJBK also had a few minor problems when the device was first installed. As the system's configuration was expanded to accommodate growing use, operators began to experience occasional difficulties. Apparently, such application exceeded the limits of the original demo software installed. We also experienced some glitches when starting the system remotely from the master control switcher. A call to the manufacturer provided us with updated software via modem that corrected the problems.

In terms of reliability, the DAD486x's performance has been impeccable. Although WJBK is not using any of the backup options available for the system, no data loss has been experienced to date. The system includes a convenient feature that allows it to return to its current state should power be interrupted or the system rebooted. For example, WJBK recently suffered a power outage that required the station's backup generators to be activated. When power returned, the system restarted, loaded its program, reloaded the current playlist, and sequenced to the proper cut. It was ready to play, before the transmitter was back on the air. Although running without backup is not recommended, in nine months of operation, WJBK has never experienced a failure.

The ENCO Systems DAD486x has dramatically changed the way audio is handled at WJBK-TV. It has allowed staff to produce work in greater quantity and with higher quality, in less time and in a more organized fashion. New applications for the product are continually being discovered at the station. Its eventual uses seem limited only by the imagination.

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

➡ *For more information on the ENCO Systems DAD486x, circle (310) on Reply Card.* ■

Field Report

Fidelipac DYNAMAX DCR1000 series digital cartridge machine

By Christopher H. Scherer

The Fidelipac DYNAMAX DCR1000 is designed to directly replace the analog cart machine. It is compact and offers many cart-like features plus digital audio recording on removable media.

The system uses 3.5-inch floppy disks as "carts." It supports standard high-density (HD) 2Mbyte and triple density (TD) 13Mbyte diskettes. (Note: the TD format name refers to its tripling of extra density [ED] diskettes' 4.4Mbyte capacity.) The system offers four sampling frequencies: 22.05kHz, 25.75kHz, 32kHz and 44.1kHz. As always, high-frequency cutoff occurs at approximately half of each sampling frequency. Table 1 shows the various recording times for each disk format and bandwidth. The system employs the apt X-100 algorithm (4:1 data reduction) to achieve these capacities.

The DYNAMAX DCR1000 is designed to directly replace the analog cart machine.

The system has two components: the DCR1020 master player and the DCR1040 record module. All master players can be made record-capable by adding a record module. In the near future, the manufacturer plans to release a subplayer, which will add a second playback drive to any master player, deriving power from the master, and also using its D/A converters for playback. All units are 1/3-rack space wide, measuring 5.5" high (14cm) x 5.5" wide (14cm) x 12.875" long (32.7cm). They can sit alone as tabletop units or can be mounted in an optional rack-mount adapter. The master player weighs 12.6 pounds (5.7kg), and the record module weighs 7.4 pounds (3.4kg).

The emulation of standard analog carts is maintained on the front panels. The player has PLAY, STOP and CUE buttons.

Scherer is an engineer at WDOK-FM/WRMR-AM in Cleveland.

Performance at a glance:

- *Digital spot recorder using 3.5-inch floppy disk media*
- *Closely emulates cart machine operation*
- *Simple yet flexible design*
- *Dynamic range of >90dB*
- *Less than 0.05% THD, record/play at 1kHz*
- *Unmeasurably low wow and flutter, crosstalk and phase error*

The CUE button does not activate a fast-forward function like its analog counterpart, but serves to either select a specific cut on a disk (if more than one exists) during ready mode, or recues the current cut when the deck is in play mode (or a cut was manually stopped while playing). The record module has RECORD, SEC, TER, and START-ON-AUDIO buttons. The START-ON-AUDIO button can be pressed after the machine is armed for recording to automatically begin the recording process when audio is sensed. The sensing threshold is adjustable from -60dB to -15dB (referenced to the adjustable input level's 0dB value) in 3dB steps. The front panel of the master player also features a backlit LCD display showing machine status, cut identification, time, title and outcue on a 2-line, 24 character-per-line screen. In addition, the record module's front panel contains peak-reading LED audio level meters scaled from -20 to +8 and an overload indicator.

Located above the record control buttons on the record module are five smaller buttons labeled COPY, MODE, SAMPLE, INPUT and FORMAT. COPY sets up the machine to do direct digital copying between machines. MODE selects either stereo or mono input for recording. Mono recording is accomplished by summing the left and right inputs in the analog domain and then recording. On playback, mono is automatically sensed and audio is fed to left and right outputs. SAMPLE sets the sampling rate. INPUT selects either the analog or digital inputs. The FORMAT button is used to erase a previously used diskette. In the case of an HD disk, it provides the option of leaving the previous formatting in place and just removes the audio address information, or completely reformats the disk. In the case of a TD disk, it just erases the audio data because these diskettes are preformatted by their manufacturers. A new TD diskette requires a quick format to initialize it, a process that is completed in less than one second. Full formatting of an HD diskette takes approximately one minute.

The rear panel of the master player has the IEC power cord connector that includes a recessed power switch, line filter, fuse holder and voltage selector, the analog audio outputs (two male XLRs), AES/EBU digital out (XLR male), the remote-control/tally connector (DB-25 female), RS-232C/RS-422A connector (DB-9 male), DC power connection for up to three subplayers (6-pin Molex), DC power for the record module (10-pin Molex), and the DCR bus connector (40-pin box header) for connection to record modules or subplayers. All of these connectors are laid out cleanly, with ample room for fingers to access them. Trim pot adjustments for repro levels are located next to each analog XLR. Output level is adjustable from -10dBu to +20dBu, at an impedance of 47V.

A backlit LCD display shows machine status, cut identification, time, title and outcue.

The rear panel of the record module has the analog audio inputs (two female XLRs), AES/EBU digital input (XLR female), the DC power input and the DCR bus (same as master player), and a parallel printer port (DB-25 female). The printer port can be used for printing labels to put on the diskettes. Trim pot adjustments also are located next to the analog XLRs for input level adjustment (-10dBu to +10dBu). In-

put levels are electronically balanced with >10kV impedance.

The record module also has a connection for a PC/AT-style keyboard. The keyboard is used for alphanumeric labeling of disks (for titles and outcues), and is used as a controller for setting status flags, shifting start/end times and establishing other parameters for recording (such as looping). Specific keys can emulate all of the front-panel machine functions as well (P = play, S = stop and so forth). Each record module includes a PC/AT keyboard.

Operation

The master player has three operating modes that can be selected from the front panel:

1. *Manual mode*. Disk always cues to cut No. 1 on insertion. Disk will only cue to other cuts if manually changed by pressing cue button.

2. *Theater mode*. Disk always cues to cut No. 1 on insertion. After a cut has played, the machine cues to the next cut (for playback in that machine at that loading only).

3. *Cart mode*. Disk cues to the next cut in rotation when inserted. After a cut has played, the machine cues to the next cut, and this cut remains cued for playback in any machine (that is set to the cart mode) when the disk is removed. This mode emulates an analog cart machine's reaction to a cart with multiple cuts on it (assuming all decks in the facility are set to cart mode). When using cart mode, the rotation will occur only when a cut is played through entirely and the next cut is allowed to cue.

Replacing analog tape heads can take several hours, while average disk drive replacement time is less than 15 minutes.

