

# BROADCAST engineering

An INTERTEC® Publication

January 1995/\$5.00



# Did You Say Odetics *Disk* Systems?

## **The CacheMachine™ From Odetics. The Automated On-Air System for Today and Tomorrow.**

You've heard lots of promises about play-to-air disk systems. But only Odetics, a world leader in on-air presentation, gives you the first real-world disk solution for today's television station. With a new system called the CacheMachine.

The CacheMachine overcomes the barriers to successful on-air play from disk — without forcing you to go backward in station automation. It allows you to play programs as well as commercials automatically and cost effectively. It provides support for multiple channels from a single system. You don't have to abandon your present technology or change your format. And you don't need a crystal ball to tell you which data compression format will become standard.

How is this possible? Because the Odetics CacheMachine uses a technique called *disk caching* to maintain your valuable commercials on archive tape in an uncompressed format for a fraction of the cost of archiving them on disk. Then the spots are automatically loaded into a disk recorder, which later plays them to air on multiple channels — with all the speed and flexibility that disk provides.

Experts agree the CacheMachine is today's only real-world disk automation solution. But there's not enough space here to tell you all its great benefits. One thing's for sure. You can't afford to make a decision or an assumption about on-air automation until you talk to Odetics.



## **Odetics**

Odetics Broadcast Division, 1515 S. Manchester Ave. Anaheim, California U.S.A.  
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# Only Telex puts UHF wireless within your reach.



## Introducing the Telex FMR-450 professional UHF wireless mic.

The Telex® FMR-450 UHF Wireless Microphone delivers the impeccable sound you get only from a UHF system — at a price that sounds remarkably like VHF.

This new professional microphone breaks through old sound barriers with flawless audio response. And because it operates within the UHF band from

524 MHz to 746 MHz, you always get clean sound and virtually no interference or congestion. Which means you can operate up to 50 systems simultaneously in a single location.

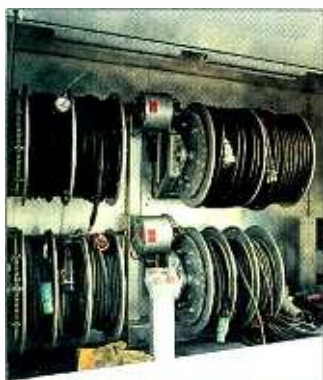
Plus, like all Telex products, we designed the FMR-450 to hold up under the most demanding conditions. In fact, it's so reliable, we back it with a full three-year warranty.

For price and product information, call toll-free 1-800-392-3497. We think you'll like what you hear.

**Telex**<sup>®</sup>

THE WIRELESS INNOVATOR.

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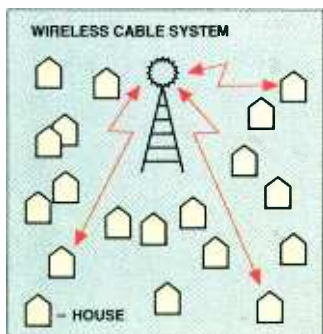
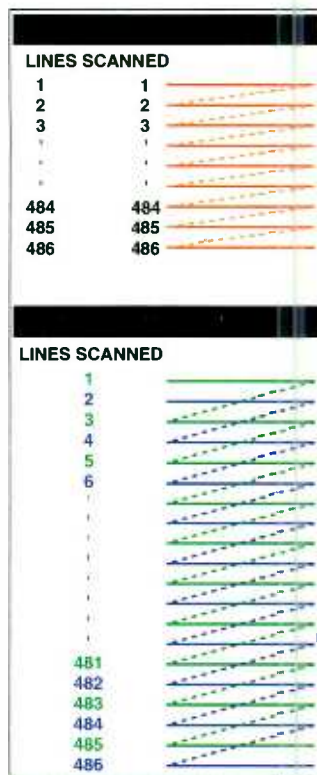
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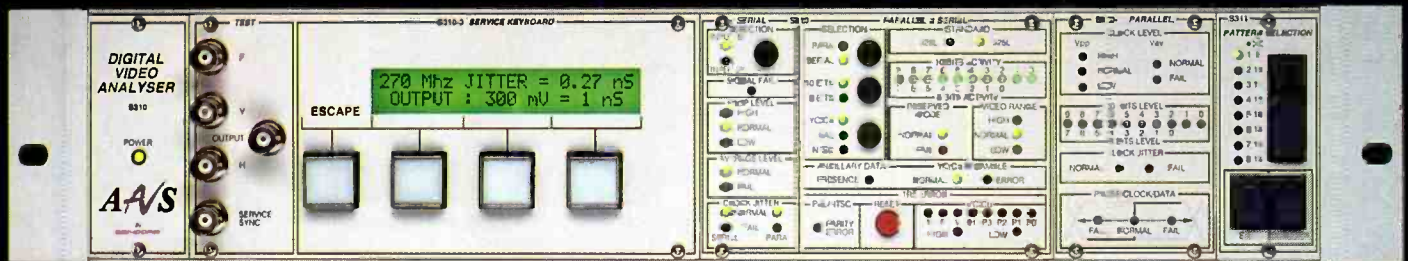
### ON THE COVER:

This month's cover symbolizes not only new packaging, but new and expanded coverage of video production and broadcast television technology and its management.



# Digital Video Testing Just Got Easier . . .

The S310 Digital Video Analyser is the only patented, all-in-one analyzer designed to take the frustration out of digital video testing. The S310 performs real time, on-line tests of key signal parameters for both composite and component, serial or parallel digital video, without complex and time consuming interpretation.



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With over 18 different, easy-to-use tests and measurements, the S310 provides you with critical performance data such as:

- Serial jitter
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- DC offset
- TRS analysis
- Presence of reserve codes in active video
- Analog signal output
- And many more

*In addition, the S310 is equipped with:*

- ◆ User-selectable alarm thresholds that provide out-of-limit parameter warnings.
- ◆ Remote control software with an RS232C/RS422 port for remote control monitoring and data logging.
- ◆ A comprehensive CCIR 601 component pattern generator with 34 test patterns, and exclusive error introduction.

Take the frustration out of your digital video testing by calling **1-800-769-AAVS** to schedule a demonstration, reserve an evaluation unit, or to order a FREE video tape.

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## NBC forms data network

NBC has announced the formation of NBC Data Network. It will be broadcast over the air using underutilized portions of the broadcast spectrum. This new service allows the transmission of data via the NBC Television Network instantaneously to an unlimited number of locations.

The NBC Data Network signal will be broadcast by NBC's owned and operated stations. The network's affiliates will have the option to be part of the data network in other markets. Ultimately, NBC Data Network will cover all major population centers in the United States and elsewhere around the world.

NBC is working with several other groups to develop new applications of the new service. It also expects to establish more business relationships as the awareness of the service increases. The current capacity of the broadcast signal is ample for its demands. NBC, however, is exploring ways to increase the data transmission capacity of the broadcast signal. This will allow for large multimedia applications.

NBC Data Network's first client is Faxcast Broadcast Corporation.

### SMPTE TV Conference to address convergence

The 1995 SMPTE *Advanced Television and Electronic Imaging Conference* will be held Feb. 10-11 in San Francisco.

"New Foundations for Video Technology" is the seminar theme, and it will address convergence and the changing face of the TV industry. The seminar begins on Feb. 9, one day before the conference begins.

Philip V.W. Dodds, founder of Interactive Multimedia Association, will be the featured luncheon speaker at the SMPTE TV Conference on Feb. 10.

### SMPTE and Montreux Symposium team up

The *Society of Motion Picture and Television Engineers* (SMPTE) and the *Montreux International Television Symposium* have announced an agreement to support each other's international conference programs held in Europe.

The Montreux Symposium also has become a sustaining member of the SMPTE. It will participate in the SMPTE Conference in the fall of 1996 in Cologne, Germany. The conference will be named "The 1996 European SMPTE Conference." The European sections of the SMPTE and Montreux International Television Symposium will organize the event.

The conference will be structured to reflect the needs of participants as the industry continues its convergence from broadcast, cable and satellite toward a common digital technology.

Beginning in 1995, and in odd years after that, the European sections of the SMPTE will participate in the biennial Montreux International Television Symposium.

Through this team effort, the SMPTE and Montreux Symposium are committed to working with each other to enhance their services to members and professionals in the fields of motion imaging and related areas.

As part of the agreement, SMPTE will promote the Montreux Symposium in the *SMPTE Journal* and *News and Notes*, the monthly newsletter. Each organization also will provide the other with display space at its annual conferences.

### IBC joins SMPTE

SMPTE also has announced that the *International Broadcasting Convention* (IBC) has become a sustaining member of the society. The organizations will increase cooperation by supporting each other's activities.

As a result of this agreement, SMPTE and IBC are committed to providing and enhancing services to the communications industries in the motion imaging and related fields. Other benefits include listing each other's conference dates and activities in IBC and SMPTE publications.

### SMPTE elects new officers and governors

SMPTE has announced its 1995-1996 officers and governors. The officers include Stanley N. Baron, NBC, as president; David L. George, Imagineering Ltd., as executive vice president; Peter A. Dare, Sony Business and Professional Group, as editorial vice president; and Richard L. Thomas, Eastman Kodak Company, as secretary/treasurer. The regional governors are: Fung Fai Lam, Sony of Canada Ltd., Canadian region; John F.X. Browne, John F.X. Brown & Associates, Central region; John C. Gates, Gates Service Group, Eastern region; T. Russell McMurray, consultant and Howard T. La Zare, FilmTec International, Hollywood region; Paul Berger, CBS Television Network and Linda A. Young, Du Art Film and Video, New York region; Neil B. Feldman, Video Post and Transfer, Southern region; and John H. Streets, Merlin Engineering Works, Western region. ■

## MARK YOUR CALENDARS FOR THIS YEAR'S EVENTS:

### February 26-28

AES in Paris (212-661-8528)

### April 10-13

NAB in Las Vegas (202-429-5335)

### May 7-10

NCTA in Dallas (202-775-3629)

### June 9-13

International Television Symposium in Montreux, Switzerland (+41 21 963 32 20)

### June 14-17

SCTE in Las Vegas (215-363-6888)

### June 15-17

INFOCOMM/ITVA in Dallas (INFOCOMM -- 703-273-7200 and ITVA -- 214-869-1112)

### July 20-23

ITS in San Francisco (212-629-3266)

### August 8-11

MACWORLD in Boston (617-361-8000)

### August 9-11

SIGGRAPH in Los Angeles (312-321-6830)

### September 6-9

World Media Expo in New Orleans (202-429-5335)

### September 14-18

IBC in Amsterdam (+44 (0) 222-566800)

### October 5-8

AES in New York (212-661-8528)

### October 26-28

MACWORLD in Toronto (617-361-8000)

### November 8-10

InterBEE in Tokyo (fax: 81-3-3284-0165)



# Buy a digital camera or else.....

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

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

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

### Introducing the *Digital SK-2600*



SK-2600P Portable Companion

- "No Diascope" internal automatic camera setup
- "Thru-the-Lens" automatic setup with standard grey scale chart

Plug-in 6 position ND and CC filter wheels allow easy insertion of special effect filters with full remote control capability



High performance Ultra-Band triax system (12MHz Green) or Field triax system for long cable lengths or Digital optical fiber system

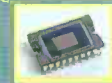
Unique PIP (Picture in Picture) Allows a second video source to be windowed with camera video in any of four quadrants or reversed with camera video

Separate H&V detail generator for viewfinder makes focus "pop" for camera operator

Exclusive single LSI device provides 13-bit (minimum) digital processing for RGB video including detail and masking.



The 600,000 pixel CCD provides 900 TV line resolution and dramatically reduces aliasing. An optional, 520K pixel CCD is available to provide switching between 4:3 and 16:9 aspect ratios at the push of a button.



**Network Users:**  
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CBC Toronto, Canada

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## *It's the local TV station that counts*

I had to laugh while recently reading a story about the cable and satellite industries. It seems a war has broken out between some cable MSOs and DirectTV. DirectTV is spending millions advertising its new service. Although the company has deep pockets, it now must make good on its promise to have millions of subscribers on-line — and quickly. One important key to that success is convincing potential customers that they can get all the programming they could ever want by satellite. In part because the company has been successful, a new wrinkle in its plans has developed.

Some large cable firms are becoming concerned as they watch their customers switch to satellite-provided service. They no longer have a strangle hold on the delivery of multiple channels of programming, and this isn't setting too well with these big guys. Their response to the currently small, but potentially huge, loss in customers is some nasty name bashing.

As cable customers jump ship and go satellite, the MSOs have launched an advertising campaign to remind viewers that the only way to get multiple channels of entertainment *while retaining access to local stations* is to remain a cable customer. They are reminding viewers that they can't get local TV via satellite.

Say what? Did the cable industry just admit that access to local TV station programming is an important deciding factor in where TV viewers spend their dollars? That's a far cry from what these same folks claimed only a year ago when must carry was the issue. At that time, their position was that viewers didn't give a heck about the local TV station. Now, cable has done an about-face, reminding customers that if they jump ship and go satellite, they'll lose access to their local news, weather and other community

information. In other words, if you go satellite, you can't get your local TV stations.

I think it's great. Here we have the entertainment industry's two darling starlets fighting over the local broadcaster. One doesn't want to admit that switching to satellite will result in the loss of local TV service. The other is finally having to come clean and admit to the world that cable without full carriage of the local TV stations is something cable customers won't tolerate.

This whole scene is a re-enactment about what *Broadcast Engineering* magazine has been saying for years. It's local programming that counts stupid!

Yes, viewers want more options. Yes, they want dependable and quality service. However, they don't want the price of those options to be the loss of local TV stations. Only now that satellite services are cutting into their customer base is cable willing to admit that viewers are demanding full access to their local TV stations. Viewers are not willing to give up access to these local resources even if some digital Johnny-come-lately promises hundreds of TV channels.

When a community looks for information, they turn to their local TV broadcasters — not cable, and certainly not satellite. The local TV station has always been a crucial ingredient in meeting a community's need for information. Cable television hasn't fulfilled that role and satellite TV never will.



*Brad Dick*

Brad Dick, editor



What do you  
get when you  
combine  
a 500 lb.  
chunk of ice  
and a TV  
transmitter?



**Great support from Harris.**

For WHBQ-TV, it was a nightmare come true. But Harris responded quickly and decisively. Three days after a quarter-ton chunk of ice destroyed their transmitter building, the station was back on the air.

**"The Harris people were absolutely super to work with. Technical ability and crisis help were determining factors."**

Tim Lynch  
General Manager  
WHBQ-TV, Memphis

In one week, they reached quarter power. But the spring ratings book loomed on the horizon, making a permanent solution even more urgent.

Harris responded again. In about six weeks, WHBQ-TV was at full power with a new 45 kW Harris transmitter.

Extraordinary circumstances? Perhaps. Extraordinary product support and service? Not at Harris. We make that extra effort every day. It's all part of our commitment to

solving the problems facing broadcasters with the best technology, the best performance and the best customer support.

Of course, you don't need an emergency to take advantage of Harris technology and support. Call us today. We'll be there when you need us – now and in the future.

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or fax 217-224-1439**

**International: 217-222-8290  
or fax 217-224-2764**

 **HARRIS  
ALLIED**

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## ATSC approves AC-3 digital audio

**O**n Nov. 10, 1994, the Advanced Television Systems Committee (ATSC) announced that Dolby's AC-3 digital audio compression technique has been approved as an ATSC standard for the advanced TV system.

The ATSC is comprised of more than 50 companies, associations and educational institutions involved in delivering television to the American public. The membership includes TV networks, the member companies of the Grand Alliance, broadcasters, cable operators, motion picture companies and equipment manufacturers. The ATSC is involved in documenting aspects of digital television, including video compression and transport, and the transmission standard.

Dolby's AC-3 will be used for the delivery of audio services in the Grand Alliance advanced TV system proposal. See Table 1 for some of the potential services and optional features associated with applying AC-3 to

advanced TV digital broadcasting. Also, see Table 2 for the main audio service and its channel combinations.

The visually impaired service will provide a narrative description of visual program content. The hearing impaired service will consist of a dialog channel processed for increased intelligibility. The dialog service will be used in conjunction with the main-minus dialog service to deliver multichannel audio in several different languages simultaneously. The commentary service will be similar to dialog, but will provide optional programming commentary. The emergency-flash service is intended to carry emergency announcements that will pre-empt other audio services. The voice-over service will be similar to the

in accord with the station authorization. The FCC noted that the monitoring and control of critical parameters must be performed by equipment capable of taking the station off the air or contacting designated station personnel in the event of a malfunction.

The commission also proposed to waive the requirement that a duty operator hold a restricted permit for those stations that elect to retain duty operators. In addition, the FCC sought comment on similar flexibility for LPTV stations and whether it is appropriate to consider analogous changes to the operator requirements governing international and experimental broadcast stations.

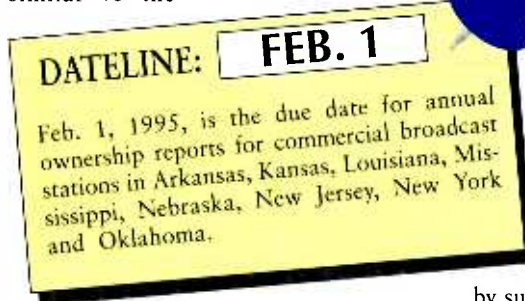
### LPTV stations eligible for 4-letter call signs

As of December 1994, a 4-letter call sign may be requested for any LPTV station that was granted a license no later than 1987, irrespective of who the station licensee was at that time. No other LPTV stations are eligible to apply at this time, and no call signs may be reserved. Dates for later-authorized stations, as well as LPTV permittees, will be established by subsequent public notices. TV translator stations are not eligible for 4-letter call signs.

Because call signs are assigned on a "first-come-first-served" basis, a request for an available call sign blocks the acceptance of subsequent requests for the same call sign until the first request is processed. In the event that more than one LPTV station requests the same call sign on the same date, the assignment will be made to the station having the "longest continuous ownership and control." If an LPTV station and an AM, FM or full-power TV station request the same call sign on the same date, the AM, FM or full-power TV station will prevail. LPTV stations may not request a call sign used by another broadcast station unless the stations are commonly owned or the LPTV station has obtained the other station's written consent.

All 4-letter call signs assigned to LPTV stations will include an "LP" suffix. Requests for 4-letter call signs must be made by letter to the Secretary, Federal Communications Commission, 1919 M Street, N.W., Washington, DC 20554. An original and one copy of the letter must be submitted. As many as five call-sign choices — listed in descending order of preference — may be included in a single request. Applicants also must submit an anti-drug certification, which is required by Section 1.2002 of the FCC's rules. ■

Harry C. Martin and Andrew S. Kersting are attorneys with Reddy, Begley, Martin & McCormick, Washington, DC.



emergency service but will provide a combination of voice-over and main service. It will not pre-empt other services.

### FCC proposes to allow unattended station operation

In light of the improvements that have been made in the stability, reliability and automatic control of transmission systems, the FCC has solicited comments on a proposal to allow unattended operation of broadcast stations.

The FCC's rules currently require every broadcast station to be operated by a transmitter duty operator holding a commercial radio operator license or permit. The duty operator is responsible for the proper operation of the station's transmitter and must be on duty at either the transmitter site, a remote-control point or an automatic transmission system monitor and alarm point.

The commission believes that because modern monitoring and control equipment is available, continuous attendance of a duty operator is unnecessary. However, the proposed rule changes will not diminish a licensee's responsibility to adequately monitor technical operations. Stations also need to remain in compliance with the technical rules. The FCC expects broadcasters to exercise due diligence in automating their stations and will continue to hold stations fully responsible for rule violations or operations that aren't

Type of service	No. of channels
Main 5.1	
Main-minus dialog	5.1
Visually impaired	1
Hearing impaired	1
Dialog	1
Commentary	1
Emergency-flash	1
Voice-over	1

Table 1. Potential services and optional features associated with AC-3.

Audio mode	Channel array ordering
1+1	Ch. 1, Ch. 2
1/0	center
2/0	left, right
3/0	left, center, right
2/1	left, right, surround
3/1	left, center, right, surround
2/2	left, right, surround L&R
3/2	left, center, right, surround L&R

Table 2. The main audio service can be composed of these channel combinations.



**You're a news editor, it's **5 minutes** to air and a big story breaks. The material's about to come down the line and the producer desperately wants it as the lead item.**

# What can you do?

Linear system.

**Don't even think about it.**

Ordinary non-linear system.

**Oh well...start digitizing for the next newscast.**

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**The whole job, no problem.**

Begin your edit immediately - even as your feed comes in. Using Scene Select,™ grab the clips you want 'on-the-fly' and instantly link them into a rough-cut. That's it - you're ready to go on-air. Even so, nothing is committed - you can still re-arrange with Segment Replace and fine tune the edits as required - right up to the wire. The story is always available for instant playout.

With Newsbox's unique true random access operation it's as fast, flexible and simple as that. No dead time, no waiting, no panic.

Newsbox offers all this - and much more - at a very competitive price.

To catch up on all the very latest news, call Craig Sherter now at: (203) 656 3100.



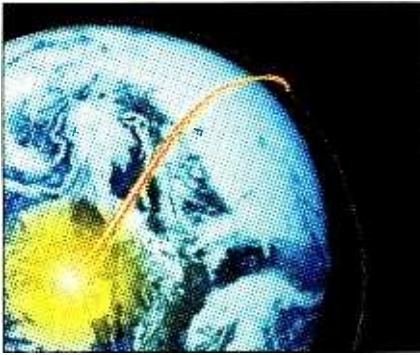
## **NEWSBOX**™

**Dedicated to news, because you are.**



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## Getting on-line, part 1

**C**yberspace, or the information superhighway, has skyrocketed forward and hundreds of on-line services are already out there just waiting to be tapped. Anyone with a computer, modem, and a communications program can jump onto the highway and any computer will do — it doesn't matter if it's a museum piece or a state-of-the-art personal computer. Accessing on-line services is easy and in most parts of the United States can be reached by simply dialing a local telephone number. A variety of service providers feature a range of services and prices.