Up to 16 cuts can be recorded on a disk. Cuts can be added at any time by arming the machine in record, and then cuing to the next available cut. Existing cuts also can be recorded over. For example, if there are three cuts on a disk and you want to record over cut No. 2, simply cue cut No. 2, remove the safe status flag (if present), press record, and then record the new audio. Just like analog carts, the new program cannot exceed the length of the cut it is replacing. If repeated cut rerecording is anticipated on multicut disks, leave a few seconds of silence at the end of each cut to allow some room for timing variations. SKIP flags also can be added to a cut to remove it from rotation.

Many new features have been added in a recent software revision (v 2.0). These include expanded editing, looping and rotation functions, full support for remote control or computer logging/printing via the RS-232 port, non-volatile RAM storage of setup defaults, up- or down-counting on timers, expanded SEC and TER cue functions and display, and a kill-date feature. A new selectable replay-lockout feature will not allow the same disk to be replayed twice in succession without pressing STOP in between plays. The three playback modes listed previously may now be specified by each disk, allowing variation from the machine's default status if desired. Current rotation mode is displayed on the LCD window.

Comparative analysis

Maintenance costs for parts are similar to analog cart machines. A new set of stereo heads for a typical cart machine costs approximately $250. Adding a new pinch roller and capstan lubrication brings the cost close to the $275 list price of a new DCR1000 disk drive. The replacement cycle time is likely to be longer with the digital system. However, analog cart tape heads can last approximately three years with average use, while the mean time between failure (MTBF) for the 3.5-inch floppy disk-drive system is rated at more than 30,000 hours, or approximately 3.5 years nonstop.

Maintenance time also should be less with the digital approach. Replacing analog tape heads can take up to several hours, while the average disk-drive replacement time is under 15 minutes. Replacing the drive simply involves removal/replacement of the top cover, power and data connectors and four screws holding the drive in place. The new drive requires no alignment procedure.

The system involves simple and familiar aspects of machine operation in a spot recorder/player.

CAPACITY	AUDIO BANDWIDTH			
	10kHz	12kHz	15kHz	20kHz
Sterec:				
2Mbyte	1:14	1:03	:51	:37
13Mbyte	7:30	6:25	5:10	3:45
Monc:				
2Mbyte	2:28	2:06	1:42	1:14
13Mbyte	15:00	12:50	10:20	7:30

Table 1. *DYNAMAX DCR1000 audio bandwidth vs. recording time (in minutes and seconds) for sampling rates of 22.05kHz, 25.75kHz, 32kHz and 44.1kHz, respectively, on 3.5-inch diskettes of HD (2Mbyte) or TD (13Mbyte) varieties. The non-standard 25.75kHz rate is chosen to allow a 60-second stereo spot to be recorded on an HD disk. The DYNAMAX DCR1000 is designed to directly replace the analog cart machine.*

Finally, the purchase price of the system is competitive with better analog cart machines, as is the cost of media. Any 3.5-inch HD disk can be used for recording. These are widely available and can cost less than $1 apiece when purchased in quantity. The TD disks also are available at some computer stores, or may be purchased from Fidelipac for $8.75 each. Disk life is listed as >3,000,000 passes/track.

The Fidelipac DYNAMAX DCR1000 series involves simple and familiar aspects of machine operation in spot recorder/players. It provides the quality of digital audio for approximately the same price as an analog cart machine. As radio stations move ever closer to the fully digital environment, the DCR1000 provides a significant and easily implemented step along the path.

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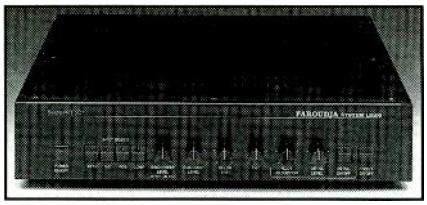
➡ *For more information on the Fidelipac DYNAMAX DCR1000 series, circle Reader Service Number 311.* ■

New Products

PAL/NTSC line doubler
By Faroudja Laboratories
• **LD100-U**: combination decoder-line/doubler-bandwidth expander; can be used to assist projectors, data-grade monitors and large TV sets to display PAL or NTSC source with image quality comparable to 35mm film display.



Circle (350) on Reply Card

Antenna product line
By NSI
• **Stiletto**: solves installation problems of tower windloading, tower space and site aesthetics; available in 3x6 and 4x8 in standard and shrouded versions; 6-15GHz frequency bands.
Circle (351) on Reply Card

Sound-absorbent wedges
By USAFoam
• **Studiofoam**: formulated of high-density polyurethane open-celled foam rubber; 2# density; flame retardant.
Circle (352) on Reply Card

Fiber-optic snake systems
By Telecast Fiber Systems
• **Sidewinder**: fiber-optic ENG/EFP video/audio/comm/control snake; extends reach to 10km without repeaters; portable; battery or AC operated; built-in UPS protection.
• **Viper**: fiber-optic EFP video/audio snake system; outboard, modular configuration of the Sidewinder system; lightweight; NiCad battery operated; optional copper pairs.
Circle (353) on Reply Card

Digital intercom system
By Clear-Com
• **Matrix Plus II**: 100x100 digital central matrix intercom system; features software-adjustable system level controls, user-transparent "intelligent linking" between systems, full system-wide programming from visual display control stations; DMTF system access from any touch-tone phone in the world.
Circle (354) on Reply Card

Video storage product
By Recognition Concepts Inc.
• **VDR**: videodisk recorder allows expandability in capacity as well as the number of bits, channels and users; RAID design permits wide range of recording times, with up to 100 minutes of composite, 50 minutes of component and 34 minutes of HDTV.
Circle (355) on Reply Card

Compact D-3 digital VTR
By Panasonic
• **AJ-D340**: weighs 31kg, 4 rack units high; accepts three sizes of D-3 casette without an adapter, giving a continuous play/record time of more than four hours on a single ½-inch cassette.
Circle (356) on Reply Card

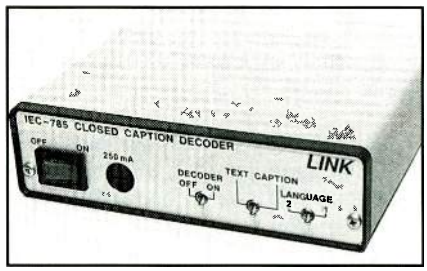
Hardware control panel
By Otari
• **CB-158**: for ProDisk line of digital audio workstations; speeds up operation of ProDisk system; recording and editing functions placed on dedicated keys; provides control of up to four external video or audio decks via ProDisk's machine control capability.
Circle (357) on Reply Card

Field production lenses
By Fujinon
• **Ah66X9.5ESM**: for ⅔-inch cameras; maximum aperture is F1.6 from 9.5mm to 313mm and F3.2 to 625mm; maximum photometric aperture is T1.8 and minimum object distance is 2.7m.
• **Sh66X7.3ESM**: for ½-inch cameras.

Circle (358) on Reply Card

Edit desk
By Winsted
• **Double Cabinet Edit Desk**: ideal for multimedia editing; set up to fit most controllers; features a total of 106-inches of space; file drawer included.
Circle (359) on Reply Card

Closed-caption decoder
By Link Electronics
• **Model IEC-785**: for insertion of closed caption and text data into the video signal for display; self-powered unit for tabletop or rack-mount operation; features looping high-impedance input, with composite video output with caption and text that can be turned off from the front panel; can process and display all standard line 21 closed-caption and text format information; two languages selectable from the front panel.