### America On-Line

America On-Line (AOL) provides its subscribers with proprietary software that provides an easy-to-use graphical interface to access AOL's on-line services. The users pay a \$9.95 monthly fee that includes five hours of on-line time. Up to six people can share one account while maintaining individual user names on the system. Although designed for households, businesses also could take advantage of this feature. AOL has nearly 300 bulletin-board areas called clubs or forums that are divided into topics created by the users. Users can also take advantage of the popular magazines and newspapers available on AOL.

### CompuServe Information Services

CompuServe Information Services (CIS) has the largest repository of information resources and offers local phone access in 135 countries. An \$8.95 monthly fee gives subscribers unlimited access to basic services, such as general reference information, airline reservations, and shopping. The fee covers up to 63 pages of e-mail messages and links users to other subscribers, fax machines, telex machines, or anyone with an AT&T Mail, MCI-Mail, or Internet address. CIS subscribers can even send messages to people on AOL. But access to more than 600 forums is the reason 1.5 million people subscribe to CIS despite hourly fees that start at \$4.95 and are based on the speed of the modem connection. Several hundred forums are used by 450 computer and multimedia

vendors to support their products while 400 other forums cover every possible professional interest and hobby.

Other services on CIS include 1,500 information databases, full text of 48 newspapers and more than 200 magazines, thousands of software libraries, and AP and Reuters news feeds. The menu system is a text-only terminal-style interface that can bewilder many people. But CIS does offer front-end software for DOS or Windows called CompuServe Information Manager (WinCim). There is a fee for the software but it is offset by a credit for on-line charges. Other programs will automatically call CIS at a scheduled time, log a user's name and password into the system, collect the user's e-mail, gather any new messages on the forums the user visits and then hangs up. This allows the user to read the messages and write responses without being on-line. When the user has finished writing off-line, the program calls CIS again and sends the messages.

### Dow Jones News/Retrieval

With 1,750 business and financial resources available on-line, the Dow Jones News/Retrieval (DJNR) service provides comprehensive business news, financial

*Contact BE editors via  
our on-line mailboxes.  
Internet: be@Intertec.com.  
CompuServe: 74672,3124.*

data, and general information. Subscribers pay a yearly service fee of \$20 and an additional \$1.50 for every 1,000 characters of text read (flat fee programs are also available). Through DJNR, the user can access the contents of the Wall Street Journal, the Dow-Jones News Service, Dun & Bradstreet reports, real-time stock quotes and many other sources. Users can locate and read items of interest using a text-based menu system. A personalized clipping service scans 1,300 sources and gathers incoming news. Although DJNR has no e-mail features, it is linked directly to MCI Mail. MCI Mail users can send and receive messages to other subscribers or to any other on-line service.

### Prodigy

A joint venture of IBM and Sears, Roebuck and Company, Prodigy is a popular

home-user service. Prodigy requires a start-up fee to establish an account and obtain the software. The monthly fee of \$14.95 entitles subscribers to unlimited access to a long list of basic services and up to 30 e-mail messages. The graphics, advertising displays, and multilevel menus make Prodigy one of the slowest systems to use, but it's a good choice for users who want basic information. More than two million households subscribe to this service making Prodigy the largest on-line service provider.

There are other on-line services targeted at specific interests. Ziffnet caters to computer users while the ImagiNation Net serves interactive game players. Microsoft has plans to launch a commercial on-line service called The Microsoft Network.

### Internet

Even though it is not an on-line service provider, the Internet is currently attracting a lot of media attention. The Internet is an electronic network linking computers at universities, military facilities and research facilities around the world. Businesses are also beginning to link their computers into this vast network. At this time, there isn't much commercial activity on the Internet, but this may change. Entrepreneurs are trying out ideas to profit from the 10 to 15 million people logging onto the Internet on a regular basis.

There are established standards that make it possible to access databases and files that reside on any of the computer systems that comprise the Internet. Each computer system has a unique address. A typical Internet address takes the form: user name@domain name.top-level domain name (be@Intertec.com). With the user's name and the address of the computer system, users can send and receive e-mail to anyone on the Internet. Individuals can also subscribe to news groups that are organized on specific topics. Subscribers receive a copy of every message sent within that group. To join, users simply add their address to the subscription list. The Internet works under the UNIX operating system.

Computer on-line services are off and running offering a wealth of information at a minimal cost. You only have to decide which services best fit your needs. ■

Editor's note: Several CIS professional forums, including the broadcasters forum (BP Forum), will be covered in an upcoming column.

Robert Goodman is president of Goodman Associates, Inc., Philadelphia, PA, a production company and converging technologies consulting firm.







## Plug and play video

higher resolutions require higher computational horsepower, especially when using 3-D graphics and animation. Many high-end display adapters improve display performance by off-loading tasks from the CPU to a specialized graphics processor on the display adapter. Plan on purchasing 1MB to 4MB of video RAM, along with 16MB to 32MB of RAM on the motherboard. (See "Buying a Desktop Video System," February 1994, for these applications.)

### Storage

Recording video images requires a video capture board. These adapters translate analog video signals into a digital RGB format. Many also are capable of compress-

ing the video data as well. Some newer boards are capable of compression on-the-fly. Other boards require that video frames be input one at a time through a storage device or from a VTR capable of quality stills. Compression is practically required if the video is to be stored on a hard drive. Most cards use JPEG, MPEG or QuickTime compression schemes to minimize file size. Storage requirements for video are enormous — 10 minutes of video can easily fill a 1GB hard drive. In addition, for real-time playback, most desktop video solutions re-

quire hard drives that are capable of transferring data at speeds above 10MB/s. Macs have built-in SCSI system ports to control the computer's drives. IBM compatibles use integrated device electronics (IDE) host adapters, which operate at transfer rates of 4MB/s. Enhanced or fast ATA IDE adapters can reach maximums of 17MB/s. SCSI adapter cards can reach transfer rates up to 6MB/s. Both types of drive controllers will coexist in most systems. There are multiple SCSI standards but the most common are fast SCSI-2 and fast/wide SCSI-2. The hard drive and adapter must adhere to the same standard.

### Audio

Some video capture boards are capable of digitizing sound at a high-quality level, but most dedicated sound capture boards exhibit better performance specs. These adapters typically record or sample and play back stereo sound at a sampling rate of 44.1kHz or 48kHz. Most cards use an ADPCM compression scheme to minimize storage space. Wavetable-synthesis technology is replacing FM-synthesis technology. Better-quality boards comply with the MIDI specifications standard in the audio recording industry.

Software for digital audio editing features visual representation of the sound waveforms, equalization, notch filtering, expanders, dynamic gating and a host of other processing tools. SMPTE time code, variable frame rates for film or video, measures and beats, and MIDI sequencers are some of the ways audio editing software handles the synchronization issue.

Almost every piece of equipment in a TV production facility has been recreated on a board set for use in a PC. Everything from digital effects to the bells and whistles once only available on the most expensive video switchers can now be found. Quality, compatibility and technical support are as varied as the products. Careful planning and system integration is necessary to achieve successful desktop video solutions capable of competing favorably with professional dedicated hardware. ■

Is it possible to turn a personal computer into a complete production studio? Considering the wide range of hardware and software on the market, the answer is yes. The question then becomes what is needed to turn the PC on your desk into a production tool? The answer can become complicated quickly. To gain some perspective, consider what is in a typical broadcast facility — most of the equipment, from DVEs to audio mixers, is based on proprietary black boxes.

Desktop video, on the other hand, tends to rely on more "off-the-shelf" components and proprietary software. Many high-end non-linear editing systems are based on standard Mac, PC or SGI platforms. The trend is toward software-only solutions, but for the moment, desktop video requires proprietary hardware. Most of these proprietary hardware solutions must be installed in a computer's bus slots or connected via communications ports.

### Desktop displays

PCs use a variety of display standards. The most common one is the video graphics adapter (VGA), which outputs a signal at a resolution of 640 x 480 pixels per frame. Frames are refreshed progressively at a rate of approximately 60 times per second. VGA to NTSC conversion cards are available, and low-cost units designed for presentation purposes can be used as an inexpensive solution for slating satellite feeds, air checks and edit masters.

Today's graphics and desktop publishing programs have the flexibility and power to create stunning graphics. Combined with a high-quality output converter, these programs can be used to create still and animated graphics for use on-air. High-end VGA to NTSC converters are available with features including gen-lock, separate key and matte channels, RGB output and character generation software.

Computer resolution is determined by the display adapter and the capabilities of the display monitor. (See "Computer vs. Video Resolution," April 1994.) Be aware that

*Desktop video requires storage measured in gigabytes.*

*Quality, compatibility and technical support are as varied as the products.*

quire hard drives that are capable of transferring data at speeds above 10MB/s.

Macs have built-in SCSI system ports to control the computer's drives. IBM compatibles use integrated device electronics (IDE) host adapters, which operate at transfer rates of 4MB/s. Enhanced or fast ATA IDE adapters can reach maximums of 17MB/s. SCSI adapter cards can reach transfer rates up to 6MB/s. Both types of drive controllers will coexist in most systems. There are multiple



Robert M. Goodman is president of Goodman & Associates Inc., a production company and converging technologies consulting firm, Philadelphia.



# Shooting Star.



The HK-377 Ultra-wideband Studio/Field CCD Camera System has the highest resolution, sensitivity and pixel count of any NTSC camera currently available. The camera employs newly-developed 2/3" FIT CCDs, each with more than 600,000 pixels. An ultra-wideband triax system with 10MHz bandwidth for each RGB channel delivers an unprecedented 900 TV Lines resolution at the base station output. The new base station has provisions for digital signal output (optional) to accommodate the demands of high-quality production.

Unique features of Ikegami's new high-end camera also include extensive remote control of detail functions, including the Skin Detail to soften the complexion and to give your stars a more youthful appearance. A high-resolution viewfinder has its own VF DTL (Viewfinder Detail) and PIP

(Picture-In-Picture) circuits. The HK-377 has an AHD (Auto Hue Detect) circuit for "skin tone capture." Master Control Panels are equipped with memory card I/O Ports. A "Snap Shot File" permits control and scene file data to be written into, and read quickly, for shooting parameter replication.

Current users include: ABC (20/20, World News Tonight, Good Morning America, All My Children, Loving, and all shows shot in NY), CBS (Late Show with David Letterman, 60 Minutes, CBS Evening News, and Sunday Morning), Disney/MGM, MTI, TNN, Turner Entertainment Network, WBNS-TV, Goodyear Blimp, Unifel Mobile Video, Channels 2 and 13 Buenos Aires, and TV Globo, Brazil.

Shoot your stars, with the HK-377. Call the nearest Ikegami Regional Office.



The HK-377/377P cameras have the Skin Tone Detail feature which received the Engineering Emmy Award for technical achievement.

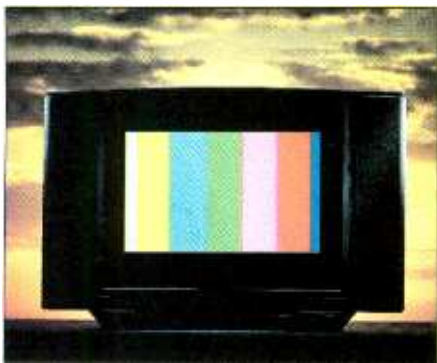


The HK-377P portable companion offers the same performance characteristics as the HK-377 and operates through the same Base Station or can be configured for stand-alone operation.

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# Ikegami



Courtesy of Harris Broadcast

With the recent successful completion of on-air tests, the American version of HDTV has moved closer to becoming a reality. The FCC's Advisory Committee on Advanced Television Service (ACATS) will soon forward to the commission its final report on ATV technology. That report will become the basis for the most drastic change ever in the U.S. broadcasting system.

#### Where did ATV come from?

The ATV movement began in 1969. It was triggered by a confluence of events affecting Japan's public broadcaster NHK (Japan Broadcasting Company), the increasingly global economy and advanced microelectronics technology. Under a mandate from the Japanese government, NHK is required to spend a percentage of its multibillion dollar annual income for research and development. This R&D is conducted in conjunction with the electronic manufacturers of Japan. As a result of the deregulation of the airwaves in Japan, concern arose in the ranks of NHK that a comfortable broadcast monopoly era was about to end.

Having scant program talent, NHK decided to rely on its technical strength to overcome the deregulatory challenge. A technical strategy was devised to use HDTV as a tool to keep NHK in business. The new technology would be developed and employed as a protectorate of NHK because of its inherent high cost. The shallow-pocketed commercial competitors would then be left struggling with obsolete technology. With a superior HDTV service, NHK could retain the technocracy's loyalty. This implausible plot was quickly eclipsed by the astounding performance of HDTV itself. NHK, along with other supporters of HDTV, quickly adopted a more public-spirited rationale for furthering its development by promoting HDTV as no less than a benefit to humanity.

The dream of a single worldwide production standard failed in 1987 because of international protectionism policies. Europe realized that a Japanese world production standard would force a Japanese transmission system on everyone. The result could

## Status update

be the demise of Europe's consumer and professional electronics business. That fear propelled the Europeans to develop their own HD standard. While the system (known as Eureka 95) successfully blocked the Japanese technological standard, the project was abandoned when the Japanese threat subsided. The next European initiative came in 1992 with an all-digital system designed to catch up with U.S. efforts.

#### ATV in the United States

Initially the United States was slower to react than Europe because there was little consumer or professional production equipment industry left to protect. Yet, U.S. program producers would benefit from a single production standard.

### *U.S. broadcasters recognized the HDTV movement as a golden opportunity for protecting spectrum.*

It was only later that U.S. broadcasters recognized the HDTV movement as a golden opportunity for protecting spectrum, maybe even gaining more. This UHF spectrum, although originally reserved for broadcasters, had come under increasing threat in the '80s by the land-mobile industry. "HDTV is coming" became the battle cry as broadcasters watched Japanese and European technology peeking over the horizon.

In 1987, broadcasters petitioned the FCC to stop further UHF spectrum allocations until the HDTV questions were fully answered. President George Bush, moved by the military threat that a foreign-dominated HD industry could pose, ordered the secretary of commerce to move the United States to the lead in HDTV technology. ACATS, a blue-ribbon Advisory Committee to the FCC, was formed following the broadcasters' 1987 FCC petition. ACATS, chaired by former FCC chairman Richard Wiley, set about stimulating the industry to develop the best HDTV system in the world. The FCC implemented President Bush's command by declaring in 1991 that the HDTV system had to fit in 6MHz, and, if possible, be all-digital. That mandate turned out to be nothing short of serious. In one step, the United States would leapfrog the rest of the world in HD technology.

#### A shepherd's pie

The all-digital 6MHz HDTV is an amalgamation of four different proponents. The four proponents joined forces in 1995 and became known as the Grand Alliance. This Grand Alliance HDTV system hardware is now in final assembly at the David Sarnoff Research Center in New Jersey. If the present schedule holds, the finished hardware will move to the Advanced Television Testing Center (ATTC) on Jan. 31. Final testing will begin in February.

By June the Advisory Committee hopes to have not only completed all tests, but the analysis and reports on them as well. The technical subgroup will then look at those results in July of 1995 and the big ACATS meeting will be held in late July, or early August in preparation of submitting the standard to the FCC.

Barring a repeat of a CBS-color-wheel-like debacle where the FCC's first color choice was overturned, the standard will become the terrestrial HDTV system for North America.

#### New spectrum usage

The largest bone of contention is whether the new spectrum should be used exclusively for the untried HDTV service. Another bone of contention is the flexible use policy. This would allow broadcasters to multiplex four or more compressed standard resolution programs for transmission on their new second channel.

The Grand Alliance team has lobbied for some enforced usage of HDTV at least in prime time, rather than allowing multiple standard-definition programs at all times. Fox is leading the way on the multiplexing issue claiming that the improvements provided by digital technology will meet the public's taste for improved quality. What is needed now, says Fox, is maximization of the opportunities offered by digital. In Murdoch's case there are at least four programming sources he would like to distribute on his network. The NAB has tried to awaken broadcasters to the datacasting opportunities the technology permits.

While the public's and broadcasters' perception of the value of digital or HDTV broadcasting remains unknown, the technology to enhance image quality and quantity is marching on. The issue for broadcasters is not *if*, but *when*, to implement some form of ATV. ■



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**B**roadcasting is a fluid industry. People move from station to station on a regular basis to advance their careers. Common advice to college graduates is to start in a small market and learn everything they can, and then move up. And talent, program directors, salespeople and general management spend much of their time advancing their careers by changing stations at appropriate times. Because the engineering field tends to be more stable, engineers may become complacent in their jobs. So with a stable position and good pay, why even consider changing jobs?

### Change jobs or stay put?

All job decisions are personal. You are the only one who can decide when the time and circumstances are right to change jobs. However, you need to look at the big picture.

*Periodically assess where you are in your career.*

Every once in a while you need to assess where you are in your career. How did you get here? Where did you want to go when you got out of school? Are you there? If not, do you want to continue to seek that goal or revise it? Is your current job meeting your needs? Are you challenged? Do you feel like a member of the team? Are you paid enough and do you get regular raises? Are you broadening your skills? Do you have sufficient job skills?

There are many reasons why you may not want to change jobs. You may enjoy your work. You may like working with your boss and co-workers. You may have a good salary and receive regular raises. You also may not want to change jobs because of family or other personal attachments to the geographical area. You may have company benefits that you cannot afford to give up. Or, your company may have tuition reimbursement

## Managing your own career, Part 2

that you may be taking advantage of.

If you are dissatisfied because of personality conflicts, what are the chances that they will be promoted, transferred or quit?

Sometimes conflict, such as job dissatisfaction, personality conflicts, or no growth opportunity may make you reconsider your decision to stay or move on.

If you are dissatisfied with working conditions, such as salary or the physical station, what are the chances that you will get a raise or the station will buy new equipment? Are there other factors, such as a possible buyer for your station or other changes in ownership or operating philosophy that would affect your decision?

### When it's time to move on

First, remember that broadcasting is a small industry. Don't do anything to alienate your existing employer, and be certain of your commitment to move on. Second, prepare for your job search. This includes updating your resumé, gathering demo reels, writing samples, and surveying the job market. You should, at all times in your career, save important writings, proposals, programs and other materials that will reflect your job skills and your skills as a manager. If you are a creative talent, keep tapes of your best programs because you may not always have an opportunity to go back and make copies. Remember to get consent from your employer to use material and equipment that belongs to the station. However, because that's how everyone gets a job in this business, it's unlikely that your boss would withhold permission for you to make a resumé tape.

### Preparing your resumé

Resumés at the managing engineer level should be one page and no more than two pages. Take time to determine the exact wording and content of your resumé. Whether you use a chronological or functional resumé depends on the types of jobs that you have had. Put yourself in the best light possible and be accurate. Resumés should be easy to read, with plenty of white space, on a conservative, quality paper stock. Use a pleasing typeface that is readable and include bold heads or italics to set off important items. Check your local library for sources on how to write resumés.

Clear with your references ahead of time to make sure it's all right to use them. Also, give them a copy of your resumé. If you want, tell them your job experience and what kind of job you are looking for. Names of references should usually be on a separate page

and given to the company when asked for. On a first interview you may choose **not** to include your references unless they are requested. When replying to a direct advertisement, you should include your references to speed up the hiring process.

### Survey the marketplace

What stations are hiring? Read the **trades** and find out who is hiring and for what types of jobs. Know what type of salary you can command. Also, find out what type of salaries are being paid for the job you are seeking. Is the salary acceptable? If you have seniority in your present job, it may be a challenge to maintain the same salary level. To get started, refer to the *Broadcast Engineering salary survey*, which appears every October. Also ask others in similar jobs in the market you are considering what starting salaries are in similar jobs. This comparative research will be critical in determining which ads you will respond to and what salary range you will ask for when you interview.

*To see what salaries are being paid in the industry, refer to BE's salary survey, which appears every October.*

The best tools for ascertaining the marketplace are publications that carry classified ads. These will give you an idea of who is hiring and in what parts of the country. Make inquiries of your industry contacts as to who is hiring.

Extensive and specific recommendations on how to find job opportunities will be covered next month. ■

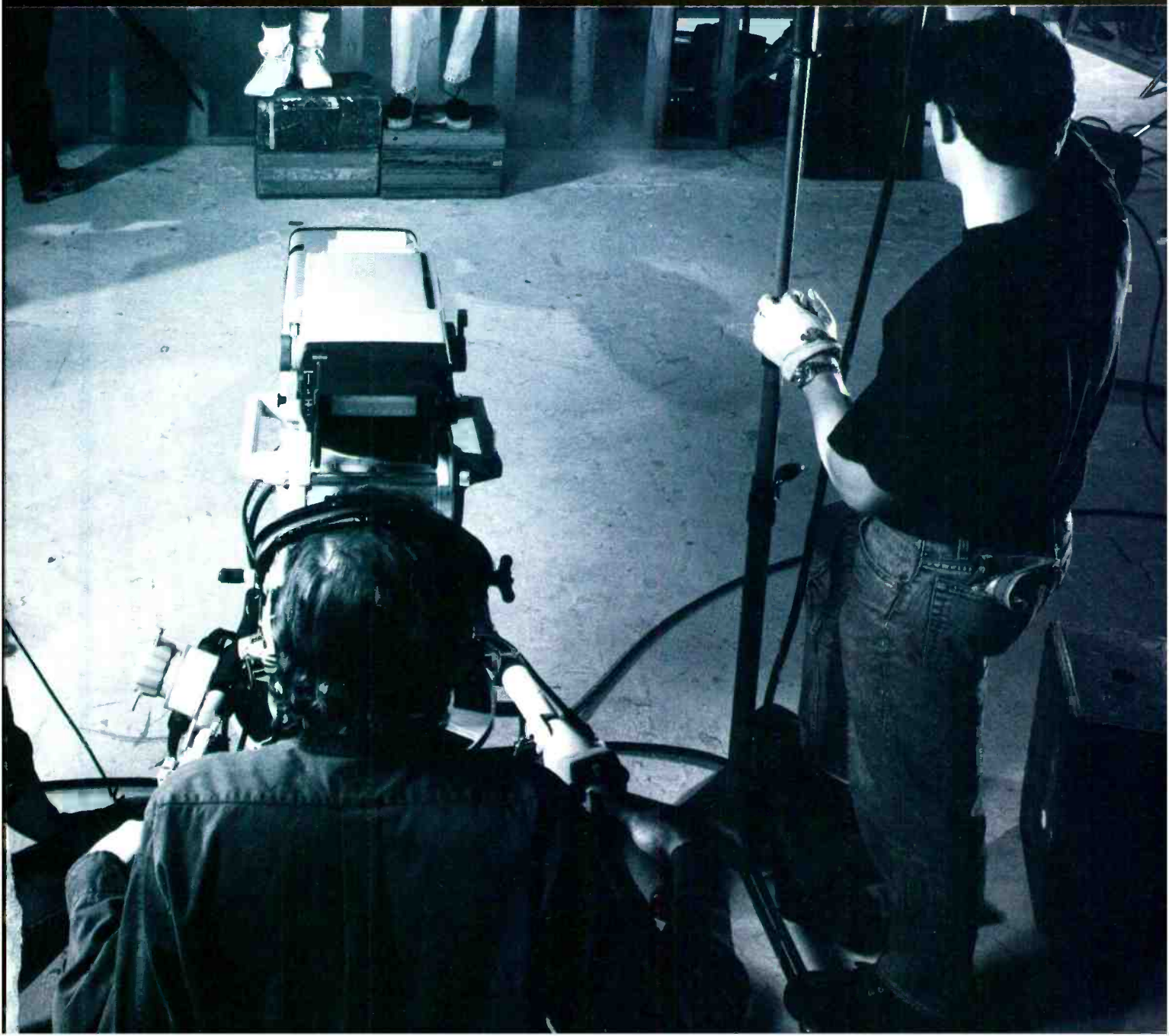
Rick Morris is an assistant professor of radio/TV film at Northwestern University. He is a former chief engineer and a former manager of engineering and maintenance for a major TV network.

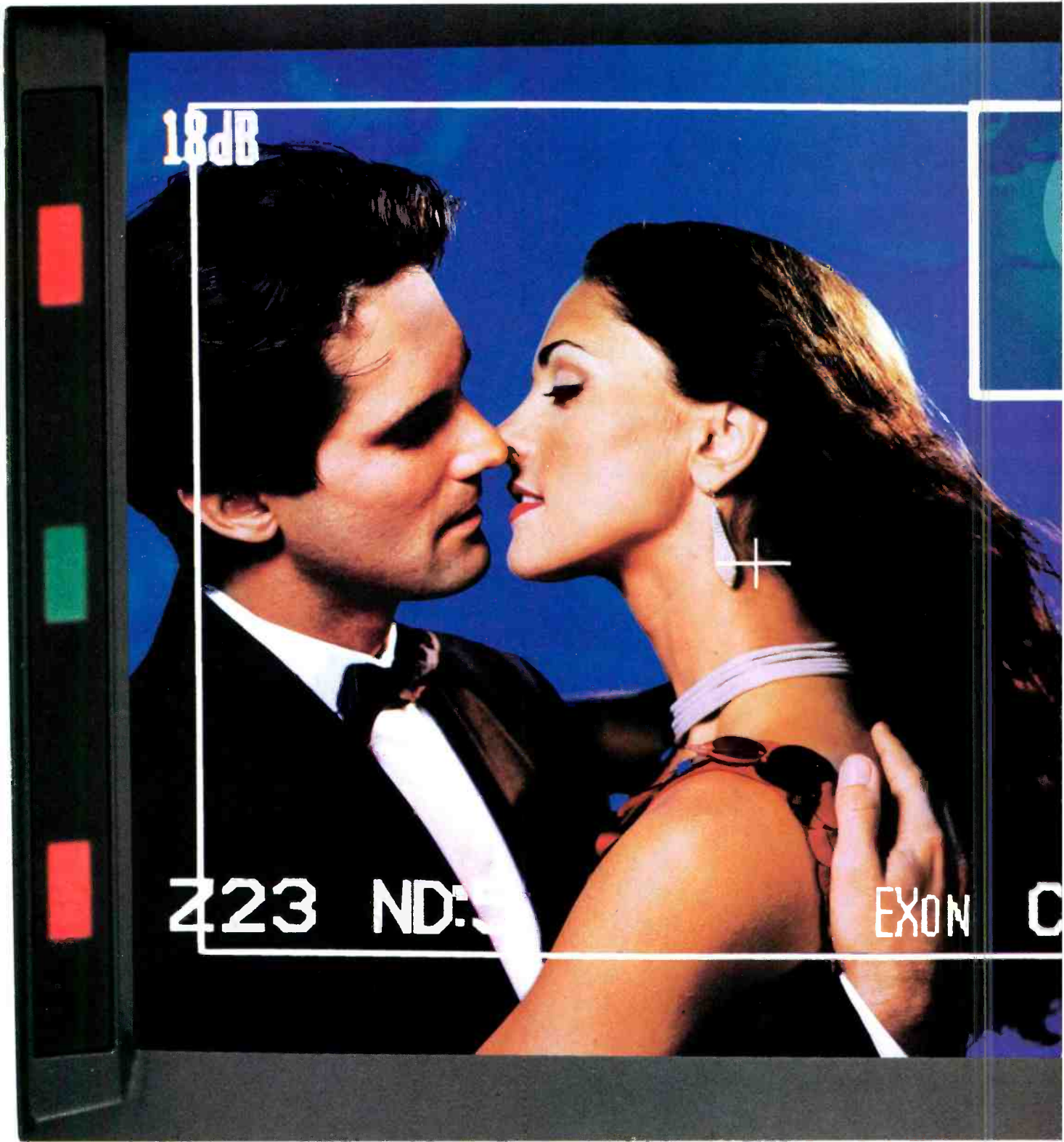
**Next month:  
Job hunting  
and locating the  
opportunities**





**SOME PEOPLE SEE THE WORLD AS IT IS AND ASK WHY.**





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## OTHERS SEE THE WORLD AS THEY'D LIKE IT AND ASK FOR A BETTER CAMERA.

For those with an eye for something better, the new Sony BVP-700 redefines the performance of high end studio/field cameras.

Sony's new Integrated Imaging Capsule is an interchangeable imaging assembly that can be transferred between the studio shell (BVP-700) and its O/B companion shell (BVP-750) for total flexibility in meeting your "hard" and "soft" camera requirements. This also protects your camera investment because it's easily upgradable to future CCD advances or when converting to 16:9 operation.

These new cameras introduce a powerful high speed digital command system for more capabilities and greater flexibility. Offering remote adjustment of the linear matrix as well as 6 way color corrector, variable gamma, black gamma control, new skin tone detail and set-up file transfer. And to deliver full video performance from the camera head to the remote CCU, Sony developed a new wideband triax system as standard.

Call your local Sony representative and ask to see it for yourself or call 1-800-635-SONY, ext. BVP for more information.

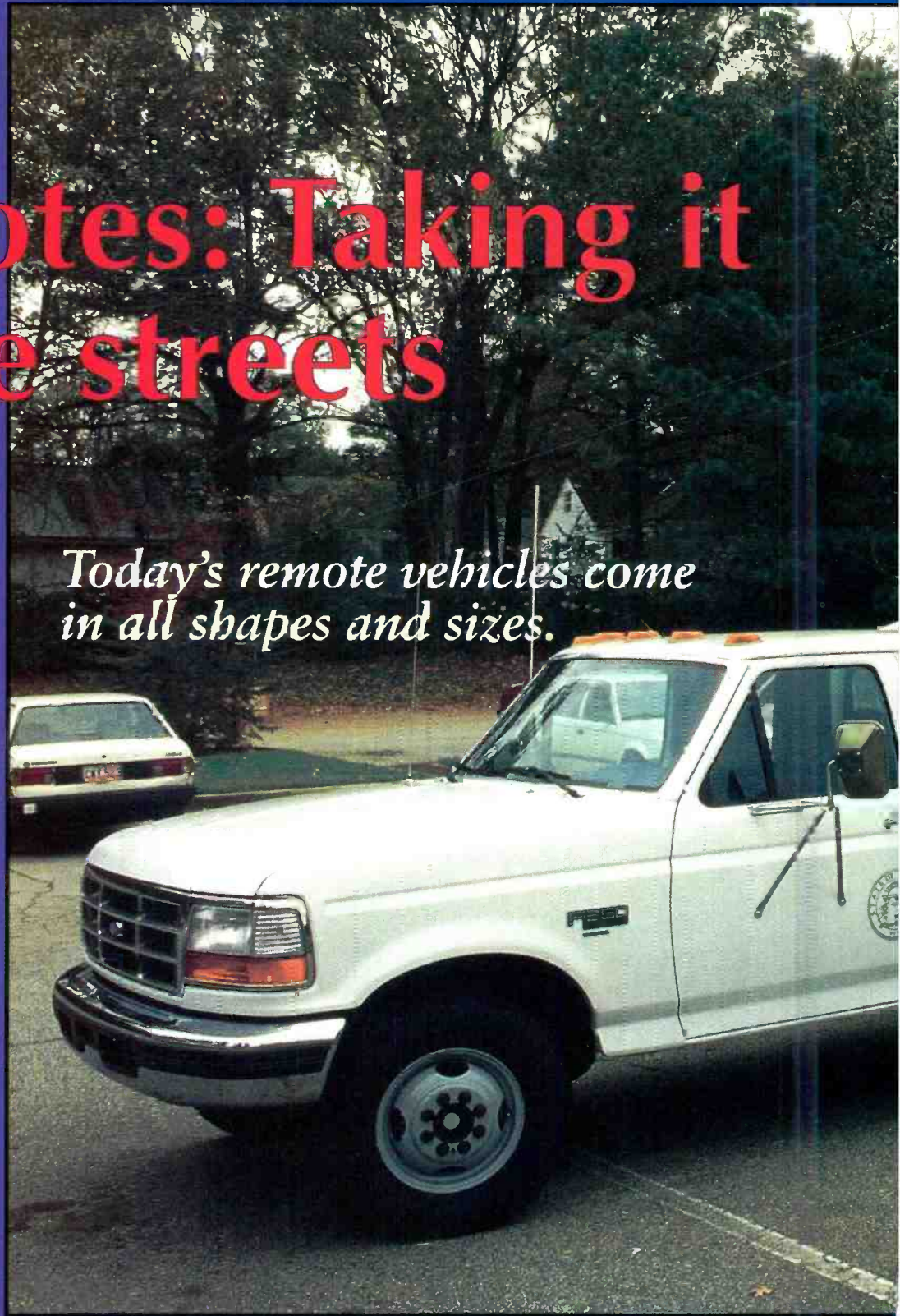
**SONY**

# Remotes: Taking it to the streets

*Today's remote vehicles come in all shapes and sizes.*

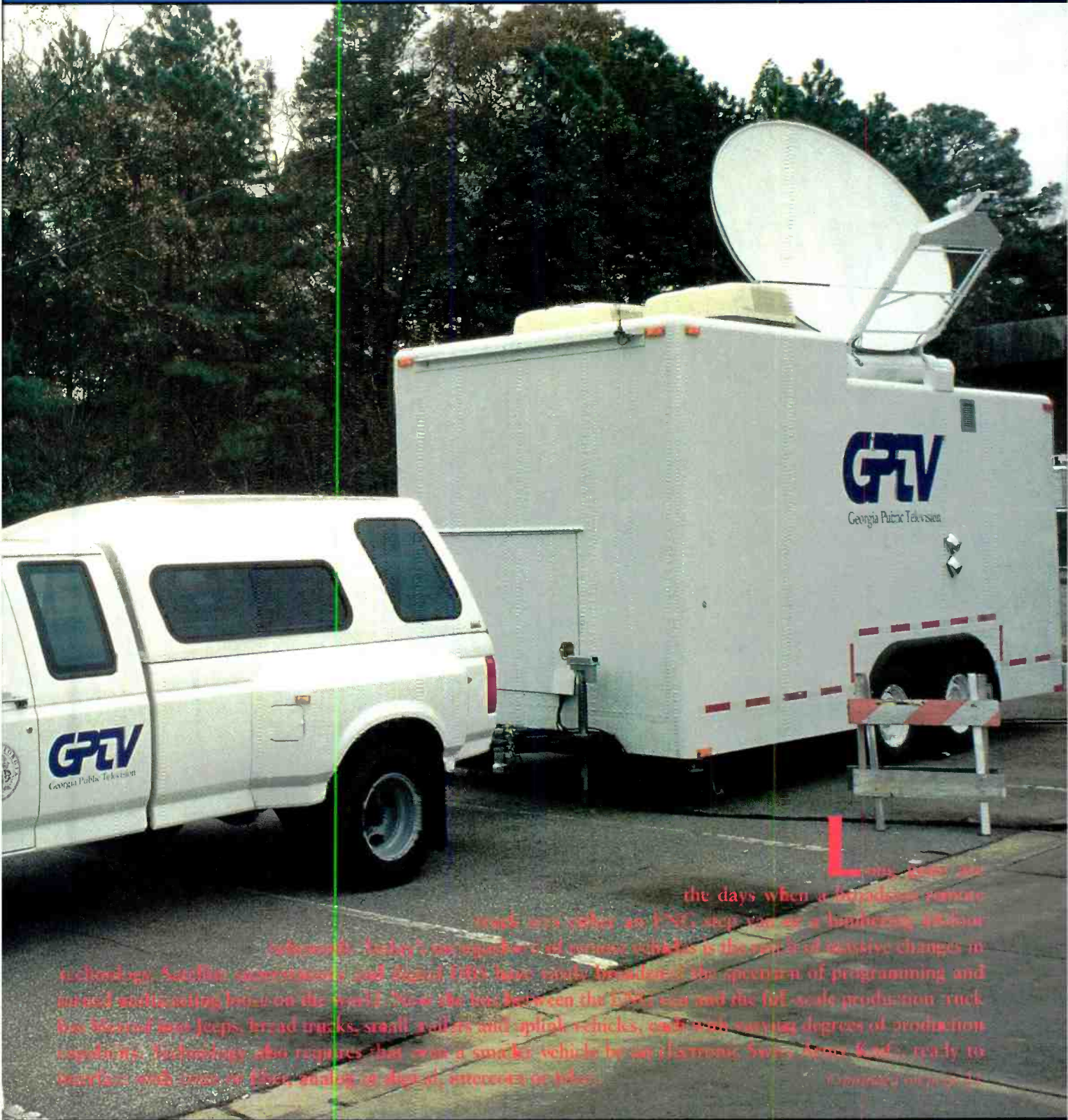
***The Bottom Line:***

*Building a remote truck is expensive. Having it sit unused can be even more costly. With today's technology, truck size means more than just square footage. Careful planning and attention to a flexible and expandable configuration can mean the difference between a truck that operates profitably and one that doesn't. — \$*



*Uplink trailer with pickup (tow) truck. Trailer can be parked and the truck then used by the operator for local transportation.*





**L**ong ago, in the days when a broadcast remote truck was either an F-56, seen you or a lumbering 48-hour behemoth, today's marketplace of remote vehicles is the result of reactive changes in technology. Satellite communications and digital video have greatly broadened the spectrum of programming and raised broadcasting budgets on the world. Now the line between the GPTV van and the full-scale production truck has blurred into Jeeps, bread trucks, small trailers and special vehicles, each with varying degrees of production capability. Technology also requires that even a smaller vehicle be an glamorous Swiss Army knife, ready to maintain such assets as fiber, analog or digital, intercoms or video.

*Continued on page 22*



All this variety means that when contracting or buying a remote production vehicle, it is more important than ever that the vehicle's capabilities be matched to the expected needs of the production. Music performance shows are heavy on audio multi-track recording. Sports shows are heavy on videotape for instant replays and off-line highlights editing. Teleconferencing requires an audio console capable of numerous mix-minus feeds, all switchable between pre and post fader.

Regardless of size, the trucks that work the most are those with a range of capabilities determined by an a-la-carte equipment setup and rate card schedule. Today's well-designed trucks have plenty of space for additional equipment. A basic complement of five cameras, two 1-inch and two Beta SP machines is carried on the larger units and can be expanded with rental units or future purchases. In some mobile units, even the tape shelves are adjustable to accommodate a variety of tape machine sizes and types. For some, changing technology is one of the best reasons to keep vehicles generic. Videotape is one area where this is particularly true. Open the tape door on most trucks and you'll be staring at 1-inch Type C and Beta SP. As a favorite of directors, VHS has also become standard. With all the camcorders now floating

## High-fiber golf

By Peter Zawistowski

This past July, ABC Sports tested fiber optics for the transport of audio signals at the U.S. Women's Open Golf Tournament. The network used commercially available equipment (Lightwave Systems' Fibox) with 20-bit A/D-D/A converters on a 4,000-foot fiber-optic audio path. The audio signals on the fiber system exhibited none of the 60Hz hum that a parallel 4,000-foot copper multipair cable picked up along its run from the announce booth to the remote truck. Overall audio quality on the fiber system was also considered to be excellent, with no frequency losses, buzz or noise added by the lengthy path. NBC Sports achieved similar results in its fiber-optic audio transport tests, using the same equipment at the 1994 Celebrity Golf Classic.

These users and others also report that the use of fiber-optic audio paths reduces installation and setup times compared to running individual audio cables or multipair copper audio "snakes." For extremely long runs, copper paths require intermediate line amplifiers, typically battery-powered. This requires technicians to make daily changes of a lot of 9V batteries. Portable fiber systems now operate in the 2- to 5-mile range without any type of line-extender amplifier.

Furthermore, the weight savings alone compared to 12-



During NBC Sports' broadcast of the Celebrity Golf Classic in Lake Tahoe, NV, a technician examines a single fiber-optic cable that is transporting the same signals carried by all the other (copper) cables alongside it. (Courtesy of Lightwave Systems.)

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pair audio cable can help justify adding fiber to the remote truck. A 1,000 foot, 12-pair audio snake weighs in around 250 pounds for lightweight cable and nearly 500 pounds for heavy-duty cable, not including connectors. A tactical field type of fiber-optic cable with the equivalent capacity weighs little more than 20 pounds.

#### Current fiber offerings

A typical fiber-optic cable today contains multiple optical fibers. Each fiber is wrapped in Kevlar, which adds enormous tensile strength and crushing resistance. A color-coded elastomeric jacket covers each fiber. A polyurethane jacket further protects and holds in place all the jacketed fibers. Gone are the days of fragile glass cable. Present fiber-optic cables have been stepped on, trodden upon by golf shoes and occasionally driven over by errant golf carts and other full-size vehicles without incident.

Exhaustively tested and qualified, these modern cables were originally developed for military applications. A 2-fiber cable that is less than 1/4-inch diameter has a bend radius of less than five inches. This is nearly equal to 8241-type coax. Covering distances of more than two miles is routine using spools of fiber cable terminated with ST connectors. An inexpensive fiber barrel with a loss of only 0.2dB can couple the ST connectors. Forget those myths about replacing connectors on fiber. Now there are simple toolkits that allow field replacement of ST connectors in two minutes. (Installation of connectors in the factory takes 20 minutes with polishing and inspection.)

Edge-emitting LEDs are the semiconductor light sources of choice today. They provide improved performance compared to earlier surface-emitting LEDs. The structures of the edge-emitting type attain a higher coupling efficiency. Their narrower active layers compared to surface types allows operation at higher bit-rates due to lower capacitance. The low cost, high reliability and improved temperature characteristics of edge-emitting LEDs compared to laser diodes (LDs) have made the LEDs popular for use in portable and remote operations. Ground loops, EMI and RFI in audio feeds become problems of the past with the fiber's

around, ENG trucks have found VHS machines to be a smart-carry.

#### GPTV hits the road

With these trends in mind, engineers at Georgia Public TV set the design for its remote truck and a medium-sized, integral truck-cab configuration evolved. The previously listed tape arrangement went onboard along with four Ikegami HL-357s and two HL-79 hand-held cameras. An RTS analog intercom with 6-channel, 4-IFB capacity was originally installed and a GVG-300 switcher complemented the Yamaha M1532 audio console. Audio was placed in the center section to have a window to production and still be buffered by the video section from the rear-mounted air conditioning. No cutting-edge technology was brought in. GPTV planners were aware that the truck would be used by a variety of freelance crews. The intention was to stay with generic, well road-tested and familiar gear. This was a prime concern because of the fact that mobile gear tends to get the most use, the worst treatment and the least maintenance of all broadcast equipment.

Over several years of operation a number of improvements and even an expansion have been made. Some have been simple, bolt-in additions that most similarly equipped trucks will eventually need. The

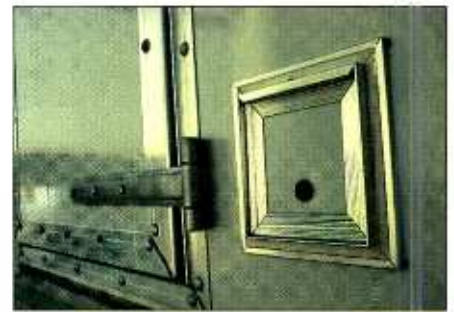
**25 years at the same job and  
what do we have to show for it?**



Power take-up reels in the back of the 46-foot trailer. Motors simplify the job of winding and unwinding cables. (Photos courtesy of Georgia Public TV.)