Circle (360) on Reply Card

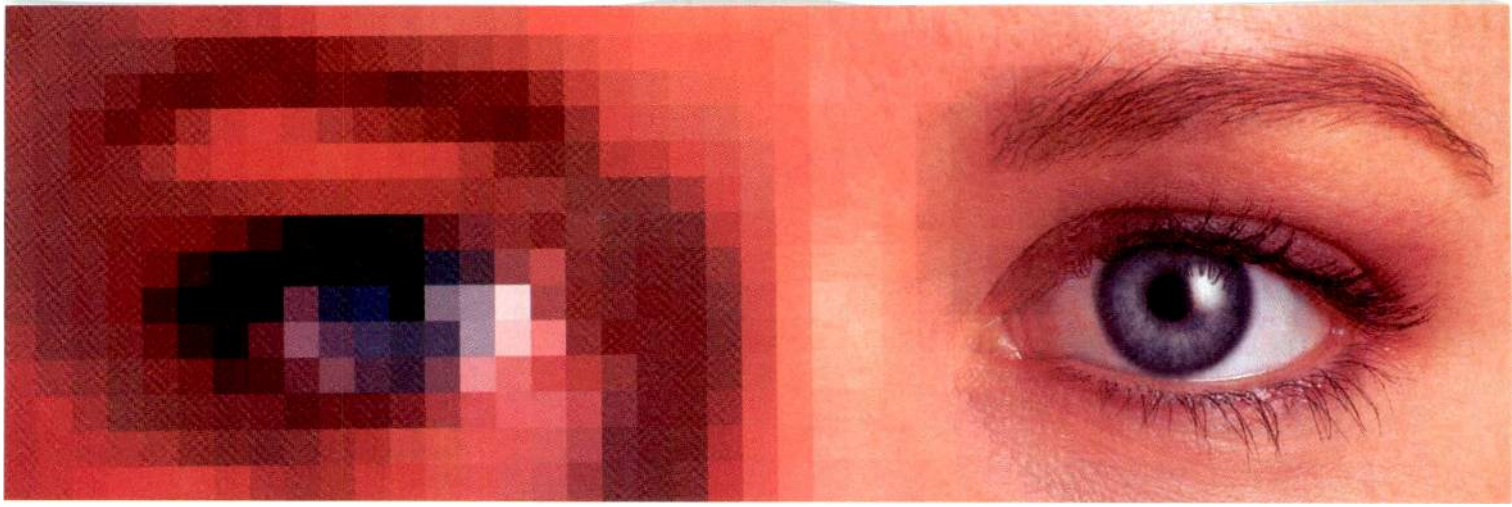
Tri-Power condenser mics
By AKG Acoustics
• **C5900**: hand-held vocal mic; features TPC-1 condenser system and Power Grip triangulated body design; InterSpider provides shock isolation.
• **C5600**: features large diaphragm TPC-II condenser system and InterSpider.
Circle (361) on Reply Card

Test equipment
By Siecor
• **VFL-200 Visual Fault Locator**: tool for visually pinpointing faults during installation, maintenance and production; emits visible red glow at point of high loss.
Circle (362) on Reply Card

TBC/synchronizer
By James Grunder & Associates
• **Feral Dual 4:2:2**: 1U high, rack-mountable unit accepts up to two TBC/frame store synchronizer boards; may be fully driven via front panel or via RS-232 serial port remote control.

Circle (363) on Reply Card

Digital video analyzer
By AAVS
• **S310**: tests serial and parallel digital video signals, ensuring that they comply to all international standards; provides user with all information needed to make accurate decisions regarding system performance and operation.
Circle (364) on Reply Card



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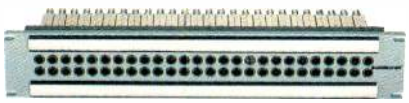

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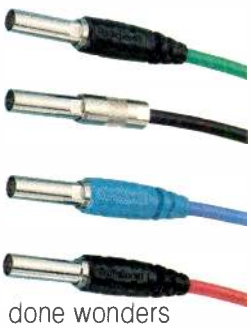

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PAL video synchronizer

By Tektronix

• **VS211A**: enhanced version of VS211; new features include 8-field memory, tracking into noise, serial digital I/O and ITS passing.

Circle (365) on Reply Card

Serial monitoring unit

By Panasonic

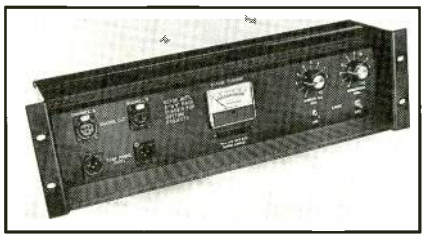
• **SMU3**: incorporates three identical circuits in a single 1U rack-mounting module; allows monitoring of SDI signals on conventional monitors; can convert any SDI signal to its analog equivalent signal; each unit has SDI input with active loop-through.

Circle (366) on Reply Card

Chassis

By Gepco International

• **Rack-mount custom chassis**: designed to fit standard 19-inch rack; made of extruded aircraft aluminum; 5.25"x4.25"x17"; includes enough channeled cut-outs for loading up to 10 PC boards; front panel measures 3.5"x17" and can be customized for various requirements.



Circle (367) on Reply Card

Video recording system

By Digital Processing Systems

• **DPS Personal Animation Recorder**: plugs directly into an Amiga expansion slot; replaces the record VCR and single-frame controller; supports direct rendering of all common image formats, including 24-bit IFF and Video Toaster framestore files.

Circle (368) on Reply Card

Widescreen CCD cameras

By Sony

• **BVP-375 WP**: 625-line, 16:9 studio/OB camera.

• **BVP-90 WP**: 625-line, 16:9 portable model camera; can be used in CCU, stand-alone or camcorder configuration.

Circle (369) on Reply Card

Communications system

By Sony

• **Laser Beam Link**: provides and maintains point-to-point video and audio communications link with field cameras; uses infrared technology instead of radio frequencies to transmit component or composite video from remote locations or between buildings.

Circle (370) on Reply Card

LCD color monitor

By Sony

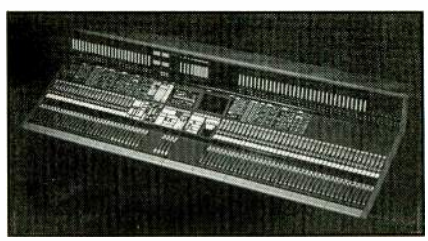
• **FDL-X600**: high-quality portable LCD color monitor for ENG and EFP; features highest pixel count of any portable LCD monitor on the market; weighs less than three pounds; powered by a standard rechargeable 9V camcorder battery or car battery adapter; 5.9-inch screen uses TFT active matrix drive system; accepts NTSC and PAL signals; automatically selects between 525- and 625-line standards.

Circle (371) on Reply Card

Digital console

By Sony

• **DMX-S6000**: digital audio-for-video post-production system; available in four frame sizes from 24 to 64 AES/EBU channel inputs and up to 56 buses; control surface can be remotely located from the separate main processing rack to aid installation; up to six transports can be controlled via the console's 9-pin machine option.