Camera sleds in the belly of the trailer, first sled is partially extended and has camera removed, more sled-mounted cameras are in the background.



Small "rat hole" near doorway allows for cabling to enter truck without having to go through the doorway.

4-IFB setup was expanded to eight as wireless microphones and wireless IFBs were added. Today's production stampede away from audio cables on mics, IFBs and intercoms has made wireless audio a basic fixture, even on the smaller mobile units. Also because of client demand, an Abekas A-53D was installed and cameras were equipped with iso tallies. Not fully foreseen at the time of purchase, many of the truck's clients have turned out to be live sporting events. The iso tallies are a must on live sports and live-for-post stage performances. Gentner units have been added for interfacing telco and intercom. If the truck is to do any live shoots, telco interface units are essential. Whatever the brand, it's smart to

spend the extra cash and get auto-answer units. Experience has proven that the grief these units save audio people is worth the money, particularly when the next mix-minus client is calling in while a show is still going on. This is the standard routine at teleconferences and conventions. Another handy gizmo on remotes is the "god box." When several crews are working with different 2-way radio frequencies, a stage announce speaker used during setup works well for paging people to the intercom or phone.

#### The large unit's metamorphosis

Not all of the changes made to the truck were easy. Two problems encountered were

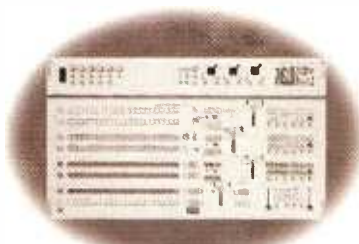
the tight space for tape operators and the clash in working environments between tape and video operators who shared one small room. It became evident that the video and tape areas needed to be separate. The video area had to be small and dimly lit so that the operator could scan monitors with ease while the tape room had to be brighter and louder and roomy enough to accommodate additional temporarily installed machines. Eventually, these challenges called for a major architectural modification.

The truck body was removed from the chassis, lengthened by 15 feet and placed onto a longer chassis with a separate cab. Now the 46-foot unit sports a large tape room at the front with an off-line editing

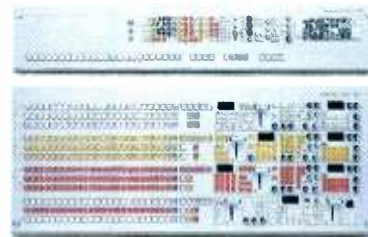
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closed-loop optical system and digital signals.

### Growing use

Sports applications aren't the only places where fiber-optic audio transport can be used. A fiber-optic backhaul link also carried the audio for the 1994 Fourth of July Boston Pops Esplanade Concert broadcast. Strung through the trees, approximately 400m (1,300 feet) of a tactical fiber-optic cable connected the stage to the mixing and announcing booth at Boston's Hatch Shell. The system that was used delivered 108dB of dynamic range while eliminating the noise and hum previously encountered in concert broadcasts. There also was no need for equalization to compensate for high-frequency losses in the music signals from the stage.

As more users try fiber for audio or video transport, remote vehicle operators will find fiber-optic systems on their clients' required equipment lists.

Peter Zawistowski is senior engineer at Target Enterprises, a remote production engineering and design firm in North Reading, MA. Respond via the BE FAXback line at 913-657-1905.

 For more information on fiber-optic audio transmission, circle (301) on Reply Card. See also "Fiber-Optic Components," p. 76 of the BE Buyers Guide.

station and expansion space. The new tape area is perfect for the truck's sports work. At the same time, the breakout panel was moved to the rear of the trailer to keep snakes and cables out of well-traveled areas. To save the crews' backs, roll-out camera "sleds" with camera-mounting heads were installed. The cameras, minus lenses, are mounted on the

heads just as if being mounted on a tripod and it all slides into the bin as a drawer. Lenses are stored in padded cases alongside the cameras. Each sled has a 600-pound capacity. The unit's breakout panel has output feeds on XLRs, BNCs, screw terminals and banana-style binding posts. To save space for storage, the tape machine racks

are arranged along the left wall of the truck, permitting rear panel access through exterior doors.

One useful and uncommon feature on the vehicle is the interconnect panel in every section. Each panel has three video lines and six audio lines run to their respective patch-bays in the video and audio sections. Also included is an RTS intercom connection assignable from the RTS source assignment panel in the audio rack. Integrally mounted, battery-powered work lights are installed on a timer circuit. This provides area work light before AC is connected and after AC has been pulled.

With a quieter and darker section for video and more room for videotape, one problem that remains is the rather limited output mixing flexibility of the Yamaha M1532. This has the truck's audio capability lagging slightly behind its picture power. Big truck or small van, it is better to have an audio console on which the inputs can be directly routed to the main outputs as well as through subs. Once a big-board feature, this can now be found on audio mixers small enough for van use. Work on The McNeil-Lehrer News Hour has shown the board also needs eight auxiliary sends per channel.

To avoid dealing with microphone-level audio signals as much as possible, GPTV's

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engineering shop came up with a microphone interface box that does a number of things. After connecting to the audio snake with a multipin connector, the unit pre-amps all mics and connects to a series of small announcer stations. Each station enables the talent at the mic to operate a cough switch or cue the mic, off-line, to the director. This is accomplished using a relay that switches the mic from one line to another. To beef up output mixing, a Yamaha PM-4000 is planned to balance audio and video capability.

**Multitrack for the masses**

There are future plans in the area of mo-

mobile digital multitrack. Ushered in by their low cost and small size, 8-track DAT machines have begun appearing in the larger remote units with good results. Instead of shelling out \$50,000 to \$100,000 dollars and lugging around a couple of 24-track open reel machines, many trucks can now load in a few of these little 8-track digitals (some with internal video sync, some external). Also, for approximately three or four thousand dollars for each set of eight, trucks can have 24-tracks of video-sync sound in a couple of feet of rack space. These units are proving themselves rugged enough for road use and they promise to become a significant force in mobile multitrack recording.

They use a standard tape format, VHS-C or Hi8, and it is available at approximately one-tenth the cost of open reel tape. These machines have all the features of the open reel decks. They are also low-cost enough for most customers to buy two sets of units — one for the truck and the other for house post, all for less than the cost of one of the older open reel multitrack monsters.

**New type of uplink vehicle**

Uplinking has become the new star of the small truck show and SNG variants abound. It was inevitable that in addition to its uplink role in big truck support, some of these units would begin to sprout cameras and microphones of their own. As mobile uplinking came in, we watched with double interest. Some commercial clients would appreciate a package arrangement with a large production truck and a small uplink vehicle, but there were additional reasons to explore the smaller end of the remote truck spectrum.

Georgia now has TVRO dishes installed or being installed in every state-funded school and vo-tech facility. A key difference between the old educational television and the new distance learning is interaction. To make distance learning work, students must be able to question their instructors and send feedback from the classroom to the studio. This often requires live and highly mobile uplink power. The same situation frequently exists in teleconferencing and corporate education.

GPTV saw this role coming and after purchasing a transponder on Telstar 401, consulted with Harris-Allied concerning uplink needs. The result was two first-of-a-kind mobile units. Not designed strictly for SNG, these S-20T uplinks uniquely com-



Interior of the uplink trailer shows plenty of room for expansion if needed.

# Telemetrics

## TM9250

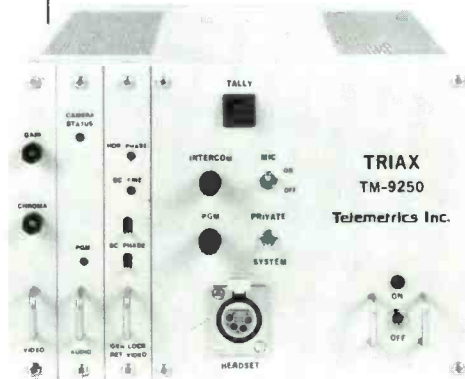
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line big truck comfort and trailer convenience. Each is towed behind a large, 6-wheeler pickup truck and are intended for situations where the uplink may be in place for a week or more at one site. Meanwhile, the one-man crew can use the pickup truck for transportation. Inside, each is like a piece of a big truck. The operator can stand and take a few steps from one side to the other. Along the face of the racks, a console can accommodate three people sitting side by side. As previously stated, smart trucks big and small have room for internal equipment expansion and these units have plenty. Each truck could fit three more racks of production or communications gear. With the air conditioner running the units are surprisingly quiet. Nevertheless, for serious audio monitoring, headphones are needed.

The trailer concept was used because operation of these units can also be automated. Included on the operator console is an IBM 486 computer and modem. These can send unit status data out and receive operating commands via phone line.

Currently equipped for uplink duties only the S-20T's production switcher is a 10x1 Grass Valley Performer for video/stereo audio switching. Each unit also features a Chyron Codi graphics generator. Although not needed for our purposes power generators can be added. All this has a hitch weight of 1,250 pounds and a towing weight of 9,500 pounds.

The units are ready for digital transmission, however, analog modulators currently fill the racks. As digital equipment becomes available it will slide into existing racks and following the Swiss Army Knife concept, be able to handle analog and digital signals. With compressed transmission, programming service could be expanded to include eight or more separate channels on the Telstar 401 transponder. The ultimate concept is that while separate distance learning programs are beamed out on multiple channels per carrier (MCPC), the S-20T units will be beaming back live participation by single channel per carrier (SCPC).

We plan to have one unit stick close to the 46-foot production vehicle while the other tours the state taking students on interactive field trips. The first two S-20Ts have been deemed such a success that Harris has decided to make them part of its regular fare. Each S-20T's racks can also be filled with more production gear for buyers with multicamera/SNG or tape editing/SNG needs. Fitted for production these trailer units should do quite well when called on to have a camera or two inside at a large event and one camera outside for standups. If a press feed is available for the event, a 2- or 3-camera area for live interviews can be set up and controlled from such a unit.

## Contracting for remote services

By Dave Doré

More and more stations are producing their own events. Often they do not have full-scale production trucks and must go out of house to get the job done. Fortunately, many companies can provide anything from the most basic setup to network-style, 14-camera packages.

The first step is determining your needs and budget. A college football game would require at least five cameras and two tape decks. Most trucks begin at a base price for just the truck with no crew, and then add crew, camera, tape decks and special effects. This allows clients to pay for only what is needed. If the show is live and graphics come from the truck, consider the type of graphics machine needed. You may also have to deal with a commercial reel, which means one machine will not be available for replays. A work-around solution is to use a deck for replays and spots and swap out tapes as needed.

If you need to run a separate machine for commercials, eliminate the operator on the spot reel and have one of the replay operators roll it. This saves money because the crew represents hard costs to the truck company, not the gear itself.

Most companies will crew your event. Make sure you ask though, regular crew members may not be available, and you may get the "B" or "C" crew. If money is tight and the event is close, you might be able to use station personnel for crew.

Another money-saving solution might be a shared broadcast. If another broadcaster is in the same venue with a truck and cameras, you might just roll in another truck with a camera or two to use on your talent. You can take the feed from the other director or switch his or her cameras yourself, breaking away to your own camera when necessary. Graphics and audio can be added along the way. Remember that you have no control over the other director's cameras.

An even less-expensive option in this situation is a back bench split. Your director sits in the other broadcaster's truck and takes a clean feed, adds audio and graphics if possible, and sends it to the station. This must be arranged with the company and the other broadcaster because the truck in question must be able to accommodate both feeds and the necessary people to run them.

### Transmission requirements

Transmission is another concern. Does the location have an uplink or feed into telco or fiber-optic lines? If not, you may also have to book a portable uplink. Often the uplink company can help with booking the satellite time as well as phones and other communication needs.

Once you determine the requirements, find a company that will provide what you need at the price you want. Several companies operate trucks throughout the country and they will often drive a truck as far as it takes to get the job. If you have more than one event, your buying power increases. Don't overlook the smaller companies, they may only have one truck, or only smaller units, but you may find them eager to get your business because all of their income depends on keeping that unit working.

The truck business is a competitive business, and it's a buyer's market. There are more trucks out there than there are events at this time. Everyone's trying to get your business, and competition forces the companies to continually update equipment to maintain the standard. ■

Dave Doré is on-air promotion director for WCIU-TV, Chicago.

One GPTV unit is among the largest and the other is among the smallest, but wherever they go, they will each be confronted with an increasingly broad array of interfaces. Both will be fine-tuned within their ranges of capability, for each specific occasion and neither will carry any exotic equipment. Today's changes in programming and its delivery have created a wide array of remote vehicles with overlapping capabilities. Broadcasters must understand their needs before contracting or designing a remote production vehicle. ■

Metlbern Bennett Files is an audio engineer for Georgia Public TV, Atlanta. Respond via the BE FAXback line at 913-967-1905.



For more information on remote vehicle construction, circle (300) on Reply Card. See also, "Vehicles, Production, ENG/SNV" on p. 96 of the 1995 BE Buyers Guide.



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# Server and LAN technologies



*As computers become a necessary part of the desktop, the next step becomes interconnecting the desktops.*

## *The Bottom Line:*

*Acceptance of computers is becoming almost universal in the broadcast and post industries. As computers become widespread throughout facilities, sharing resources becomes a requirement. So by taking advantage of current networking technologies, an entire facility can be tied together. Now shared resources include not only information and data, but audio and video as well. ——— \$*

In the early 1900s, author Elbert Hubbard once said, "One machine can do the work of fifty ordinary men. No machine can do the work of one extraordinary man." His vision hits home when the subject relates to connecting computers together through a local area network (LAN). Broadcasters are implementing networks at the station level in increasing numbers. In some cases multiple networks are used to serve different departments in a variety of unique ways. Often, a station engineer may be required to assume that "extraordinary" role, not only as the "hardware guy," but possibly as the system administrator.

Engineering departments are typically involved with the planning of the physical plant. Station engineers have always been concerned with signal flows, whether they are audio, video, RF or digital. Designing a LAN is a natural extension of that process. Fundamental questions addressed during the planning stages are similar, including:

- What will the system be used for?
- Who will need access?
- Where will the equipment be located?
- What degree of redundancy will be required?
- What materials can be reused?
- What materials will need to be purchased?

Perhaps the most important question concerns whether the plan will be able to accommodate and take advantage of emerging technologies over the next five years. The adage that the only sure thing is "death and taxes" can certainly be modified to include obsolescence.

The proliferation of networks in business is due in part because files and resources can be

easily shared, both department- and company-wide. Other reasons include things like e-mail, which replace the need to send paper memos, and software, such as Lotus Notes, which allows whole documents to be moved through a company for review or changes. The term work-group computing has become a buzzword in many companies.

Departments found within a broadcast station may be diverse in their duties, but they require a great deal of interaction. For this reason applying these work-group solutions makes sense. Broadcasters can also use the network to carry traditional audio and video information formerly carried on other types of cabling. By understanding the concepts of the LAN and some of the underlying data communications standards, a system can be planned that should be useful for a long time.

## **The basics**

The problem of interoperability between different types of hardware and operating systems was addressed by a set of standards known as the open systems interconnect (OSI), developed by the International Organization for Standardization (ISO) and the Institute for Electronic and Electrical Engineers (IEEE). The OSI standard is comprised of seven layers. Each layer has a unique purpose and an explicit set of rules applicable to its use. The seven layers are:

1. **Application.** Handles communications between the user or the user's application and the layers below. It talks directly to the network operating system.

2. **Presentation.** Translates data essential to connecting and maintaining compatibility between different types of computer platforms (i.e. PCs to Macintosh).



*Believe it or not,*

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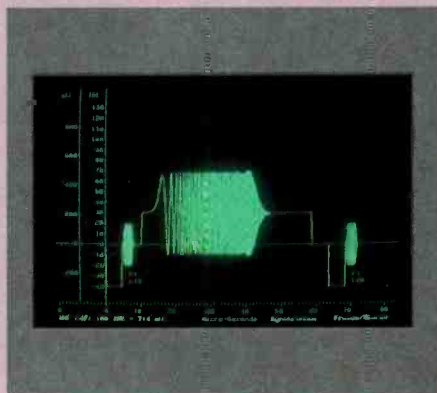
this is exactly what

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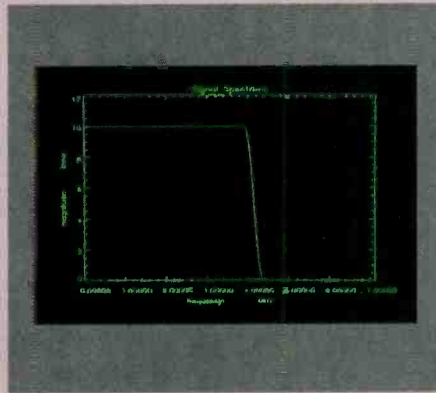
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3. **Session.** Sets up the connection and provides support between communicating applications.

4. **Transport.** Maintains integrity of the data communications elements.

5. **Network.** Helps route data across a network that uses multiple segments.

6. **Datalink.** Encapsulates the data and adds the appropriate header information.

7. **Physical.** The physical hardware needed to

connect the system, such as the network interface card (NIC), cabling and connectors.

Data is passed from the user to the network, from the top (application layer) of the stack to the bottom (physical layer) on to the network. The process is reversed when the user receives data from the network. For more information on LANs, see "Troubleshooting," p. 16 of *BE* April, May and June, 1994.

**Network operating systems**

Computers connected to a LAN are considered either servers or workstations (also

**Servers and OMF**

The great interest in video servers and networking is largely due to the ability of server-centered production techniques to bring substantial benefits to the broadcast facility. When properly implemented, a server-centered production system with its disk-based editors, recorders, and playback systems, can dramatically improve the production process. Editing can speed up substantially because the process is completely non-linear. Production benefits from multi-user access to the shared central library. Playback also can be quicker and more efficient because edited material is instantly available to air.

Server-centered production offers several improvements to the production process, especially in the fast-paced world of news. Implementation is critical and starts with selecting the basic architecture for the system. Networked systems for digital media sharing come in two basic architectures: file transfer and client-server.

**File transfer architecture:** When file transfer technology is applied to video production, the media files, which contain the audio and video data, are actually transferred from the server to the workstation and back again. For instance, video stored as a file in the server would be transferred over the

**What to look for...**

The following is a short list of questions that provide a starting point when considering a server-based system.

- Does the server support your needs for recording, playback and editing, including audio and effects?
- Does the system operate in client-server or file-transfer mode?
- How much storage is supported, and at what data rates and bandwidth?
- Is the system a video/audio-only server or is it a true file server capable of storing text, graphics, and other material essential to the production process?
- How many users can be connected? How many can operate simultaneously, and at what cost (system slowdown or increased network access times)?
- Does the system use networking technology or video for linking to outlying workstations? What speeds are supported?

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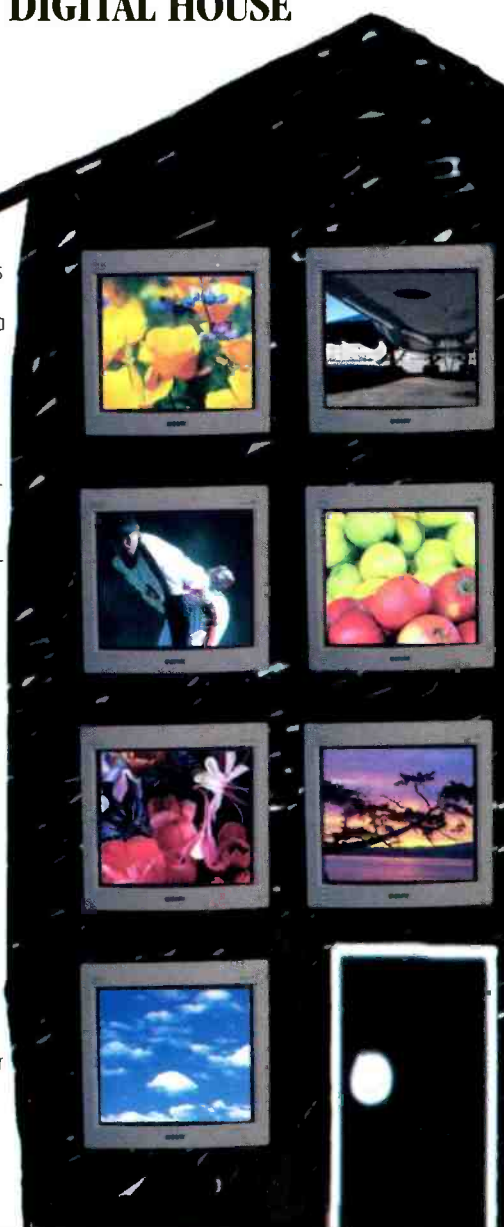
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# DIGITAL COMPONENT:

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2





DirecTV is the world's first all-digital TV distribution service. Successfully launched in 1994 by parent company GM Hughes Electronics, DirecTV is also

North America's first direct broadcast satellite (DBS) service. DirecTV delivers 150 channels of digital-quality pictures and CD audio via two high-power satellites built by GM Hughes. The digital broadcasts can be received by homes equipped with Digital Satellite System (DSS) 18-inch dishes and digital receivers.

With home reception equipment sales running at 100,000 systems per month, DirecTV represents one of the most successful introductions in broadcasting and consumer electronics. It also distinguishes itself as the first North American installation for Sony's Digital Betacam® recording system, introduced in 1993. Today, DirecTV is the largest Digital Betacam facility in the world.

DirecTV programming includes ESPN, CNN, USA, The Disney Channel - among other major cable networks, as well as special interest and educational fare. Up to 50 channels are dedicated to pay-per-view movies and special events. Also available on this diverse service are more than 25 channels of commercial-free CD-quality music.

### *Digital Betacam takes over the house*

In planning the launch of the revolutionary multichannel DirecTV programming service, Hughes could not be content with just the state-of-the-art in broadcast video technology. They also required cost-effective equipment and systems that would set a new standard for picture and sound quality while guaranteeing reliable and continuous operation. A high degree of automation was central to the plant's design. Additionally, the designated video format would also have to anticipate future demands for higher levels of performance, in a dynamic and competitive communications environment.

David Baylor, DirecTV's senior vice president of operations, reviews the decision-making process that led to the selection of Digital Betacam technology: "We considered a tapeless facility but the technology was not ready then and it is not quite ready now.

"We wanted the best tape format available to do the job. A high degree of automation was key for running a 150-channel facility. Digital Betacam met our criteria for a reasonably low-cost format that would provide high reliability, a high-quality reproduction of the recorded signal and a format that lends itself well to operating in an automated environment."

In April 1993, Hughes selected Sony

Business and Professional Group's new Digital Betacam 1/2-inch component technology as the house format for the 150-channel service. Previously, Sony had been awarded a \$50 million contract to design, integrate, install and maintain the Hughes DirecTV broadcast center in Castle Rock, Colorado.

During 1995, another Sony company will be joining the DirecTV family, when Sony's consumer division starts manufacturing and selling DSS home reception equipment.

*The Sky's the  
Limit for  
Digital  
Betacam  
Technology*

### *Colorado workhorse*

DirecTV's Castle Rock Broadcast Center in Colorado is North America's first all-digital broadcast facility and one of the world's largest TV broadcast facilities. There are currently 320 Sony Digital Betacam VTRs and related systems installed at the Broadcast Center. The equipment is controlled by a sophisticated, software-driven automation system.

The programming for DirecTV is collected at the 55,000-square-foot Broadcast Center from domestic satellites, fiber-optic landlines and videotape. Movies and other tape material are delivered on Digital Betacam cassettes from production houses serving the major movie studios and other program suppliers.

As a result, the adoption of Digital Betacam technology by DirecTV has led a growing number of post houses to invest in Digital Betacam VTRs. These facilities are expanding their use of Digital Betacam recording as a cost-effective digital component format for editing and other postproduction projects. Because Digital Betacam VTRs are playback-compatible with analog Betacam and Betacam SP cassettes, these houses can continue to use existing tape libraries.

As the workhorse format at the multichannel DirecTV facility, Digital Betacam machines perform a variety of recording and playback functions. They form the heart of the pay-per-view playback operation. Digital Betacam VTRs are also called into service to compile and play back promotional and interstitial material. This material is aired during movie intermissions and during empty commercial slots on DirecTV's so-called "turnaround" or immediately retransmitted channels, such as CNN.

Digital Betacam VTRs are also used to record incoming channel feeds that are played back with a time delay. And Digital Betacam equipment performs postproduction functions at the Castle Rock Center.

### *High quality at low cost*

When GM Hughes Electronics was selecting a house format for the Broadcast Center, it focused on several key criteria. First, it required a format that was both high quality and cost-effective, because it would be operating a 150-channel programming service offering MPEG-compressed digital-quality video and audio.

As a serial digital plant, Castle Rock was planned as a facility in which digital video and audio signals



David Baylor, Senior Vice President, Operations, DirecTV



could be communicated to every recording, post-production, playback and transmission station through a common coaxial cable. The serial approach would dramatically reduce the costs of wiring the facility while maintaining image quality.

Quality during dubbing was also crucial, because DirecTV prepares eight air masters – four for playback, with four in backup – for its pay-per-view channels. Because of the anticipated size of the tape library and enormous demand for blank media, DirecTV needed a compact format that was relatively inexpensive to buy and store.

Additionally, because the DirecTV operation is dominated by long-form programming, Digital Betacam technology is significantly less expensive than hard drive type storage. It's estimated that Digital Betacam recording costs less than five cents a megabyte. With a file server, composed of an array of disk drives, it is far more expensive.

### *The components for success*

The Digital Betacam format's component 1/2-inch cassette approach was well-positioned to meet DirecTV's cost and quality requirements. As a component video recording system, Digital Betacam technology delivers a high-quality video format that supports DirecTV's MPEG-based digital compression transmission system. Component video eliminates cross modulation – the interference caused by mixing RGB signals in a composite video environment – and maintains quality video throughout the Broadcast Center and transmission path.

Digital Betacam recording's digital component technology allows DirecTV to generate high-quality copies of movies for playback. These copies are identical digital clones and are virtually free of generational loss, artifacts and cross modulation.

Regarding the overall quality of Digital Betacam recording, Baylor said, "We have not seen any artifacts at all." This includes recordings made in editing as well as dubbing, relates Baylor.

The Digital Betacam format's four channels of digital audio also serve the sound requirements of DirecTV's entertainment programming.

Digital Betacam equipment complies with the Serial Digital Interface (SDI) standard. As a result, the machines seamlessly integrate into the cost-effective and quality-maintaining serial design scheme at the Castle Rock operation.

In planning a facility with more than 300 machines, DirecTV found the costs associated with D-1 component VTRs to be beyond its budget. By designing Digital Betacam technology as a 1/2-inch-based format incorporating mild 2:1 compression, Sony has furnished DirecTV with a high-quality, full-bandwidth digital component system that is also cost-effective.

At \$40,000 for a Digital Betacam machine and \$40 for an hour of tape, the 1/2-inch system was a logical alternative to D-1. The compact, 1/2-inch Digital Betacam cassette controls the costs associated with storing masters and managing tape stock at DirecTV.

### *A track record of reliability*

Two other criteria that were central to DirecTV's selection of Digital Betacam equipment relate to reliability and the ability to easily integrate within an automated facility. Because the Broadcast Center is

on the air all the time, DirecTV needed a format that was highly dependable and relatively low maintenance. In selecting a reliable format and machine design, the reputation and broadcast video experience of the manufacturer was also of great importance.

As Baylor recalled, "We needed uninterrupted video and audio all the time. You have to be able to do backups on-line that don't interrupt service."

He also explained one of the other realities of running a broadcasting operation: "You can't resend data packets if they are messed up. That is not an option in television because when a second is gone, it's gone.

"We had confidence in Sony. They know the broadcast business."

Because the Digital Betacam format was new when it was selected by Hughes, the company was influenced by Sony's track record as a leading manufacturer and supplier of broadcast equipment, video recorders and integrated video systems.

"When we committed to Digital Betacam," said Baylor, "there were zero machines in the marketplace. We studied the prototypes, spoke to their engineers and relied on our experience with Sony and they came through with the product as they promised."

Sony's experience in implementing 1/2-inch-based Library Management System™ multicassette systems (LMS) for analog Betacam was also important. It ensured that DirecTV's two Digital Betacam-based LMS systems and 60 Flexicart® units would operate smoothly.





In awarding the contract to Sony to design, integrate and maintain the Castle Rock Broadcast Center, DirecTV underscored its recognition of Sony's preeminence and reliability in the broadcast field. As part of the contract, 17 Sony engineers and technicians function as Castle Rock's on-site maintenance team.

The reliability issue was the major reason why DirecTV did not designate a disk-based, file server system. File server technology was not considered mature or dependable enough to support an operation of DirecTV's magnitude with its sophisticated, plant-wide automated controls.

One of the other benefits offered by Digital Betacam technology is that its high-quality, digital component recording provides operations like DirecTV with a migration path to new digital storage technologies. Hard-disk, magneto-optical and other non-tape solutions have possible applications at DirecTV for shorter-form material, such as the recording and playback of interstitial material. In these applications, the reliability and cost-efficiencies associated with the Digital Betacam system for long-form playback and program archiving can be leveraged with the capabilities for random accessibility delivered by file servers and other non-tape media.

It remains crucial to the DirecTV management today that their programming service delivers uninterrupted video and audio. Sony's Digital Betacam approach, backed by the company's long heritage in the real-world demands of broadcasting, provides a

tape-based solution that continues to achieve DirecTV's goals.

In the future, Digital Betacam technology - because of its digital component recording - will provide a migration path to mature, cost-effective file server technology. The result will be operations that combine Digital Betacam recording with magneto-optical for near-video-on-demand and other multichannel applications.

### *Automation in a serial environment*

Because Castle Rock is a multichannel facility, DirecTV's plant incorporates a high degree of automation through computer controls. This factor is key to managing a plant of Castle Rock's complexity and also in keeping overall people and machine counts to a minimum. The demands of the operation require the flexibility to easily reassign machines in a computer-controlled environment.

Therefore, Hughes specified a format that would lend itself well to an automated environment. Another prerequisite was a recording and playback system that could be easily integrated into Castle Rock's plan for a serially designed plant.

"Digital Betacam, because of its serial digital implementation and its error and help reporting coming out the machine, allows us to run an automated system," Baylor said. "Otherwise, we would need a lot more people" at the facility.

Digital Betacam recording, based upon its capabilities and actual performance in Castle Rock, has proved to be a tape-based format that is well-suited to an automated environment. The format's features have been a major factor in the successful and efficient operation of the Castle Rock broadcast operation.

The DirecTV installation incorporates Sony's unique Interactive Status Reporting (ISR) concept, software that coordinates with the Digital Betacam VTR's onboard status monitoring and the overall automation scheme. If a problem is detected on one of the Digital Betacam machines, the automation system makes sure a backup machine is ready to go - all without human intervention.

The 1/2-inch design of the Digital Betacam cassette lends itself well to the automated environment at Castle Rock. Robotic systems can easily load and unload the cassettes, once again reducing the need for staffing. And Digital Betacam VTRs and cassettes are easily integrated into DirecTV's LMS and Flexicart multicassette systems, the first choice in playback automation.

Looking to future needs at DirecTV, Sony can also draw on its long history in playback automation, in-depth knowledge of industry needs and the reliability of its automation systems to provide the migration path to future broadcast automation applications. These include near-video-on-demand and other multichannel applications that will likely involve hybrids of Digital Betacam technology and non-tape storage.

### *The marriage of hardware and software*

A sophisticated software system, custom-designed and installed by Sony, forms the "brain" of the Broadcast Control System (BCS) at Castle Rock. The software reflects Sony's extensive software de-





velopment and engineering capability based at Sony Operations and Technical Services (SOTS) in San Jose, CA. The group's in-depth understanding of broadcast operations, computer software and broadcast video equipment ensures that both software and hardware "talk" to each other and work well together.

The BCS provides the central automation, or hub, for DirecTV, receiving information from the traffic system that schedules all of the programming planned for airing by DirecTV. Once translated into "machine language," the software performs many functions. These include starting the Digital Betacam VTRs and switching the crosspoints on the plant's Sony 1,048x1,048 serial digital router.

Through the BCS, the Castle Rock Broadcast Center can be operated as a dynamic and flexible system, sharing resources among 150 channels and reassigning machines as needed. This also makes Castle Rock a unique broadcast operation: The level of flexibility and dynamic reassignability it has achieved makes it the only true multichannel facility in the world. Therefore, the Castle Rock Digital Betacam operation is well-positioned to incorporate any new file server technology that is likely to arrive.

From Baylor's perspective, "Digital Betacam is fine quality. It's what we are putting on the air today. It should give us a library that will live into the future."

#### *Positioned for the future*

With the future promising improvements to the broadcast TV system in the United States and new forms of video storage and playback, DirecTV, through Digital Betacam technology, will enjoy the benefits of "future proofing." Digital Betacam recording provides DirecTV with a format that can support widescreen 16:9 NTSC broadcasting and other anticipated enhancements to the broadcast system.

Considering his facility's current and future use of Digital Betacam technology, Baylor added, "Digital Betacam is the epitome of the state-of-the-art in videotape machines. It is small, it has high quality, high reliability, is reasonably priced and also has a tremendous amount of capability."

As a component digital serial format, Digital Betacam will also easily integrate with anticipated shorter-form disk-based and magneto-optical formats. These formats are designed for ease of access, manipulation and other non-linear applications. Future hybrid digital systems will likely combine the benefits associated with the Digital Betacam recording system for long-form programming with the capabilities offered by solid-state systems for shorter forms.

DirecTV, through its satellite-delivered digital broadcasts, is raising the level of expectations for high-quality TV pictures on the home screen. Digital Betacam equipment has also set a new standard for the cost-effective, reliable operation of a fully automated, multichannel component digital video broadcast plant. As consumers and broadcasters continue to demand even higher levels of performance, it may not be too long before Digital Betacam technology is asked to deliver even more on its potential.

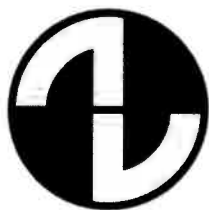
## KEY ELEMENTS OF DIRECTV'S DIGITAL BETACAM IMPLEMENTATION

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- High quality of digital component recording and playback.
- Cost efficiency of 1/2-inch tape-based component approach.
- Reliability of tape-based format and Sony's reputation.
- Compatibility with software-controlled, highly automated, serial digital plant.
- "Future-proofing" for migration to new digital storage and advanced TV systems



# AUDIO PLUS VIDEO INTERNATIONAL



Audio Plus Video International, as its name suggests, focuses on the worldwide video business. During its 14 years in operation, APVI has earned a reputation here and abroad as one of America's leading standards conversion houses. The North-

vale, NJ, company's success is reflected in its merger with Manhattan Transfer/Edit to create International Post Limited. The new parent company, which went public in 1994, is listed for investors on NASDAQ. Also in 1994, the Audio Plus Video International Division made a \$1.25 million investment in Digital Betacam® equipment.

## *Internationally connected*

Because the company is in a service-driven business with a worldwide reach, Audio Plus Video International must be responsive to the needs of its customers on a global scale. It must understand its clients' quality and budget needs. And, it is imperative that Audio Plus Video be familiar with the technical and economic factors affecting foreign broadcasters virtually everywhere.

As a result, Audio Plus Video International has developed a "network" of contacts around the world. The vital information helps APVI anticipate changes in formats abroad for its own planning needs. It also enables Audio Plus Video to provide accurate advice and guidance to clients distributing to foreign customers.

## *A client-driven business*

When APVI made its decision to purchase Digital Betacam VTRs, the move was initially client-driven. The standards conversion house was responding to a changing format scene internationally. APVI had observed a migration toward the Digital Betacam format in a growing number of broadcast operations throughout the world. Another key factor for APVI was the growing domestic adoption of the format as a cost-effective digital component recording system for mastering movies and other programming.

According to André Macaluso, president of Audio Plus Video International, "The Digital Betacam format is extremely important to us since the international and domestic television markets have embraced it as a distribution and broadcast medium."

Audio Plus Video's primary customer base is Ameri-

can. Clients include the three major broadcast networks and leading syndication companies and cable networks. The list includes Columbia Pictures/TriStar, Turner Broadcasting, WorldVision, Viacom, The Discovery Channel, National Geographic, Encore Media, Orbit Entertainment, Hearst, the National Basketball Association and the Children's Television Workshop.

The conversion masters that APVI prepares for its clients are used to make copies that are distributed to its clients' customers. The many different TV and broadcast operations throughout the world are the ultimate destination for the tapes ordered by Audio Plus Video's clients.

APVI's Macaluso said his company was "delivering PAL Digital Betacam to European broadcasters, such as Turner and Orbit, and NTSC Digital Betacam to Encore here in the States."

## *Convertible and clonible*

Audio Plus Video International's operation includes 12 Digital Betacam VTRs, eight PAL and four NTSC. In its ongoing use of Digital Betacam equipment, APVI has found that the format's 10-bit component recording, using 2:1 compression, delivers virtually all of the quality

associated with full-bandwidth component digital.

The Digital Betacam format's digitally recorded component system offers special benefits to a company like APVI, which focuses on standards conversions and international distribution.

Because a standards conversion is a digital process, digital video recording keeps the signal in the digital domain. Thus, there are fewer artifacts and other problems introduced in the conversion process. This is a significant advantage because artifacts are more noticeable in PAL, a higher resolution broadcast standard than NTSC.

Another benefit offered by Digital Betacam recording takes place during duplication. APVI can create virtual clones of masters. This ensures quality cassettes for distribution.

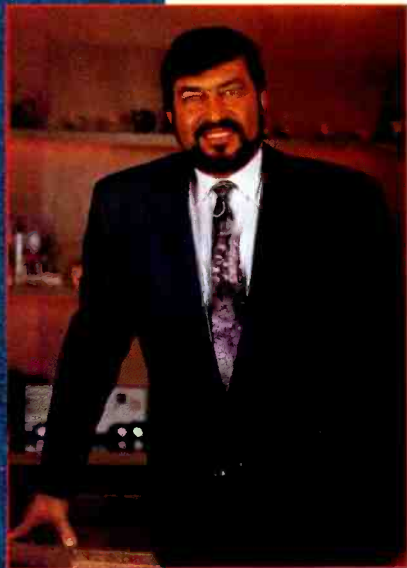
## *Digital component becomes more accessible*

Because of the lower costs associated with the Digital Betacam system, Audio Plus Video is able to offer more clients the option of mastering in a digital component format. Digital Betacam masters deliver top quality to clients today, and they anticipate the demands of 16:9 and other advanced TV systems tomorrow.

For these reasons, APVI considers Digital Betacam recording the most cost-effective all-digital approach to standards conversions and duplication.

In some cases, programs are converted to D-1 and duplicated on Digital Betacam VTRs for distribution to broadcast operations that have requested the new digital component 1/2-inch format. APVI is currently delivering PAL Digital Betacam cassettes to Turner Broadcasting and Orbit Entertainment for distribution to European broadcasters.

*Digital  
Betacam  
System  
Converts for  
the Future*



André Macaluso, President,  
Audio Plus Video International Inc.



The growing acceptance of the Digital Betacam format internationally is underscored by its selection by Turner Broadcasting for CNN I, its international news service.

For other clients aware of the benefits of Digital Betacam recording, but still distributing in Betacam SP and 1-inch, for example, Audio Plus Video is mastering conversions for them on Digital Betacam machines. APVI is also recommending Digital Betacam recording to other clients. The relatively low costs associated with Digital Betacam tape – \$40 an hour, compared to more than \$100 an hour for D-1 – has made it possible for these customers to finally afford digital component masters.

APVI first adopted Digital Betacam recording, Macaluso said, "in response to clients who were starting to use it." The format is also "a recommendation we make for clients who wanted D-1 but found it too expensive for them. Now we can suggest that Digital Betacam can be an answer for them."

#### *Meeting international standards*

As a company working in a global business, APVI is aware of the often higher demands for video quality in 625-line European operations. The company attributes these differences to the higher resolution of the PAL and SECAM systems and to the more stringent broadcast quality standards in Europe.

Another factor that is affecting APVI's business is the increasing quality expectations now that the benefits of digital video recording technology have spread around the world. Audio Plus Video also knows that broadcasters are interested in new formats that will let them make an easy transition to 16:9 widescreen and other advanced TV systems.

"The international community is becoming very finicky and their technical needs have sharpened," Macaluso said. "So what you record on is critical. Options like Digital Betacam make it possible for us to give our clients better masters and a better delivery format."

From Audio Plus Video's perspective, therefore, the Digital Betacam format fits in well with the strict requirements of foreign broadcasters today. The company also believes the format's bandwidth will also allow for 16:9 and other advanced TV systems tomorrow.

#### *Fitting into the operation*

Audio Plus Video International also benefits from the flexibility and versatility offered by Digital Betacam equipment. The company's operation features equipment in several standards and a wide range of formats. These formats include D-1 and D-2, as well as analog formats, such as 1-inch and Betacam SP.

APVI has found that Digital Betacam VTRs are compatible with its facility, fitting in without technical problems and additional equipment. This has contributed to the Digital Betacam system's advantages as a flexible format that can integrate into a

range of setups at the APVI plant.

Macaluso summed up Digital Betacam technology's versatility both from a technical and operational perspective: "I am especially impressed with Digital Betacam's versatility regarding bandwidth, both 4:3 and 16:9 aspect ratios, and the ability to plug the unit in anywhere in the facility."

#### *Tape advances and size advantages*

Because APVI maintains an extensive library, the Digital Betacam cassette's size is also an advantage. The ½-inch cassette's compact size keeps storage costs down. Another plus is the ease with which it can be shipped around the world.

As a company that still remembers 2-inch quad and other formats that have been introduced through the years, APVI also appreciates the advancements in tape technology delivered by the Digital Betacam system.

As a metal-based tape format that uses ultra-fine particles, a stronger base film and a tougher magnetic particle layer, Digital Betacam cassettes have impressed APVI with their high quality and durability.

#### *Audio capabilities*

Although Audio Plus Video started in the standards conversion business, it has expanded its services to meet the additional needs of international program distribution. These include a range of mixing, sweetening and language dubbing-related audio services, in which Digital Betacam VTRs are playing an expanded role.

Digital Betacam recording's four digital audio channels permit greater flexibility in the manipulation of music-and-effects tracks than formats like 1-inch, which offers only two analog tracks. As Macaluso explained, "The format's four digital audio channels are superior in quality and allow for multi-

*"Options like Digital Betacam make it possible for us to give our clients better masters and a better delivery format."*





language audio capabilities, a great benefit for our clients who are distributing worldwide."

### *Solid-state: Not ready for prime time*

Although Audio Plus Video has examined some new forms of large solid-state storage requirements, it is not an investment the company is likely to make in the foreseeable future.

Audio Plus Video views disk-based recording and storage as out-of-sync with the needs and budgets of its clients. According to Macaluso, "Tape is the cheapest, the most flexible. File servers are cost-prohibitive for a service company like mine today."

This is a particularly significant observation, because it is made by a company involved in a heavily client-driven business with an international clientele.

Because the basis of APVI's work is long-form programming, tape remains for its clients the most cost-effective media for TV programming. The random-access capability of file servers is not a factor for a company like APVI, because its business is dominated by conversions and duplication.