Circle (372) on Reply Card

High-definition videodisc recorder

By Sony

• **HDL-5800**: high-definition write-once videodisc recorder/player; can store

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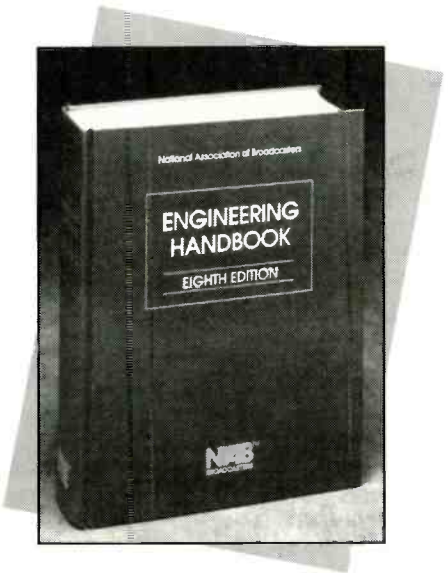

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High-definition video products

By Sony

• **HDVF-770**: low-power 7-inch high-definition camera viewfinder; designed to fit HDC-500 CCD camera; 50% smaller than previous model; consumes half the power, operates at 12VDC; horizontal resolution of 800 TVL and an advanced peaking circuit.

• **PHM-3400E**: 34-inch high-definition color monitor; uses Trinitron technology; 16:9 aspect ratio; 25MHz video signal bandwidth.

Circle (374) on Reply Card

Business and industrial products

By Sony

• **DXC-537AP video camera**: latest version of DXC-537P camera; improvements include separate high-quality shotgun effects microphone, an updated optical low-pass filter and refinements in the video processing circuitry to enhance video performance.

• **PVV-1AP recorder**: dockable Betacam SP 2000PRO recorder supersedes the PVV-1P unit; adds ability to provide color playback via VA-500P playback adapter.

• **EVO-985P**: Hi8 format recorder; includes all features of a full editing machine, including improved servo speed, digital audio jog capability, improved field-based dropout compensator, and luminance and chrominance noise reduction.

• **PVE-500 editing controller**: ideally suited to integrate with the Hi8 and 2000PRO series machines and DFS-500 digital effects switcher; serial control ports drive three VTRs, a video switcher and an audio mixer.

Circle (375) on Reply Card

Furniture systems

By Sysflex

• **Flexible technical furniture**: complies with 19-inch industrial standards; completely modular; ergonomic; front rack angle adjustable from 0-30°; easily adjustable with an allen key; wide range of accessories available.

Circle (376) on Reply Card

Video production system

By For.A

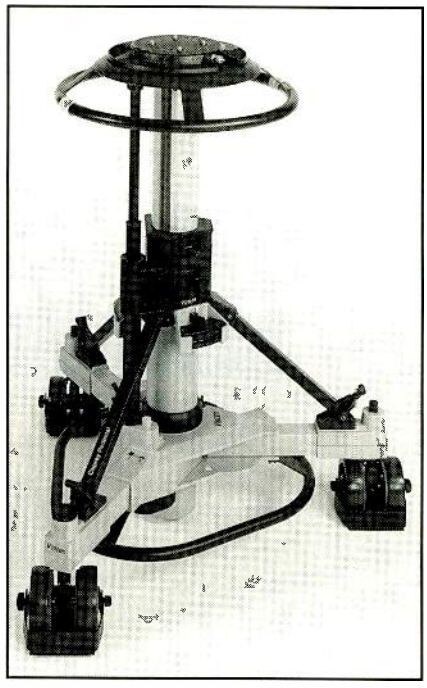
• **VPS-300P**: features full spec mixer with digital wipes and a built-in 3-D DVE with light source.

Circle (377) on Reply Card

Pedestal

By Vinten

• **Osprey Plus**: enhanced version of Osprey pneumatic portable pedestal; offers additional stability and increased payload capacity; optional lightweight dolly fits standard dolly track and easily adapts Osprey pedestal column for tracking shots.



Circle (378) on Reply Card

Digital component mixer

By For.A

• **DVM-400P**: superior 16/32-bit processing; includes three key layers with shadows; compact design.

Circle (379) on Reply Card

Measurement TV demodulator

By Barco

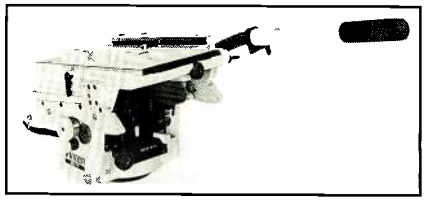
• **TMD 200**: consists of three separate units combined in one mechanical housing: a tunable RF downconverter covering from 45MHz to 860MHz, a TV demodulator with sound trap and a TV demodulator without sound trap; features four switchable RF inputs, a high S/N ratio, selectable synchronous and envelope detectors, and a zero reference pulse.

Circle (380) on Reply Card

Cam head

By Vinten

• **Mk7B Classic cam head**: provides extended pan and tilt fluid drag levels, improved ergonomics and increased mechanical stability for narrow angle shots using the larger, higher magnification telephoto lenses; maintains previous 114kg payload capacity with 19kg weight.



Circle (381) on Reply Card

Digital video effects system

By For.A

• **MF-300P**: features a 3-D DVE with anti-aliasing; also includes light source, trails and page turn.

Circle (382) on Reply Card

Noise-reduction system

By For.A

• **UPD-500P**: median/recursive noise reduction; includes color correction.

Circle (383) on Reply Card

Robotic camera control options

By Vinten

• **XY joystick**: for Exyped pedestal; allows camera to move by pointing joystick in desired direction.

• **active steer ring:** allows Exyped to be controlled like a conventional manual pedestal.

• **Motion Memory**: allows Microswift system to record multi-axis moves and replay them exactly again and again; 100-second memory pool per camera; movements can be entered from MIC100 control panel or directly from pan bars.

Circle (384) on Reply Card

Remote-control system

By Barco

• **RCDS remote-control and diagnostic system**: for simultaneous monitoring and remote control of the headend, monitoring of the coaxial network

and monitoring of the fiber-optic network in a cable TV system; communicates with operator's central office PC and one or more technician-based PC(s) through RS-485 and RS-232 links and via public telephone network.

Circle (385) on Reply Card

3-D digital effects system

By CEL Broadcast

• **MERIDIAN-fx-1000**: modular concept with an all-digital 4:2:2:4 core; analog component or 601 digital component inputs or outputs, together with linear key input in digital or analog, can be configured in a system; basic unit is single-channel model -1000 housed in compact 4U rack unit, capable of A/B transitions with 3-D position/rotation.

Circle (386) on Reply Card

Noise-reduction system

By CEL Broadcast

• **P425 Elvira**: makes digital video noise reduction accessible to post-production, duplication, corporate and industrial facilities; sources can be either analog composite or component.

Circle (387) on Reply Card

Recorder/editor

By Digital Audio Research

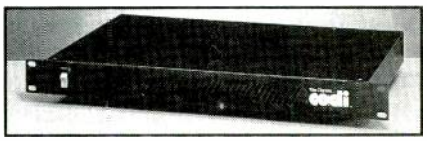
• **Sabre**: 8-channel optical disk-based workstation; features include easy-to-use interface; fast single-page editing; reel-rock, varispeed and TimeWarp; waveform editing; VTR emulation option; multiple external machine control and time-code chase; compatible with SoundStation and Sigma systems.

Circle (388) on Reply Card

Generator enhancements

By Chyron

• **CODI improvements**: more than 30 new features, including non-display buffer, timing features, event timer and timed macros; 8-bit, 256-color PCX graphics; RGB chroma-key for matting; matrix wipes; PCX graphics import; multipoint operation with sequencing; message upload and download from host computer; software and hardware executable GPI macros; GPI write-to-battery backed-up RAM for power-on instant displays.



Circle (389) on Reply Card

Transmitter

By Harris Allied Broadcast Division

• **Harris Quest series**: 1kW solid-state VHF/FM broadcast transmitter; 8.75-108MHz broadband design; integrated exciter; simple front-panel discrete control and monitoring; standard VSWR protection; AC/DC overload protection; remote-control capability;

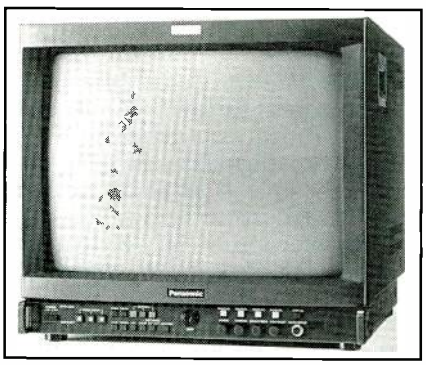
built-in LPF with directional coupler and RF sample port.

Circle (390) on Reply Card

Monitor

By Panasonic

• **AT-H2005D**: digital signal processing Grade 1, 20-inch picture monitor; all signals processed in digital domain until conversion, just prior to CRT driver circuits; inputs include serial and parallel digital inputs, as well as conventional analog composite and component inputs; serial digital inputs feature active serial loopthroughs and EDH; includes three analog composite inputs and one analog component input.



Circle (391) on Reply Card

Tripod systems

By Vinten

• **Vision ST packages**: contains either the Vision 5LF or Vision 10LF pan and tilt head, with single-stage toggle clamp tripod, spreader and soft case.

Circle (392) on Reply Card

Sound effects library

By Digital Audio Research

• **Sound Effects Library**: collection of digitally recorded sound effects and atmospheres; available in 1) a set of three optical disks for use with SoundStation, Sigma or Sabre digital audio workstations; or 2) in a set of five CDs for use with any system; both formats include a 120-page catalog.

Circle (393) on Reply Card

Auto setup monitors

By Pesa

• **PM4400 series**: Grade 2 auto setup monitors; includes 20-inch and 14-inch models; fully compatible with Grade 1 BM4400 series; equipped with multistandard decoders with RGB, YPrPb, PAL, NTSC or SECAM inputs; features automatic sensing and switching of scan rate.

Circle (394) on Reply Card

Character generator

By Pesa

• **CG Stylist**: real time anti-aliased character generator with full operational compatibility with CG Plus graphics workstation; features optional dual-frame buffer and software.

Circle (395) on Reply Card

Software

By Chyron

• **iNFiNiTi! and MAX!> software options**: Message Compose Editing now includes word wrap, insert mode, character grouping and positioning with a mouse; Flash Font features instant texture mapping; Function Key Enhancement includes setup and trigger multiple effects.

Circle (396) on Reply Card

Editing system

By CMX/Chyron

• **AEGIS**: includes rotary switches that can be reassigned by software; LED windows display status of each switch position; features jog/search knob, trackball and floppy disk drive; magnetic signal system provides up to 21Mb of data storage on single disk; Lookahead Preview feature allows editor to create cluster of edits and preview them at once, as a group; Lookahead Assemble speeds assembly process by not stopping recorder between edits when sources are available.

Circle (397) on Reply Card

Routing switcher matrices

By Pesa

• **RM2416V**: video matrix; features 24 inputs and 16 outputs in one rack unit; 100MHz bandwidth.

• **RM22416A**: audio matrix; 24 inputs x 16 outputs stereo or 24x32 mono in two rack units.

Circle (398) on Reply Card

Serial digital routing switcher

By Pesa

• **SD5000**: designed using 600Mb digital switching technology; ideal for switching D-1, D-2, D-3 or PAL and compressed 16:9 HDTV signals; offers flexibility of substituting fiber-optic input and output modules, in groups of eight, with coax I/O modules; 64 inputs x 64 outputs in 10 rack units.

Circle (399) on Reply Card

Workstation disk

By Accom

• **WSD**: desktop real time disk recorder; features custom hardware interface to SGI Indigo; immediate picture transfer to/from SGI Indigo; 32 seconds of uncompressed storage; full ethernet and SCSI implementations; full motion preview on workstation monitor.

Circle (400) on Reply Card

Standards converter

By AVS Broadcast

• **Cyrus Prime**: motion-compensated standards converter converts between all world standards; features all-digital 10-bit decoding and encoding with precise sample rate conversion interfaced to a central core conversion process; supports all variations of analog and digital component video in serial and parallel.

Circle (401) on Reply Card

Mapping and effects system

By AVS Broadcast

• **FreeForm**: digital video effects system includes 3-D image mapping and warp facilities.

Circle (402) on Reply Card

Digital keyer

By AVS Broadcast

• **Dimension**: provides artistic control and flexibility with numerous new facilities, including chroma-keying and key masking, storage, shaping, positioning and transition capabilities.

Circle (403) on Reply Card

Digital color corrector

By AVS Broadcast

• **Balance**: new range of internal color-correction capabilities for Integra.

Circle (404) on Reply Card

Noise reduction/image enhancement system

By AVS Broadcast

• **Film Noir**: film/video noise reduction and image enhancement system; features new adaptive composite input and output options.

Circle (405) on Reply Card

Mixer

By Panasonic

• **AS-D700C**: component serial digital vision mixer; features 15 SDI inputs as standard and with optional modules, four parallel digital inputs (CCIR656) and four component analog inputs can be added; CCIR601 processing, switchable between 8- and 10-bit operation; 23 inputs routed by two 23x10 integral routing switchers to 10 primary source buttons on preset/program bus, key source bus and separately to key fill bus; features two linear key circuits that can be keyed over the other; includes 48 different wipes.

Circle (406) on Reply Card

Camera/recorder and MII VTR

By Panasonic

• **WV-F500 camera**: 3x½" CCD superhigh sensitivity camera; resolution of 700 TV lines; 60dB S/N ratio; sensitivity of f8 at 200lux.

• **AU-45H dockable VTR:** ideal accompaniment to WV-F500; uses 24-minute cassettes; 25% reduction in weight and 30% reduction in power consumption.

Circle (407) on Reply Card

Closed-captioning systems

By Blue Feather Company

• **Caption Box**: portable; lightweight; runs on 12VDC; works with IBM compatibles; optional stenographic keyboard input.

• **Open Caption Upgrade**: takes closed-captioning signals and converts them to open captioning; includes Caption Box features, plus direct type-in mode; runs simultaneously with VGA monitor; also works as character generator.

Circle (408) on Reply Card

Paint and animation package

By Information International

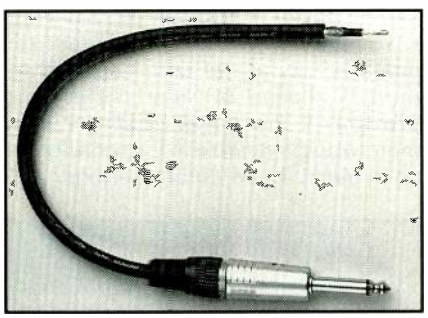
• **ARK*Image***: object-oriented; designed for Symbolics XL 1200 computer and IBM POWER Visualization System multiprocessor; provides artist with various 2-D tools; completely tablet-driven; any user command can be undone instantly with a penstroke; all image operations can be applied with a brush.