### *Converting to the future*

As the world continues its migration into the digital domain, APVI is finding that the demand for the Digital Betacam format is growing. As it looks at a worldwide Digital Betacam VTR population approaching 7,000 machines, Audio Plus Video is considering increasing its investment in the format.

From its unique perspective, APVI sees more and more video moving across the country and the world. As a well-informed global video player, Audio Plus Video is aware that the world is becoming more digital and more component. As a client-driven business, Audio Plus Video knows it must be equipped to both serve those needs.

Digital Betacam technology provides Audio Plus Video International and the clients it serves a high-quality, cost-effective and flexible system for speaking the new international video language.

## KEY ELEMENTS OF AUDIO PLUS VIDEO'S ADOPTION OF DIGITAL BETACAM IMPLEMENTATION!

- Component digital recording minimizes artifacts caused in standards conversion process.
- Provides high-quality, digital clones for distribution abroad to quality-conscious PAL broadcasters.
- Makes digital component recording more affordable to cost-conscious customers for mastering.
- 4-track digital audio provides versatile mixing and language dubbing capabilities.
- Flexible format and compact 1/2-inch format integrates well with facility and shipping needs.
- Anticipates increased quality demands by foreign broadcasters.

Digital Betacam, Betacam SP, Library Management System and Flexicart are trademarks of the Sony Corporation.

# SONY®



By Stevan Vigneaux

network to an editing workstation and then sent back as an edited piece. Because the media files are extremely large, the transfers take a considerable amount of time even at the speeds of today's fastest networks. A 7-minute clip, after compression, is approximately 1GB. A 1GB file transfer takes more than 80 seconds at 100Mb/s, however, most networks operate in the 10Mb/s range. In addition to file data, housekeeping information must also be transferred, which further slows the process.

**Client-server architecture:** In a client-server architecture the audio and video media files are never transferred off the server. The editing workstation's client software works directly on the server's files using the network without the need to transfer files to the workstation's local drives. Client-server architecture eliminates time required for the transfers.

Comparing the transfer time in a file transfer implementation against a client-server architecture's nearly instant real-time access makes client-server architecture the only viable approach for applications dealing with the large amount of data inherent in media files. The downside of client-server architecture is that all the files are in a single location and if the server goes down access may not be

- Does the system store composition data (EDLs) and play the composition "on the fly" from the original source material or does it require the finished compositions to be re-recorded (rendered) and kept as yet another copy that consumes additional space?

- Does the system have provisions for archiving material off-line (tape libraries, video jukeboxes)? What is required to access that material?

*Implementing a server-based production system requires considerable research and planning. Doing your homework now can pay off in the future through increased resource utilization and efficiency. As computer-based systems become more powerful, many stations will have to install one in order to remain competitive.*

called clients). The workstation is usually the computer on the user's desk. There are two types of network operating systems — *dedicated* and *non-dedicated*. A non-dedicated network uses software to allow the sharing of disks, printers, and other devices between workstations. It is also known as a peer-to-peer network. These networks generally have some limitations when compared to a dedicated system, but they perform well for tasks that require simple sharing of resources.

Dedicated networks use at least one dedicated server and one or more workstations

or clients, thus the term "client-server network." The server contains the network operating system, related utilities and all files that are common to the particular operation of the business.

### Network topologies

*Bus, star and ring* are topologies that prescribe how computers can be attached to a network. (See Figures 1, 2 and 3.) The bus configuration refers to a string of nodes connected in series. New nodes can be inserted any place along the bus. In a star configuration, each node is connected to a

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central device. In the ring configuration, nodes are attached to one another in a circular fashion.

Perhaps the most critical decision a network planner has to make is the choice of topology, which relates directly to the overall performance of the network in terms of its speed and reliability. To prevent data from colliding and becoming unreadable, the OSI provides a service at the datalink layer that allows for an orderly method to access data on the network. Three general categories of channel access methods include *token passing*, *polling* and *contention*.

Networks configured as token passing are arranged in a ring topology. A token bit is passed around the ring and handed to a computer that initiates a request to transmit — then only that computer can transmit. When the transmission is completed, the token is passed back to be used for the next request. Token-ring, ARCnet and FDDI are examples of networks using token-passing. A less prominent arrangement is the polling method, which sequentially polls each device connected to the network. The final method, contention, allows any device on the network to transmit any time; this can be used within either bus or star topologies. If two or more computers transmit at the same time, each will wait a random amount of time to retransmit. The most common type of net-

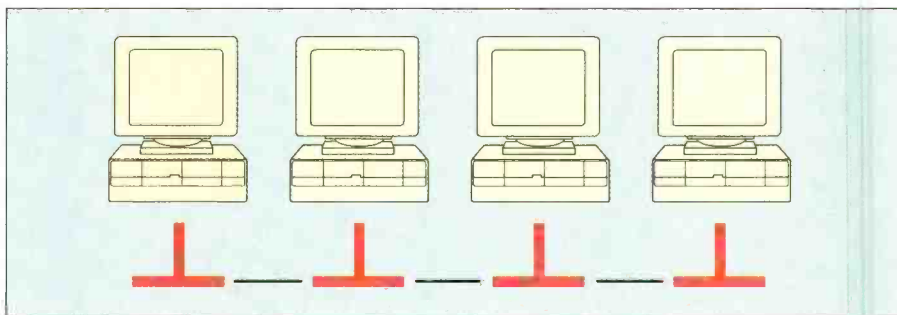


Figure 1. In a bus topology all of the systems are linked one by one to a single wire. With this method, a transmission from any node will tie up the entire network.

work using contention is *Ethernet*.

Ethernet has become the system of choice for most businesses. As a result the technology has seen great advancements, most notably in terms of speed. Network speed is particularly critical when considering imaging and multimedia applications, including the delivery of real-time video and audio. (See Table 1.)

### Ethernet

Data communications standards for networking within the OSI model were

developed by subcommittees of the IEEE under what is called the 802 family. Ethernet is defined by the specification known as 802.3. Standard Ethernet networks are rated to transfer data at approximately 10Mb/s (megabits per second). Fast Ethernet is rated

possible. Server problems can become critical quickly. For more information on server-based production, see "Moving to Server-Based Production," October 1994.

The key questions for servers center on maximum storage capacity, total system bandwidth and the network operating system. The network software provides data processing, file management, network interface, and is the foundation upon which all application software is developed.

### File structure

Another thing to consider is the file structure used to store and transfer files. Anyone who has worked with computers is familiar with the inability of one application to read another application's files. The key to avoiding problems of this nature is having a file structure that is compatible with all of the applications running on the system. Avid's Open Media Framework (OMF) is one such file structure.

To date nearly 200 companies have signed up as OMF partners and many have implemented OMF support in their products. Currently work is under way on an enhanced OMF specification and toolkit to provide increased support for software developers.

OMF files can contain media objects (audio, video and graphics) as well as composition objects (a "super EDL" in a sense). Applications using OMF can use file headers to determine which files contain needed objects and then access those objects directly. In addition, relationships between objects in a file can be determined.

For example, news footage from the field can be stored intact as a media object and then modified with a composition object. The composition object defines a series of edits and effects that ultimately become a package used for the 6:00 news. A second composition object can then be defined to build a package for use on the 10:00 news. A third composition object can build "B" roll for the morning newscast. All the while, the original field footage remains intact on the system, and is only stored in one location. Composition objects are simply used to modify and output the information in the proper manner.

Vigneaux is senior marketing manager, broadcast products, Avid Technology Inc., Tewksbury, MA.

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at 100Mb/s, although the specification for it has not been ratified by the full IEEE as of this writing. Other technologies exist for the delivery of high-speed data across a network, such as ATM (asynchronous transfer mode, 155Mb/s) or FDDI (fiber data distri-

*Improper selection of a hub can create a "traffic-jam" over the network.*

bution interface 100Mb/s+25Mbit/s overhead = 125Mb/s), however, fast Ethernet is expected to gain wide acceptance because of its upward compatibility with existing Ethernet installations.

There are generally four types of Ethernet networks and each has limits for the maximum distance between devices (nodes) on the network bus. Connections between nodes are also known as segments.

10Base5 — also known as thick Ethernet uses RG-8 or RG-11 coaxial cables limited to about 500 meters between segments. Thick Ethernet is used mainly as a backbone of the network bus. The cable is connected to spe-

cial transceivers. Each transceiver is attached to the PC with a multiconductor wire attached to a 12-pin D-type connector.

10Base2 — also known as thin Ethernet uses RG-58 coaxial cable limited to 185 meters between segments. The RG-58 cable is daisy-chained to each device on the network bus. The cables are fitted with 50Ω male BNC plugs and attached to each node with BNC "T" adapters. The beginning and end of the network bus must be terminated into a 50Ω load. 10Base2 can also be connected directly to a central hub in a star configuration.

10BaseT uses unshielded twisted pair (UTP) cable. The devices in networks that use UTP do not connect directly with each other but rather to a common hub in a star arrangement as opposed to a bus. The hub is a multiport device that can be passive or active; active hubs can provide a means to block out a port that has failed. This is done to maintain proper communications through the remainder of the system. UTP can be purchased in several grades depending on the distance between devices and desired throughput. The cables are typically terminated to RJ-45-type modular plugs, however, in larger installations, wires can be terminated on specific types of punchdown blocks.

100BaseT is similar to the above but operates at 100Mbit/s.

**Cabling**

Because of cost, ease of installation and reliability, UTP has become the popular choice for cabling networks. It's also an important factor in network design. As more data is forced through the pipe, more bandwidth is required. As in any good transmission sys-

**Transfer times**

**Ethernet**

1MB/s = 1.25fps

**SCSI 2**

10MB/s = 12.5fps

**FDDI**

100Mb/s = 12.5MB/s = 15.6fps

**HIPPI**

100MB/s = 125fps

**ATM**

155Mb/s = 19.4MB/s = 24.2fps

*Typical transfer times for different types of networks. (Table courtesy of A.F. Associates, Northvale, NJ.)*

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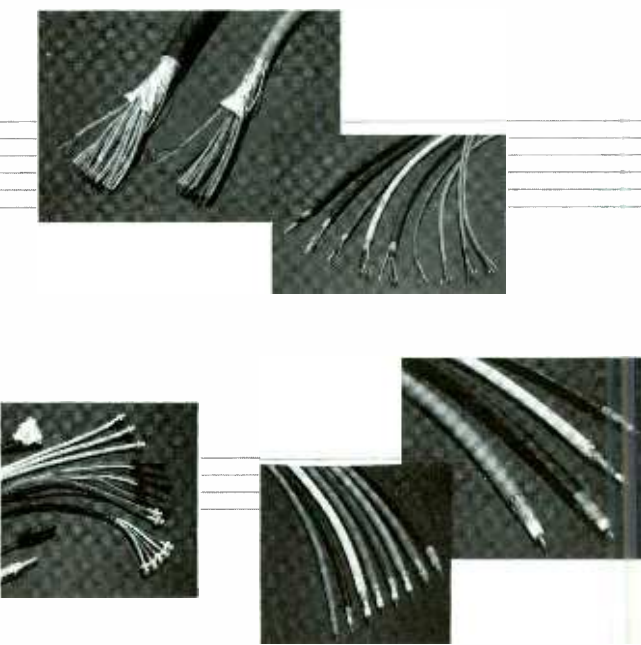
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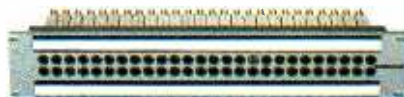




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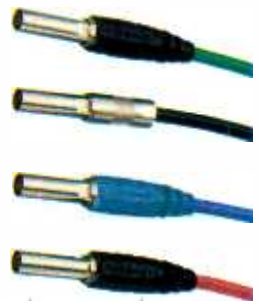
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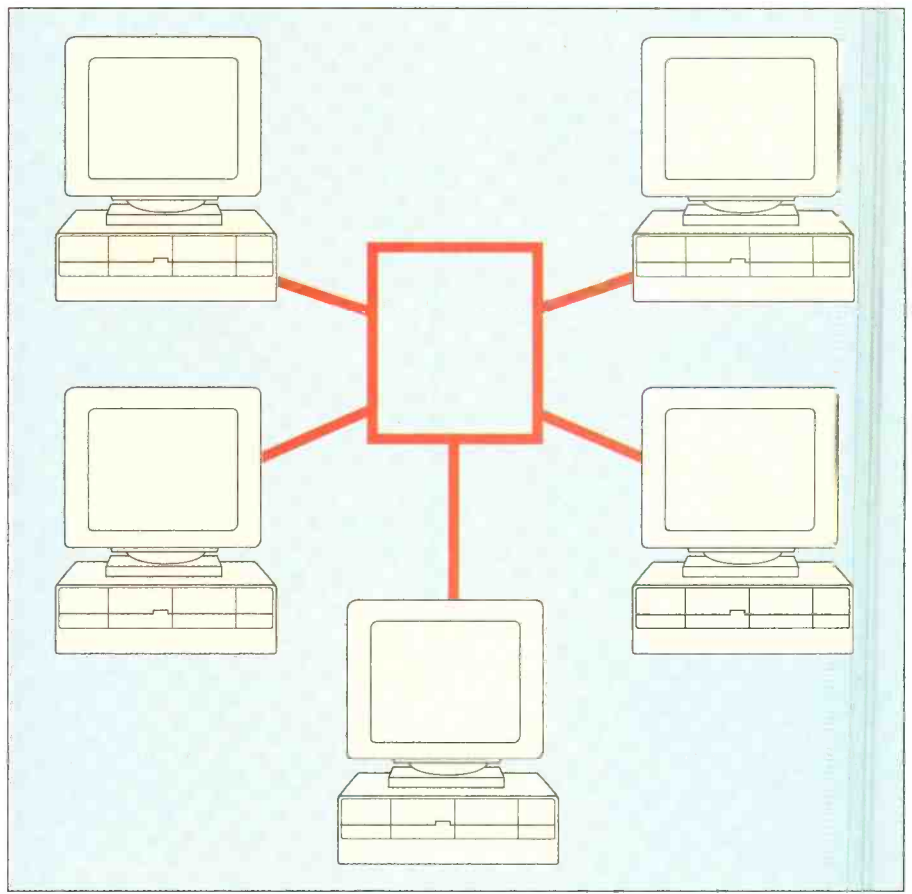
tem, the selection of cabling and proper installation are key to long-term operation.

The Electronics Industry Association (EIA) and the Telecommunications Industry Association (TIA) have developed a set of standards currently known as EIA/TIA-568 and 570. These standards are based upon the star topology, (such as 10BaseT or 100BaseT), which assumes a direct connection to a central device such as a hub. It references all the current bounded media (cabling), such as UTP, coaxial or fiber, and deals with almost every possible aspect of cabling. Although the document is intended to ensure consistent practices among professional cabling installers, it provides excellent information for planning and installing a system. The document can be obtained directly from the EIA.

Before purchasing UTP, be sure to check the category type. This refers to the maximum bandwidth of data that can be passed through the cable without errors, typically due to high-frequency rolloff limitations inherent in twisted pair cable.

Hubs are available in several varieties depending on the application. Improper selection of a hub can create a traffic-jam over

*Figure 2. In the star topology, each node is connected to a central unit, either a server (small networks), or a hub in larger networks.*



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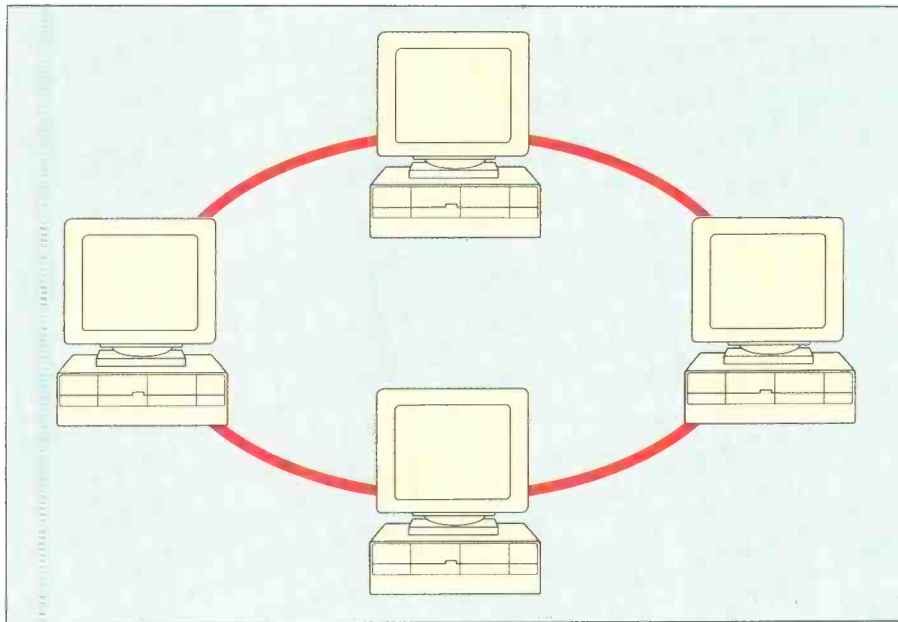


Figure 3. Ring topology is commonly used in token passing network applications. A token is passed around the ring and only the computer with the token is allowed to transmit.

the network, particularly with fast Ethernet. Hubs can be passive, active, full duplex or switched and accommodate both UTP and coaxial media. They usually have eight to 12 ports and several hubs can be connected together, if additional ports are required.

Some also provide a means to monitor the operation of each hub/port from a remote workstation connected to the network.

#### Servers

Proper selection of the file server is vital for

an efficient and reliable system. One of the primary jobs of the file server is to "serve" files to the workstation when requested and store files created from the workstation.

Servers should use a powerful CPU (at least a 386) and lots of RAM. Network operating systems use memory in many different ways. As a rule, the more users on the system, the more RAM will be required. Network utilities are usually provided with the operating system that allow the system administrator to view memory allocations. For the server to work efficiently, painstaking thought should be given to the various mediums that will be used to store and retrieve data.

All data on the network is important; how important will vary from one application to another. Servers should be equipped with an appropriate backup device and it should be tested and used frequently. Servers are also computers and as such are subject to the same quirks as a workstation. They tend to operate longer, however, and are more disk intensive than most PCs. A good file server can be described as fault tolerant.

Servers can be equipped with several hard disks through a technology known as redundant array of inexpensive drives (RAID). RAID is nothing more than a means to electronically tie together several hard disks. With RAID, if any single drive were to crash, data and programs would be protected.

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**RAID and SCSI**

There are five levels of RAID. Although RAID 0 has gained an informal reputation, it only allows data to be written across multiple drives while treating those drives as a single drive. There is no fault tolerance in this arrangement, but performance is increased because of the capability of the drives to read and write data simultaneously.

The RAID levels are:

**RAID 1.** Data is written to two drives, also known as mirroring. Performance is also increased because requests can be made to either drive (depending on which head is closest). Concurrent requests can also be handled.

**RAID 2.** Not used for PC-based networks.

**RAID 3.** Uses a parity drive and one or more data drives. The parity drive holds error information needed to restore the system.

**RAID 4.** Similar to RAID 3, but uses no interleaving and writes data on a block-by-block method.

**RAID 5.** Does not use a dedicated parity drive like 3 and 4. Instead, it writes one block of data and interleaves parity information between all disks.


Most high-performance servers use the small computer system interface (SCSI) protocol, due to its superior performance and ability to interface with a wide variety of I/O peripherals. The American National Standards Institute (ANSI) approved SCSI-1 in 1986. It supported an 8-bit data path, asynchronous data rates to 1.5MB/s, synchronous data rate to 5MB/s, and up to eight devices.

*Many UPS systems can connect to a serial port on the computer, and with the appropriate software drivers, can perform an orderly shutdown without data losses.*

Greater demand for performance and an improved command set to address newer devices, such as CD-ROM drives and optical scanners, have created the need for an updated SCSI, hence SCSI-2, which supports 16- and 32-bit data paths. The data transfer rate also increases to 40MB/s for a 32-bit data path. SCSI-3 is on the drafting table and is expected to support enhancements including copper and fiber-optic mediums at a signaling rate of up to 1.0625GHz and a proposed high-performance serial bus (particularly useful to multimedia types).

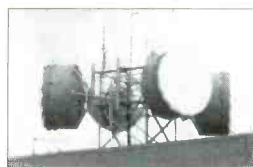
Finally, don't forget to use a quality uninterruptible power supply (UPS) as a power source for your server. Many UPS systems can connect to a serial port on the computer, and with the appropriate software drivers, can perform an orderly shutdown without data losses. These are just a few of the many details that need to be considered when designing an efficient network able to grow with emerging technologies.

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

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# Wireless cable systems and MMDS



*More about wireless.*

## *The Bottom Line:*

*Some day soon, wireless cable operators will offer hundreds of video programming channels together with a multiplicity of other telecommunications services. FCC chairman Reed Hundt is banging the drum for competition and is excited about wireless. It's this competition that is making U.S. technology the de facto worldwide standard in helping to build a global information infrastructure. — \$*

Approximately 2.6 million subscribers use wireless cable in 55 nations, including more than 600,000 in 160 U.S. systems. About 80 additional U.S. systems are expected to begin operations by 1996. Almost all established systems transmit in the vicinity of 2.5GHz, with a few operating in the 12GHz, 18GHz or 28GHz bands. Years ago, the FCC designated a portion of the 2.5GHz spectrum as *multichannel multipoint distribution system* (MMDS) spectrum (2.596-2.644GHz), a term often used interchangeably with "wireless cable." More recently, the FCC designated spectrum at 28GHz as *local multichannel distribution system* (LMDS) spectrum (27.5-29.5GHz). The LMDS spectrum has tentatively been reserved for uses similar to wireless cable.