Circle (409) on Reply Card

Instrument cable

By Gepco

• **Part No. LN888**: low triboelectric noise cable; features an 18 gauge flexible conductor and extra flexible jacket; for use in connecting instruments with amps, mixers, effects gear and outside signal processing equipment.



Circle (410) on Reply Card

On-line editing systems

By Accom

• **RAVE**: non-linear, full-quality on-line editing system; provides 10-bit D-1 or D-2 video image quality; complete edit suite integration; reads and writes industry standard on-line and off-line EDLs; graphical user interface; non-linear D-1 storage up to 30 minutes; non-linear D-2 storage up to one hour; up to eight non-linear playback sources.

• **Axial 2010**: features 12 high-speed serial ports standard; high-resolution non-interlace edit display (1,280 x 1,024); extended control of serial de-

vices; user-definable menus and controls on keyboard display; EDL; exclusive caching function for automatic "B roll" operations.

Circle (411) on Reply Card

CD player generation

By Studer Revox

• **D730 and D731:** successor models to the A727 and A730; D730 is the desktop model; D731 is a 19-inch rack-mount version; both units feature a large LED display and allow START and STOP cues to be set anywhere; digital output can be configured according to SPDIF format or AES/EBU format.

Circle (412) on Reply Card

2-D/3-D software environment

By Softimage

• **Digital Studio**: complete line of professional digital editing products for video editing, sound editing, compositing, titling, paint, image processing and 2-D/3-D animation.

Circle (413) on Reply Card

Line drawing add-on

By Chyron

• **Sketchpad**: provides capability to draw free-form lines by finger on a touchscreen monitor and all standard CODI functions; can also operate with MicroTouch ClearTek 1000 touchscreen system; operating features include selectable touch sensitivity, time adjustments for horizontal phase, subcarrier phase, key delay and touch accuracy calibration.

Circle (414) on Reply Card

Digital communication system

By Philip Drake Electronics

• **DCS3000:** provides a true digital solution for all studio and OB intercom/talkback applications; single 75Ω coaxial cable is used for interconnection between each control panel and digital routing matrix; giving a full 10kHz audio bandwidth throughout the system; external audio equipment is interfaced via 16-bit A-to-D and D-to-A converters housed within the matrix; 128x128 matrix capacity housed in 9U of rack space.

Circle (415) on Reply Card

Digital audio edit mixer

By Philip Drake Electronics

• **DMX-1000:** compact digital audio mixer designed for video post-production uses; features 20 digital or analog sources on the input side, and four mix buses, four monitor buses and two effects send buses on the output side; includes 7-frame delay.

Circle (416) on Reply Card

Converters

By Studer Revox

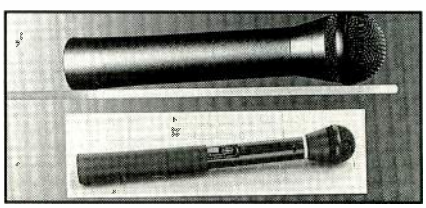
• **DS-D C4:** A/D and D/A dual-stereo converters in a 3U and 4 TE "Europe" format; A/D module converts, in 18 bits, four analog inputs into two AES/EBU outputs in 44.1kHz or 48kHz sampling frequency into four analog outputs; both modules include AES/EBU separate synchronization input and clock jitter reduction

Circle (417) on Reply Card

Microphone/transmitter series

By Telex

• **HT-200 series:** features impressive RF field strength, an antenna integral to the unit that prevents interference, and an easily accessible battery compartment; all switches and controls mounted at base of unit; uses a standard 9V alkaline or NiCad battery and provides a low battery LED for easy monitoring; available in four condenser or dynamic head configurations.



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Telephone interface

By Telex

• **TIF-951:** provides bidirectional communication between intercom matrix and standard dual-tone multifrequency (DTMF) telephone; allows telephone to access all crosspoints of the matrix, dynamic party lines, IFB circuits and other forms of communication; provides transparent link to the telephone system.

Circle (419) on Reply Card

Automation system

By Odetics

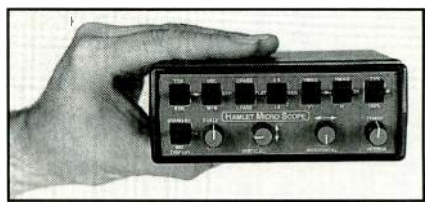
• **OmniCart:** multichannel automation system simultaneously compiles, records and plays to air; multichannel automation software manages recording, program replay and spot insertion for several independent stations on a 24-hour-a-day basis; manages up to eight playlists; supports up to 300 multispot cassettes and accommodates mixed cassette sizes.

Circle (420) on Reply Card

TBC/synchronizer

By Hamlet Video International

• **Hamlet Dual 4:2:2:** 1U high, rack-mountable time base corrector/synchronizer; features high-band performance and full-frame 8-bit 4:2:2 processing; each control includes a preset recall mode and can be fully driven via the front pane or via RS-232 serial port; offers multiple input selection, transcoding between composite and S-VHS video and gen-lock with SC and H phase controls.



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Multiple signal source

By Miles

• **Digital striper:** integrates elements of multiple digital video and audio reference signals into one product, as well as provides additional benefits and functions, such as a Moving Zone Plate and Station Logo Ident.

Circle (422) on Reply Card

Standards conversion system

By Snell & Wilcox

• **Alchemist with Ph.C:** features a fully specified all digital path, 10-bit digital processing, component and composite digital interfacing, and TBC.

Circle (423) on Reply Card

Digital status monitor

By AKG

• **DSM 7:** for checking significant parameters of digital audio connections to AES/EBU and S/PDIF standards; comes with headphones, battery pack and carrying case.

Circle (424) on Reply Card ■

Continued from page 53

Full-screen graphic generated on a PC-based graphics system.

a frame of video, paint it, and output the new frame as video. Creating backgrounds, logos and graphics is quick and easy on the system. Finished projects can be output as either files or video. Files can be transferred to graphics workstations where even more sophisticated tools can be used to further customize the images. Graphics files also can be transferred from workstations into the PC systems, thereby enhancing the workstation's capability.

Two videoDesigners are currently in use at the New Jersey Network, operating on 486/DX2 platforms with RGB monitors. We installed the hardware and software ourselves. Our production capability has been significantly expanded because of the ability to exchange images between the PC and the Graphics Factory workstations. There are some elements and features available on the PC systems that are not available on the workstations and vice versa.

Practical applications

New Jersey Network produces a show, "Meadowlands Marquee," for which a different visual image was desired. The typeface, *Lettres Eclatees*, provided the new appearance we wanted. The characters sort of look like smudged, free-hand crayon-drawn letters. Credits for "Marquee" are created on the PC and colorized. The files are then moved to the Graphics Factory for inclusion in the show.

The PC is used frequently for work involving our underwriters, the corporations that help sponsor the New Jersey Network. The underwriting department provides materials, logos, stats and other flat art needed to produce the spots. With the PC and a copy camera, it is easy to create backgrounds and place the logo where needed. The quality of the flat art runs the gamut from quality stats to black-and-white art that's been faxed. The quality of the brushes, especially the airbrush, make it easy to take poor-quality fax art and make it look good. One of the system's strengths is the quality of the paint system, a conversion of the software used in the Dubner DPS1.

It also helps that there are so many graphic components available for the PC that may not be available in your workstation. A major underwriter may need a tag line with a font available on the PC but not the Graphics Factory. The tag line can be easily created on the PC and then exported to the workstation. The videoDesigner is not only a workhorse, but a versatile art system with applications at almost every phase of a project.

Glossary of desktop video terms

By Steve Epstein

In desktop video there are many terms that newcomers might not be familiar with. These terms have originated in the computer industry, video industry or both. Here is a list of some terms as they apply to the desktop video arena.

4:2:2: A digital video standard where the luminance is sampled at 720 times a line, and the two chrominance channels (R-Y and B-Y) are sampled at 360 times a line. The 4 and 2 relate to the multiple frequencies of the color subcarrier signal.

8-bit: Typical quantizing levels for digital video standards. Eight-bit quantizing results in 256 levels of gray scale video.

10-bit: Quantizing level that results in 1,024 levels of gray scale video.

Alpha: A computer graphics term that refers to the degree of opacity of an image when overlayed (keyed).

Aliasing: A jagged, stair-step appearance of angled lines or other image artifacts on a graphics or video display.

Anti-aliasing: The removal of inherent alias artifacts through digital filtering.

Bit: A single unit of digital data.

CCIR 601: A digital video standard using luminance and two color-difference signals. Luminance is sampled at 15.3MHz or 720 times per horizontal line, and chrominance is sampled at one half that rate.

Chrominance: The color portion of the video signal, including hue and saturation information, but not brightness.

Component video: The technique of recording video in which the chrominance (color) and luminance (brightness) parts of the video signal are processed and manipulated as discrete signals (or components).

Composite video: The standard video signal that combines chrominance and luminance information into one combined signal to produce a picture.

Compression: The technique of reducing the amount of data needed to represent a video or audio signal. International standards for video and still image compression are set by MPEG and JPEG.

CYMK: Cyan, Yellow, Magenta and BlacK. Cyan, magenta and yellow are the three master colors of the subtractive color family. They produce the color spectrum of reflective art images printed on paper.

D-1: The original component digital videotape format for recording CCIR 601 video. Newer digital formats include D-5, component digital Betacam and DCT. D-3 also is a new composite format.

D-2: The original composite digital videotape format for recording NTSC or PAL digital video.

Desktop video: The application of personal computer systems to the performance of video editing and post-production tasks.

Dithering: The close intermingling of dots of various colors to produce what appears to be a new color. In digital video terms, it is the process of adding quantizing or spatial noise to reduce contouring or other alias artifacts.

EDL (edit decision list): The list of instructions that comprise many of the editing decisions for a project.

Frame: In NTSC, a video frame consists of two fields interlaced to produce a video image. NTSC uses 30 frames per second to create the image and simulate motion.

Gray scale: The range of luminance levels from black to white.

Interpolation: A process used in digital video effects systems that averages a number of pixels to create a new pixel.

JPEG (Joint Photographic Experts Group): An international standard-setting body for still picture data compression.

Key (keying): Superimposing one video image over another.

Keyframe: A specific frame to which a set of specific attributes (size, rotation and location) is assigned to a video image.

LTC (longitudinal time code): Time code that is recorded on one of the two audio tracks or on a dedicated linear time-code track on videotape.

Luminance: The monochrome element of a color video signal. In essence, it is the brightness or intensity of the video image.

MJPEG (motion JPEG): A method of video compression where each frame or field is compressed using the JPEG algorithm.

MPEG (Motion Picture Experts Group): An international standard-setting body for video and audio compression. To achieve maximum compression, the MPEG standard algorithm uses information from previous frames (interframe coding), which makes it difficult to edit, frame advance and play backwards.

Opacity: The degree of translucency of a pixel. An opacity setting is used most often with keyed images. Usually, an opacity value of 0 would be a completely transparent image, a value of 100 would be a completely opaque image.

Pixel: A PICture ELement. The smallest basic element, or individual data of color, of a video image.

Quantizing: The process of converting the voltage levels of a sampled analog waveform into digital data.

Rotoscope: The frame-by-frame process of retouching images of a live action clip.

RGB: Red, Green and Blue. The three primary colors in the additive color family used for projected image display.

Sampling: The process of periodically measuring an analog waveform's amplitude. *Sampling rate* is the rate at which the samples are taken.

SC/H phase: The phase relationship of the chrominance subcarrier to the leading edge of horizontal sync.

Spline: An equation computed by the system that defines the acceleration and deceleration aspects of the image as they change from one keyframe to another.

Subcarrier (SC): A continuous sine wave that constitutes a portion of the color video signal. Used to carry the color information in a video signal.

System H-phase: An adjustment that moves the output horizontal pulse relative to the REF IN horizontal pulse. Used for timing video signals.

System SC-phase: An adjustment that changes the phase of burst on composite output video relative to the burst in the reference input. Used for timing video signals.

TBC (time base corrector): A synchronizer used to remove time base errors that result from the mechanical process of recording and playing back video on tape.

Time code: A system of identifying frames recorded on videotape by assigning each frame a chronological number based on a 24-hour clock.

VITC (vertical interval time code): A form of time code in which the time code is converted to data and placed on a line in the vertical interval of the video signal.

Acknowledgement: This glossary is based on the *Video Glossary* from Digital F/X, Mountain View, CA. To obtain a copy, call 800-955-8273. ❑

Preview

AUGUST...

AUDIO TECHNOLOGY UPDATE

• Digital Audio Effects
With microchip precision, every imaginable audio effect can be obtained with today's hardware. The capability of delay, reverberation and sound alteration is almost simple, once the audio is transformed into the digital domain.

• Digital Audio Workstation Update
A review of the latest crop of digital audio workstations.

• DAB: Radio's Rising Star
The industry's first look at the in-band DAB tests by the EIA, and how radio's next technology is being examined.

• Radio in Transition
A look at new remote-control technology for radio stations. Although stations still rely on devices to turn on and off transmitters and read meters, sophisticated remote-control systems can integrate with the automation system.

SEPTEMBER...

AUDIO AND VIDEO PRODUCTION SYSTEMS

• Production Suite Technology
Video production customers are often willing to pay more for that extra bit of production capability. Having the latest equipment available to them is another way to retain the current customer base and attract new ones. The same rules also apply to broadcasters.

• Building a Component Video Suite
Component video production is receiving an increasing amount of attention as producers and engineers strive for maximum quality images. We will examine the technology available to build state-of-the-art component video production suites.

• Non-Linear Editing Systems
Non-linear editing is the hot topic among video producers. Whether that includes desktop systems or more powerful mini-systems, lots of options are available to users.

• Linear Editing Systems
A look at how the traditional EDL-based systems are appropriate for much of today's program production.

• Digital News-Gathering on a Desktop
A look at how it's possible to completely edit and produce news features on a desktop system.

• Radio in Transition
Getting that radio signal from the studio to the transmitter or from the remote site back to the studio can be an impossible task. The author looks at some of the new ideas available for sending audio/data via STL and RPU systems. Both audio and digital technology will be discussed.