In this article we shall review and compare the technology used in MMDS and LMDS systems. We will then briefly assess the impact of digital technology upon the overall video marketplace.

## **Current and future TV technical standards**

Most wireless cable operators deliver video programs using one of the three well-known analog TV transmission technical standards: NTSC, primarily in North America and Japan; SECAM, primarily in France and the former Soviet states; and PAL almost everywhere else. MAC, a newer analog transmission standard, also is available. At this time, none of the transmission standards rely on bandwidth compression.

This year, U.S. wireless cable system owners will begin purchasing newly developed compressed digital video encoders for studios, up-

links and transmitter exciters. Matching decoders for subscribers' households will be installed at the same time. Compressed digital video technology will allow wireless cable systems to expand their channel capacity from 30 channels to from 90 to 150 virtual channels. (A virtual channel provides about the same amount of visual information to the viewer as the original channel. This is accomplished by using digital and compression technologies to carve the currently allocated 6MHz channels into seven to 10 virtual channels.) Compression technology will allow wireless cable system owners to offer their subscribers more choices and even several improved definition channels.

## **Moving to digital**

Although the FCC expects all U.S. wireless cable operators to convert from analog NTSC transmission to many-virtual-channel digital transmission, no deadline has been set for the conversion. Eventually, wireless cable operators will deliver all video programs as compressed video rather than in the current uncompressed video formats.

## **Configuration, costs and capacity**

For hundreds of communities within the United States, the FCC has issued licenses that permit the transmission of up to 31 6MHz NTSC TV channels within the spectrum band 2.500-2.686GHz (MMDS and ITFS bands) plus up to two 6MHz channels within the spectrum band 2.150-2.162GHz (MDS band). An MMDS system operator in a community typically will have purchased many of these licenses and will have leased time on others, especially the instructional TV channels whose owners can lease extra capacity,



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The waveform monitor, Model 5222, features eight channel operation. Picture display is included. Line select operation offers readout in both NTSC or PAL (SECAM III) notation. Selected line(s) are highlighted in the picture display and in the combined 1V/1H display. Cursor measurements apply to both time and level and provide 0.5% accuracy.

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but not sell their licenses outright.

The FCC has reserved for these licensees (and for certain others) the spectrum of 2.686-2.690GHz (response band) for transmissions by subscribers back to the system operator. The additional frequencies are needed for interactive capability. An MMDS system often uses a transmission height of 100 meters. Operators either construct their own tower or lease space on an existing tower. One or more transmit

**Most wireless cable operators deliver video programs using one of these analog TV transmission technical standards: NTSC, SECAM or PAL.**

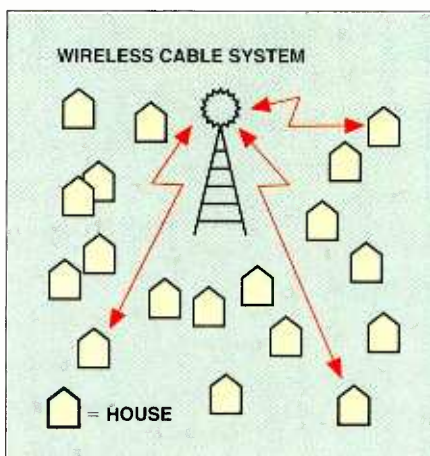


Figure 1. A standard wireless cable system has a tower and homes that are scattered around the tower. The signal is broadcast from the tower to the homes.

**Installing the service**

Reception of MMDS signals requires a relatively sophisticated receive system. It is not a user-installable technology in the United States, although a Mexico City operator with more than 300,000 subscribers has reported success with customer self-installations. In the United States, field technicians visit each receive site and measure the signal strength. Assuming the signal strength is sufficient, a short tower is installed or the dish is mounted on the house rooftop. A typical 0.3m to 0.8m antenna provides from 15dB to 24dB of gain.

A downconverter is then installed on the tower or roof just behind the antenna. The typical consumer downconverter, which has a 4dB to 8dB noise figure, bandpass-limits

the output for standard VHF or UHF frequencies for use by the TV receiver. The overall installation is much like that for cable television once you get behind the downconverter. Once connected to a set-top descrambler and TV converter box, service is available to the consumer.

In systems that are testing interactive capability, a response transmitter is connected in parallel with the downconverter. Interactive set-top converters also are installed.

**A typical MMDS station serving a large area covers about 3,000 square miles, with a radius of 15 to 40 miles.**

antennas and several receive antennas are then located on the tower to pick up local and distant TV stations. In some systems operators install additional antennas for the subscribers' interactive response transmission. All of the systems rely on scrambled transmission schemes.

A typical MMDS station serving a large area covers approximately 3,000 square miles, with a radius of 15 to 40 miles. Transmitter TPO is 100W per channel or less. This is based on the typical waveguide loss of 3dB and a transmit antenna gain from 12dB to 15dB.

Wherever the line-of-sight to a residence is obscured by deciduous trees whose leaves have fallen, the field crew must estimate the received signal strength for spring and summer operation. Typically, a receive antenna will ensure that the NTSC carrier-to-noise at the input to the converter will be better than 45dB to 48dB for each channel. It may exceed 50dB for many channels. This type of performance means the customer will receive a high-quality signal.

**LMDS installation and costs**

An LMDS installation, unlike that of MMDS, can sometimes be handled with a window-mounted antenna. The received power levels are measured for each of the system's surrounding transmitters. If window reception is not possible, a temporary external antenna like that for MMDS may be necessary. At sites where the power level from at least one transmitter is adequate, a permanent antenna and (28GHz band to UHF/VHF band) integral downconverter is installed. This system typically provides 6dB to 8dB noise figure. Typical antennas are an array about 0.16 meters square that deliver 30dB gain. At adverse locations, a parabolic reflector up to one meter in diameter (giving 50dB or more gain) may be used instead to obtain more directivity.

**Total system costs**

Today, each of the single transmitters used to transmit 50 channels costs from \$250,000 to \$400,000 (including duplexers and back-up hot spare). A city encompassing 1,500 square miles requires 30 cell sites. Each tower used, including site-use rights, erection, transmit antennas, and installation



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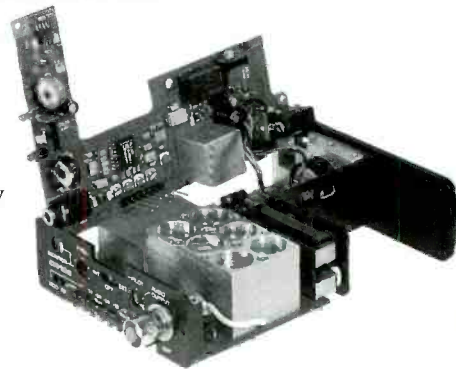
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will cost from \$20,000 to \$80,000. Again, the operator may rent tower space at some sites, which reduces costs. The set of small building enclosures that house the standby electric power generators, control and test equipment, plus installation of the set of 30 cells, typically will cost an additional \$1 million or more. As for MMDS, the down-link antennas and receivers for program reception typically cost about \$80,000.

*By continuing to be a low-cost provider, wireless cable should do well in its current entertainment business and as a pull-down competitor in all-digital services.*

Therefore, the total costs likely will range from \$9 million to \$15 million for 30 cells. The above costs apply only for current analog stations.

The total cost for an LMDS customer installation exceeds that for an MMDS installation by about \$200. A decade from now the total cost should be about the same. Like MMDS, the incremental cost for deployment of a wireless cable LMDS set-top containing a compressed digital video decoder will be about \$250. However, no downconverters yet are available that are certified to work at these frequencies. For LMDS digital encoding and interactive services, the same cost considerations apply here as for MMDS.

### Wireless cable systems and competing technology

The impact on competing technology on the delivery of compressed digital video will be determined in part by: 1) the pace at which each type of provider adopts compression; 2) the capital and operating costs that each incurs; 3) the relative financial endurance of each competing technology; and 4) the pace of evolution of demand, which depends particularly on relative marketing skills.

Within the next five to 10 years, the TV signal deliverers most likely to benefit from digital and compression technology are those to whom the fewest transmission channels are available. These are in approximate order, beginning with the fewest:

- Telephone company, using installed wire pair
- MMDS, or wireless cable

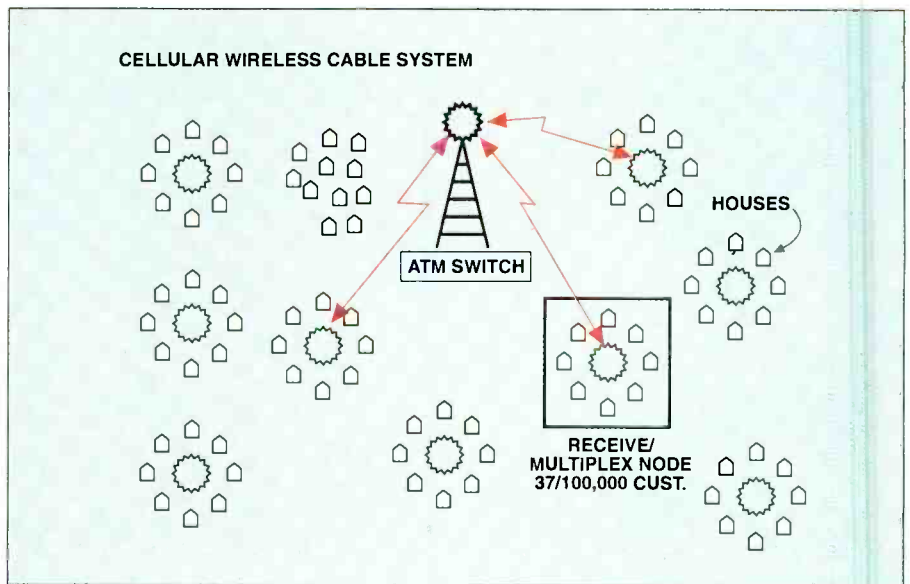


Figure 2. A cellular wireless cable system. A call originates from a customer and travels to the node where it is multiplexed into a frequency and returned to the ATM switch.

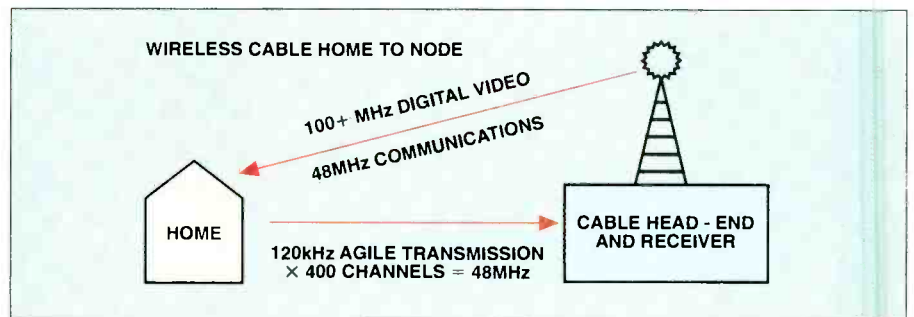


Figure 3. Wireless cable home to node.

- VHF/UHF terrestrial broadcast
- Broadcast from satellite direct to household, TVRO or DBS
- LMDS
- Wired cable television
- Telephone company using various fiber/coax hybrid cable configurations or fiber cable only.

### What to expect


By 1997 the U.S. telecommunications video delivery market will experience a considerable oversupply of channel capacity, as will the markets in other nations.

By 1999, the U.S. TV viewer market may be split into two different submarkets. The first will be the long-familiar conventional TV market, comprised of broadcast, cable, satellite and MMDS. These competing delivery systems each will offer multiple (up to a hundred or more channels) of broadcast and cable network entertainment programming, some of which will be interactive. The second submarket will be for intensely interactive, everything-on-demand services. Here, a half dozen of the same competing delivery systems each will offer tens of thousands of programs and video from databas-

es. Most will be oriented toward entertainment, but many will be oriented toward interactive self-education.

Major delivery systems will likely target both submarkets. Each delivery technology will use whichever technology mix allows it to sustain the lowest-cost service. By continuing to be a low-cost provider, wireless cable should do well both in its current entertainment business and as a pull-down competitor in all-digital services as these new markets develop. ■

Dr. Weston Vivian, former U.S. Congressman, is president of the consulting firm Vivian Associates and teaches at the Institute of Public Policy at the University of Michigan. Andrew Kreig, author and attorney, is vice president and communications director of the Wireless Cable Association International.

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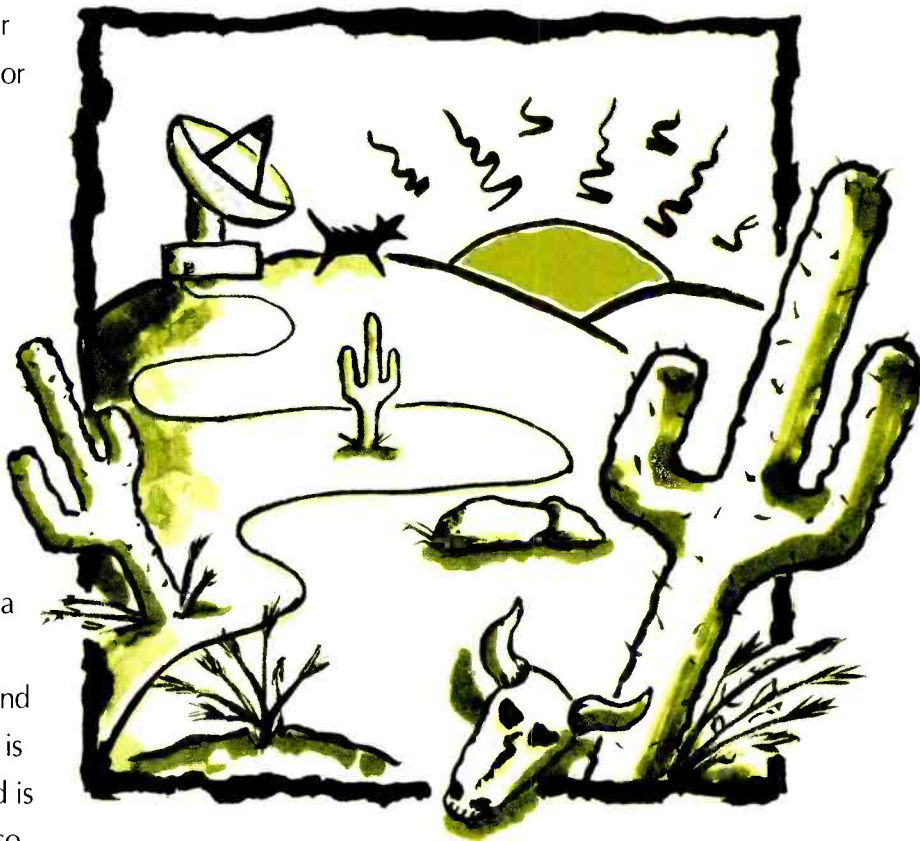
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# Transition to digital



*As the computer and video industries converge, similarities as well as differences become evident.*

## **The Bottom Line:**

*With this issue we introduce a year-long series of articles on digital video technology. This and next month's feature articles look at the confusing issue of video resolution. Exactly what is video resolution and how is it measured? Future columns will cover serial digital basics, routing, wiring and handling embedded audio. Finally, we'll show you how to design an all-serial digital video suite. Stay tuned.* — \$

**H**istorically, traditional video media has been viewed in terms of broadcast video, computer display and video compression, while the emerging media falls into an area that is referred to as "digital video." How is this new media of digital video defined? The answer usually depends on whom you ask. The problem is that application areas abound, including CD-ROM, CD-I, MPEG, D-1 and many others. These formats may be similar, but each one has its own specific issues and concerns.

Part 1 will concentrate on traditional media. Part 2 will address issues specific to the emerging digital media. The goal is to make you aware of and informed about the types of problems you will encounter as the media is transformed into a digital form. The hope is to provide enough information, with references to more information, to help you better understand issues as they pertain to your application.

## **The impact of digital media**

Who will be affected by the new digital media? That's simple — everyone. In the consumer market there will be changes in every type of product — from video games to digital movie players, cameras to videocassette recorders, and computer screens to TV receivers. Digital technology will have a major impact on the telecommunications industry. There will be a major change in the way television is produced and distributed, corporate communications are handled and information is transmitted. Forms of video distribution will include multiplexed signals, video on demand and direct broadcast satellites. The way broadcast professionals perceive and process information will change.

## **Video**

What is video? The Society of Motion Pictures and Television Engineers (SMPTE) defines video as: 1) a term that pertains to the bandwidth and spectrum position of the signal resulting from TV scanning; 2) the term is commonly used to identify the electronic mapping of scene luminance and color information, usually within time-variant systems; 3) correlated audio is included and usually implied.

The definition still holds up because it describes the historical derivation of the term, while not precluding the new forms of digital media. Most people think of video in the form that is transmitted for reception by television. This is the composite form of video, which SMPTE defines as: *video, composite signal: The electrical signal that represents complete color picture information and all sync signals (includes blanking and the deflection sync signals to which the color sync signal is added in the proper time relationship).*

A composite video signal is composed of a great deal of information, including timing signals and image content, all compressed together into a single component. The important aspect to remember is that a composite video signal is a compressed signal and that broadcast television is a bandwidth-limited media. A great deal of confusion and errors result from not understanding this.

## **Resolution**

The question of resolution is complex, and the SMPTE definition is quite long. In simple terms, Quantel defines it as: *a measure of the greatest amount of detail that can be seen or resolved in a reproduced image.*

Many people think of resolution as the number of dots or pixels (picture elements) on a screen. For example, the CCIR 601 specification defines the



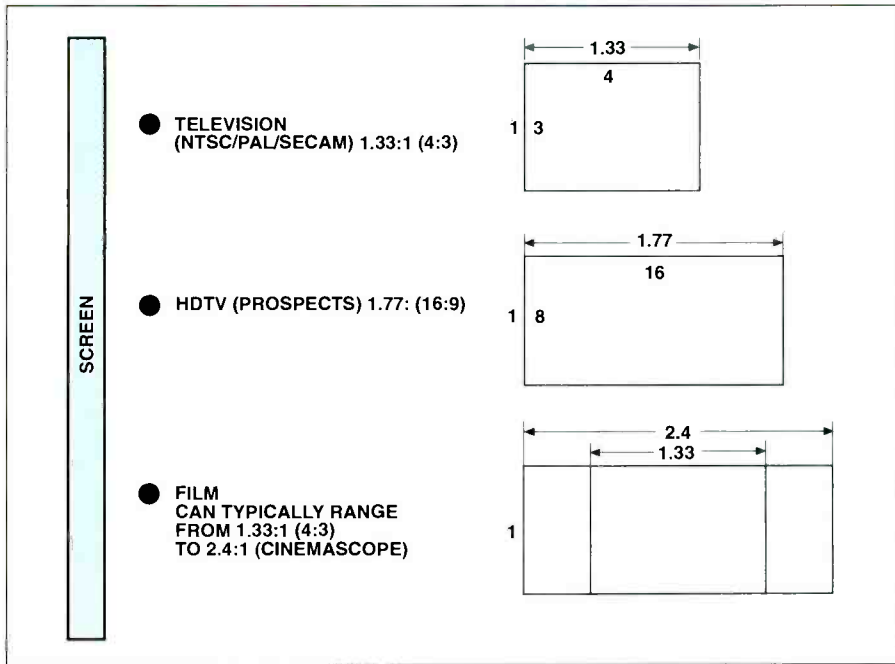


Figure 1. Some of the various screen aspect ratios in use today. As can be seen, film formats present the widest variety.

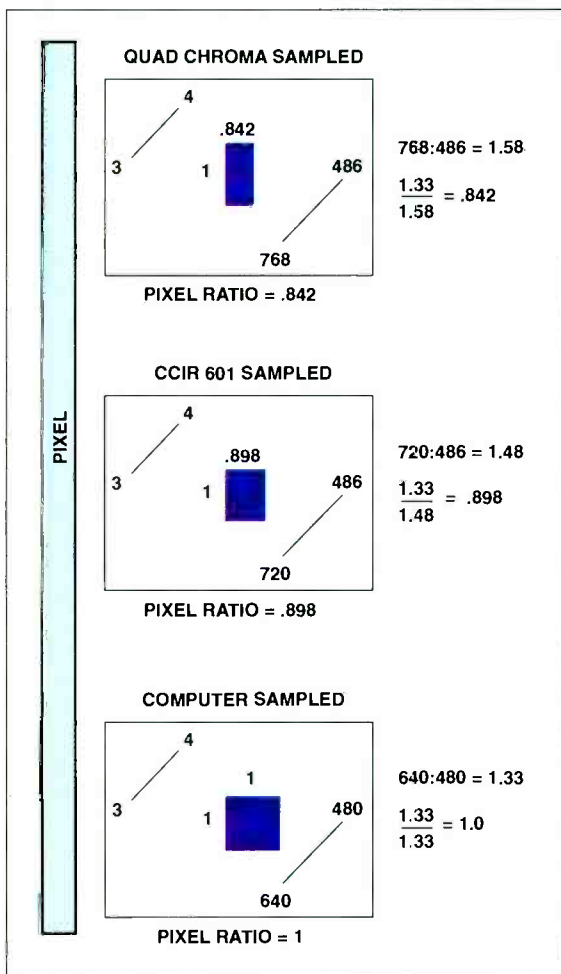


Figure 2. Pixel aspect ratios vary as well, depending on the source and sampling method.

and this is why confusion exists in the computer market when resolution is referred to as just a diagonal screen measurement. A larger screen does not always mean higher resolution.

Resolution can also be applied to the depth of the pixel information, like 8-bit or 24-bit pixels. This depth resolution is the quantization level of the digitizing process as applied to the video sampling. For example, 24 bit typically refers to eight bits each of red, green and blue values, while 32 bit refers to the same component values, but with the addition of an 8-bit alpha channel (i.e., key, matte or Z buffer).