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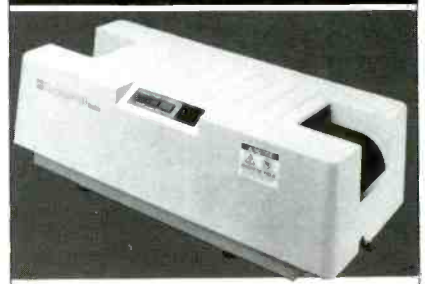

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TELEVISION OPERATIONS ENGINEER Apply your expertise to assisting with new installations and to maintaining and repairing of VTRs, cameras, switches and character generators. Success in this position will require an AS degree in electronics with 2-3 years of broadcast troubleshooting or operations experience.
TELEVISION MAINTENANCE ENGINEER As an integral member of our team, you'll design and document the creation of custom equipment, the installation of new facilities, and the maintenance and repair of uplink equipment. Essential qualifications include an AS in electronics (or equivalent experience), at least 5 years in TV engineering, and hands-on experience with component-level repair, and system design and installation.
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CHIEF ENGINEER: Midwest, VHF network affiliate is looking for a hands-on chief. Applicants should have control room, maintenance, and transmitter experience. Great opportunity for Supervisor or Assistant Chief to move up. Send resume to J.D. Walls, Operations Manager, KCAU-TV, Sioux City, Iowa 51101. EOE, M/F.

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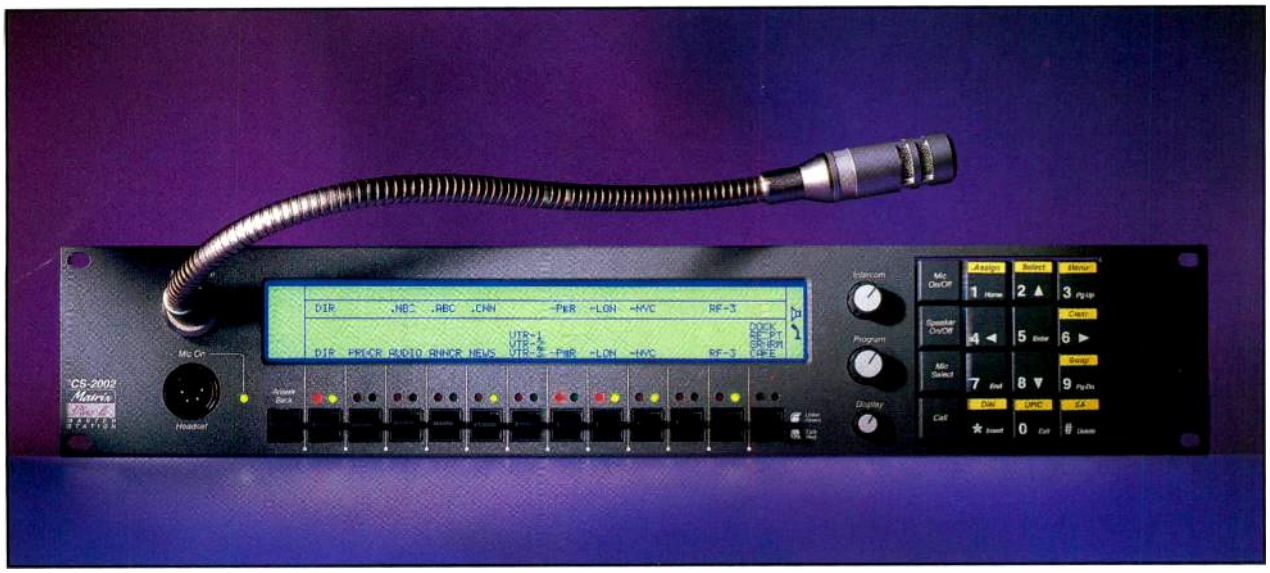

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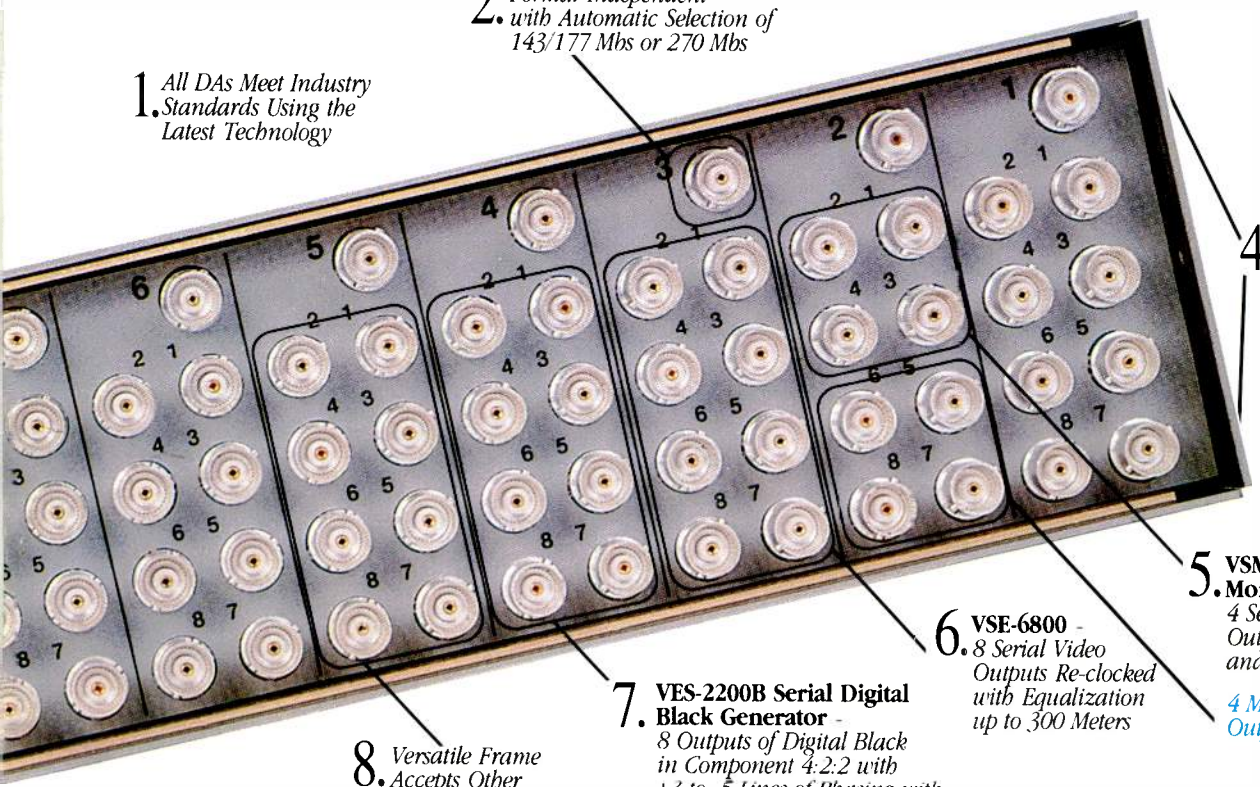

4. *10 Modules in a 2 RU Frame (4 Modules in a 1 RU Frame)*

5. **VSM-6800 Monitoring DA** - *4 Serial Video Outputs Re-clocked and Equalized*

   4 Monitoring Video Outputs of PAL/NTSC

6. **VSE-6800** - *8 Serial Video Outputs Re-clocked with Equalization up to 300 Meters*

7. **VES-2200B Serial Digital Black Generator** - *8 Outputs of Digital Black in Component 4:2:2 with +3 to -5 Lines of Phasing with an Analog Black Reference*

8. *Versatile Frame Accepts Other Modules such as VES-2200 Serial Digital Logo Generator*

9. *EMI Tested to Comply with FCC Part 15*

(And The Price Helped!)

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