**Is there more than just resolution?**

Yes, there is more than meets the eye at aligning graphics to a display grid at a certain resolution. It is assumed that with a 640x480 display, the ability to show graphics would be limited to starting on pixel boundaries, like 300, 301, etc. However, by using interpolation, it is possible to specify an arbitrary starting location that is not restricted to a whole number grid reference. For example, a graphic could be started on location 300.25, which would be shifted a quarter pixel from location 300. This is called subpixel positioning.

*The important aspect to remember is that a composite video signal is a compressed signal and that broadcast television is a bandwidth-limited media.*

luminance resolution for an NTSC video image as 720 samples per active line. Color is sampled at half this rate and yields 360 samples per active line.

The first observation that can be made is not to assume that all of the components in a video signal have the same resolution. In fact, this is the historical derivation of the term 4:2:2. It once represented the multiplier factor of the subcarrier frequency at which the different components were sampled (4-luminance: 2-chroma red: 2-chroma blue).

Video produced by computers is usually RGB and has uniform sampling for all components. Also, having the same resolution does not guarantee video signal compatibility. Other factors contribute to compatibility, such as bandwidth, color space and interlace.

Another way of thinking about resolution is the number of dots per inch (dpi) on the screen, which is why resolution is sometimes referred to as a diagonal measurement of the display. Given the diagonal measurement of the screen, the aspect ratio of the display and the dpi, it is possible to derive the display's resolution.

Sound confusing? It can be,

How would a 16x16 icon be displayed in this fashion? To display the icon at location 300.25, 25% of the original value of pixel location 300 is blended with 75% of the first pixel of the icon, generating a result to be displayed from location 300. To display location 301, 25% of the first pixel is blended with 75% of the second pixel. This is continued, and in this manner, the entire icon is displayed shifted a quarter pixel over on the display grid.

This does not create any additional resolution; it just makes better use of the resolution available by using interpolation. Although this example pertains to a horizontal shift, it could also be applied to a vertical offset. No additional resolution is created, but smoother motion is achieved for motion

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## Transition to digital

graphics, especially if the motion is slow.

The cost for this improvement in graphic motion comes in the hardware needed to perform the interpolation in real-time. Computer applications can, of course, do this well, but in non-real-time. This is one of the reasons computers are popular in composition solutions.

### Aspect ratios

Originally, video was unconcerned about the aspect ratio of the pixels because TV displays are not pixel-based. For digital NTSC systems when sampled at four times subcarrier, the result is 768 horizontal samples per active line and 486 active lines per frame, for an aspect ratio of 4:3. The resulting pixels have an aspect ratio (width/height) of 0.842.

Computers are good at displaying graphics. The horizontal and vertical axis are in the same scale, resulting in pixels of equal height and width — a pixel aspect ratio of 1:1. When video support was added to computers to maintain compatibility with the 4:3 aspect ratio displays, screen resolutions like 640x480 were chosen to get square pixels. This was one of the initial incompatibilities between video and computers stemming from the need for square pixels in computers,

while video derived its sampling rate as a multiple of the subcarrier frequency.

Screen and pixel ratios come in all flavors. (See Figures 1 and 2.) It is possible to convert between signals created in different ratios by resampling the signal. But first the relationship between images of different resolutions and ratios needs to be clarified.

It is possible to display a 640x480 signal as a full 4:3 aspect ratio display, and it is possible to display a 720x486 signal as a full 4:3 aspect ratio display. The time it takes to display a horizontal line and the time it takes to display a frame can be the same. However, the timing used to display the pixels (the pixel clock) will differ in the two examples. The 720 horizontal pixel display uses a faster pixel clock than the 640 horizontal pixel display in order to cover the active portion of a horizontal line in the same time.

To cover this topic in a limited space, only the horizontal values will be referenced in this discussion. If the 720 and 640 video systems described above were digital NTSC signals, it would be possible to interface them using an analog interface. A 640 NTSC signal could be copied to a 720 NTSC signal via resampling with an analog interface. The digital 640 signal would be D/A con-

verted to an analog signal, then resampled to a 720 signal in the A/D process. The drawback is a generation loss, which is the result of passing the signal through the analog circuits.

To digitally resample these signals, the problem becomes more complex. First, assume a system displaying a digital 720 signal and you attempt to display a digital 640 signal on it (i.e., displaying a computer graphic created in 640 on a serial digital display at 720). The same pixel clock would be used by the display, and the 640 signal would not fill the 720 display, ending up 80 pixels short. (See Figures 4 and 5.) A DVE could be used to resample the 640 signal in real-time to fill the 720 display, but that would be expensive. On the other hand, a computer application could be used to resample the 640 signal to fill the 720 display, but it would be slow.

Both types of resampling would result in some form of artifact being produced during the conversion process. To avoid these cost, time and artifact concerns, the best method is to create the original material in the resolution and aspect ratio in which it will be displayed.



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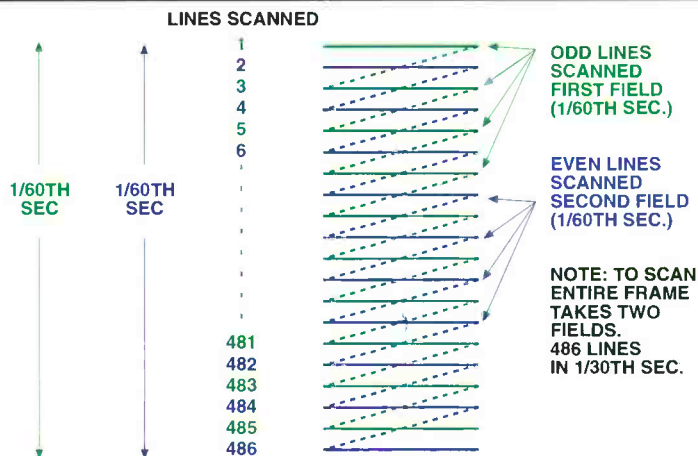
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## PROGRESSIVE



## INTERLACED



## Broadcast video vs. computer video

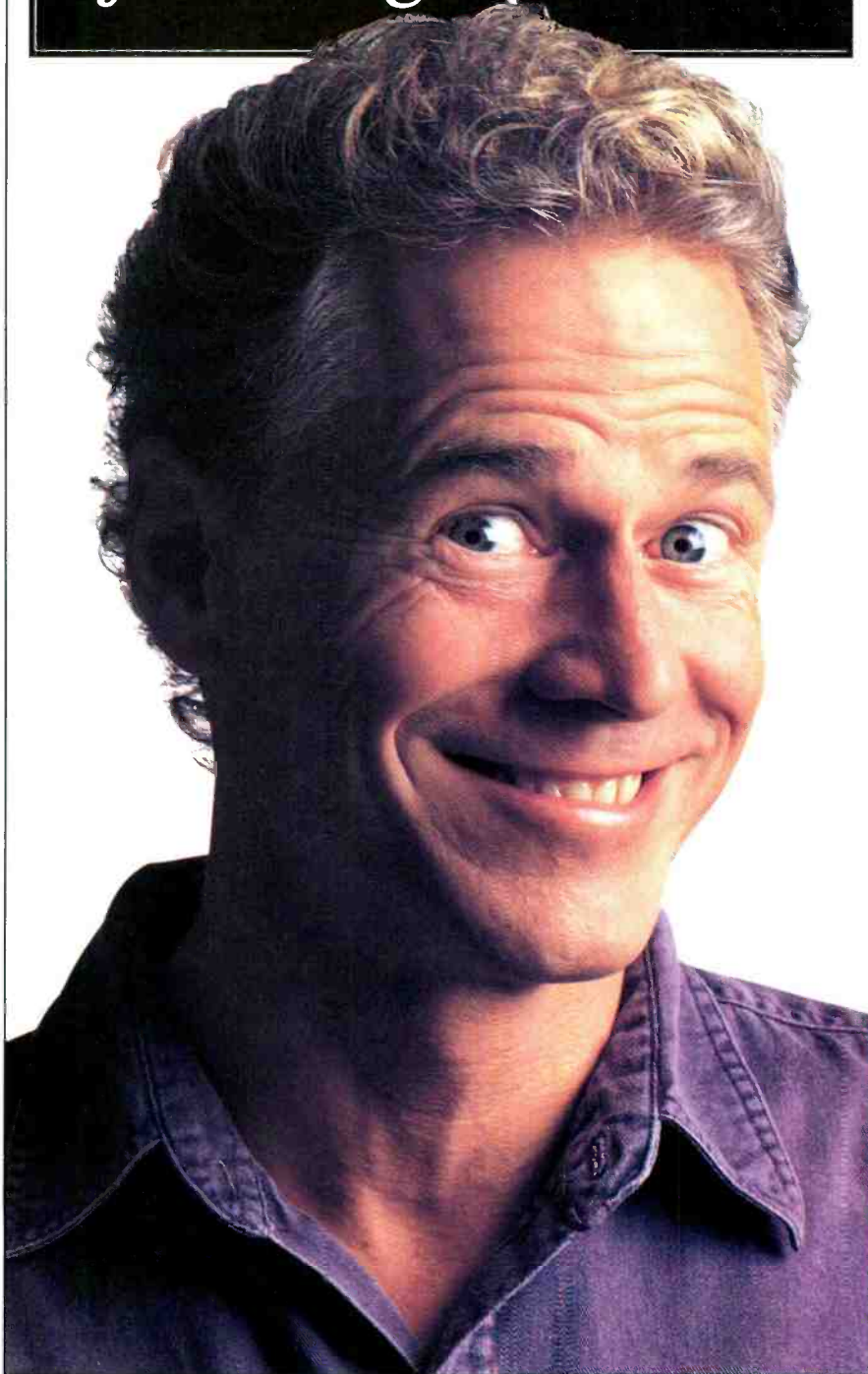
When a video signal is compressed to a composite-encoded signal for transmission to, or display on, a TV set, information is lost. The method used for encoding and the quality of the process determines how much information is lost and the final image quality. This means that when displaying an RGB computer graphic on a TV set, it will be compressed. Most people don't realize this.

Encoding to composite format is the source of problems including legal colors, bandwidth restrictions and interlace. There are other considerations, but for now, let's examine some of the major contributors of errors to this encoding process.

Legal color issues result from the use of two different color spaces. This is why video production uses a component YUV form for storing pixels — it saves space and matches the color space of the composite

Figure 3. In progressively scanned displays, the entire display is updated every frame (approximately 1/60th/s). In interlaced displays, only one set of lines (odd or even) are updated in 1/60th/s. To update the entire frame requires two scans (1/30th/s).

Remember how  
you felt the last time  
your system gave you  
more performance than  
you thought possible?



signal used for transmitting a video signal.

However, computer graphics almost exclusively use an RGB color space, a cube with axis of red, green and blue. The composite video signal uses a cylindrical color space with intensity along the long axis and hue and saturation in the circular planes.

If a computer graphic is displayed that has colors that fall outside of this cylinder, they will not be translated properly into a composite video format. Illegal colors manifest themselves as blurred colors, noise and the speckling of an image.

Bandwidth reduction occurs when a computer image is compressed into a composite video signal. Broadcast composite video is bandwidth-limited because of the amount of spectrum allocated to video transmission. Typically, 6MHz to 8MHz is allocated for bandwidth in most transmission systems, while the usual computer image can easily require 10MHz to 100MHz to produce a crisp display.

Bandwidth and scanning frequencies should not be confused. Many people think it is possible to take a computer image with a horizontal width of 640 pixels and display it on a television. This may be wrong. Compatible resolution does not always mean compatible images.

If a video signal that is generated with a horizontal resolution of 640 pixels, but a bandwidth of 30MHz, is inserted into a device that expects a 6MHz band-limited signal, ringing and group delay errors result. The computer image displayed on the

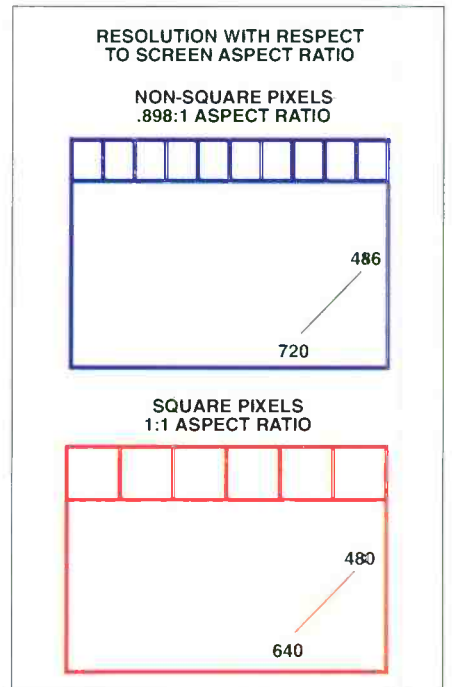


Figure 4. As pixel size is decreased, more are required to fill a display. Depending on pixel aspect ratio, the ratio of horizontal pixels to vertical pixels may not match the display's aspect ratio.



TV set would have errors that look like echoes on either side of a high contrast transition. This is because the circuitry is designed for a signal of 6MHz or less.

Computer displays tend to be progressively scanned, while video uses interlace. Interlace is another wonderful artifact of the NTSC compression scheme. Computers can scan all of the vertical lines of a frame in one field, video only scans half of them. (See Figure 3.)

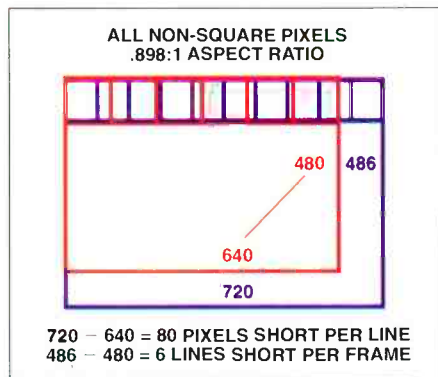
It takes two fields for video to completely scan one frame. If there is motion during the frame, then the second half of the lines for the objects in motion will have moved during the  $1/60$  of a second between fields.

The danger of displaying computer graphics on an interlaced display is that while certain graphics will look fine on a progressive display, they will "flicker" on an interlaced display. Think of displaying a computer graphic that is a series of black-and-white horizontal lines. When this graphic is displayed on an interlaced screen, all of the even (or black) lines will be displayed in one field, and all of the odd (white) lines will be displayed in the other field. The result is a TV screen that alternates each field between totally black and totally white.

While capturing a video image into a computer will result in a soft image (compared to the crisp signals of a computer), displaying a computer image on a television will include distortion unless proper care is taken to convert the image. This includes making sure the colors are bounded within the composite color space, reducing the bandwidth (with a low-pass filter removing the high-frequency information) to prevent errors and filtering the signal vertically to minimize interlace artifacts.

### Computer video vs. computer video

Not all computer video is the same. Computer video can range from a standard wide bandwidth RGB display to a compressed  
*Continued on page 59*



**Figure 5.** When displaying images on displays with a different pixel count, the pixel clocks must be adjusted, otherwise the image may not fit the screen properly. If the pixel clocks cannot be adjusted, the images must be interpolated causing artifacts.

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# 1995 technology forecast



*Things are better and I can prove it.*

## *The Bottom Line:*

*See, I told you so — again. This year's survey is another positive indicator of the industry's improving health. Not to echo an echo, but it's looking better and better. — \$*

**A**s stations look to the next millennium it appears that some of the doubts and fears so common only a few years ago are fading away. Stations are spending more, even to the point of exceeding their planned equipment budgets. Technical staff sizes have increased and continue to do so. If you want more good news, read on.

### **By the numbers**

Readers are always interested in the industry forecast. Although they are aware of their station's spending plans, knowing what the other guy is planning is good information to have. For more than a decade, *Broadcast Engineering* has provided an advance look at where the equipment dollar was going to be spent and how healthy budgets were. This year is no exception. So let's get to the numbers.

The last three years of equipment budgets are summarized in Table 1. As you'll soon see, combining the past three years into one table will make the analysis a bit easier. In a word, budgets are up and stations are poised to rebuild and replace lots of hardware in 1995.

The 1995 equipment budget for a top 50 station is more than one-half million dollars, \$535,494. The equipment budget for stations located in the 100 and lower markets is about 35% that amount. Measured over all markets, the average equipment budget for 1995 is \$348,527. A top 100 market station's budget is about 75% of that amount or \$261,961.

Because Table 1 includes data covering the last three years, it's easy to look for budget trends. Keep in mind these are forecasted budgets. As we'll see later, what a station forecasts and what it actually

ended up spending is not always the same.

Comparing forecast budgets for 1994 and 1995, we see that all budgets are up. The top 50 market equipment budget is up almost 3%. The top 100 market budget is up more than 6%. The below top 100 market budget is up a whopping 38%. Measured over all markets, 1995 equipment budgets are 8% higher than last year. One year doesn't make a trend, so let's look at the period from 1992 through 1995.

*For more than a decade, BE magazine has provided an advance look at where the equipment dollar was going to be spent and how healthy budgets were.*

Not every market category saw yearly increases, but the overall trend remained upward. From 1992 to 1995, the top 50 market equipment budget has increased by more than 18%. The below top 100 market stations budgets are up 37%. Measured over all markets, 1995 equipment budgets are more than 14% higher than in 1992.

### **Forecast spending vs. actual spending**

Let's look at the overall health of the industry by examining what stations actually spent on equipment. As you'll see, predicted spending did not always match actual spending.

Overall, TV station expenditures (not budgets)



looking for other shifts in spending plans for 1995. To do this, I compared predicted spending in 1994 with that predicted for 1995 on an equipment category-by-category basis.

There isn't much of a shift in most categories. However, three types of equipment see double-digit increases in planned spending.

Measured over all markets, there is a 23% increase in the number of stations planning on buying routing and distribution equipment. Last year, 14% of the stations indicated plans to buy such equipment. This year more than 37% of the respondents said their stations would be purchasing such hardware. The large increase in the number of stations planning on buying routing and distribution equipment is constant across all markets. Stations have decided to make the move for new backbone equipment.

The two other categories show similar increases in planned spending for VTRs and switchers. In each case, approximately 12% more stations are planning to purchase these items in 1995 than in last year.

Two equipment categories showed double-digit drops in planned purchases. Antennas and graphics equipment fell out of favor with stations. Respectively, they were down by 17% and 15% when measured over all markets. Approximately 30% fewer stations in the below 100 market stations plan on purchasing graphics equipment. However, that category is down only 7% in the top 50 markets. For the other equipment categories, single digit changes up and down are the norm.

### Who's the boss?

Over the last 10 years we've seen the perceived importance of the chief engineer and similarly titled positions fall in the eyes of some. This magazine has reported the widespread reader disappointment in how many stations treated their engineering talent.

For a while, layoffs and consolidation were the norm and many engineers felt their opportunities were limited or non-existent. The worm has turned folks and engineers

are becoming more important to stations every day. Let's look at the personnel and buying authority side of station operation.

Table 3 summarizes station technical staff size for the past three years. Note that since 1992, the median technical staff size in all markets has increased. In 1992, the top 50 market station had a technical staff of 24. That has increased to 28 today, an increase of almost 17%.

The top 100 market stations also have experienced staff growth. Today, the median technical staff is 15. When looking at the entire TV market, the median technical staff size has increased by almost 7% since 1992. We're finally going in the right direction!

In the 1992-1993 time frame we saw an increase in the use of consulting and contract engineers. There was also an increase in the amount of work performed by contractors. That trend is shifting.

Compared to 1992, the use of contract engineers for TV work has fallen in both the top 100 and below top 100 markets. Unfortunately, these gains were offset by the increased use of contract engineers in the top 50 markets. However, there is some good news. Since 1992, the amount of work done by contract people is getting smaller. In the top 50 markets only 10% of the work is done by contract personnel. That's down 4%. Measured over all markets, 11% of the technical work is handled by contract personnel. There is more positive news on this front.

### The bottom line

I've probably heard every possible argument about how engineers aren't needed today. I've been told they were as obsolete as dinosaurs. I've been told that today's

equipment is so smart that anyone can keep it going.

Well, I've got news for those opinionated and uninformed folks — you're wrong. The industry sees the situation just the opposite. Engineers are not only important, they are more important than ever.

This year's survey asked two questions on equipment acquisition. The first, "Who specifies the brand of equipment to be purchased?" and second, "Who makes the final decision on brands of equipment?"

Since 1992, the number of stations who rely on their technical managers to specify the brand of equipment to purchase has increased every year. Ninety seven percent of the respondents say their technical manager (CE, DE, DEO) specifies the brand of equipment to buy.

At the same time, the number of stations who rely on non-technical managers to make the brand selection has fallen. Barely 17% of the respondents to this survey said that non-technical managers specify the brand of equipment to buy. Compare that to 97% of the respondents who say their stations use chiefs and directors of engineering to make those decisions and the relative value of the technical manager's knowledge is obvious. Engineers are becoming increas-

Table 3. Station technical staff size 1992--1994.

Market size	1994	1993	1992
Top 50	28	28	24
Top 100	15	15	13
Below top 100	11	13	6
Over-all	16	19	15

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have increased 27% since 1992. Over the same period, the forecasted equipment budgets were up by 15%. What happened was that stations have been spending more for equipment than they originally planned.

The top 50 market spending went up by 30.5% during this time frame. The largest increase in actual spending took place in the below top 100 stations with a 53% increase in spending from 1992 to 1995.

The forecast budget for top 50 stations in 1994 was \$520,914. These stations actually spent \$518,896, just 0.4% below projections. However, in every other market category, stations spent *more* for equipment in 1994 than they had originally budgeted.

### The shopping list

So what do stations want in 1995? In a word, lots of new equipment. Supported by hefty budgets, stations are in a buying mood. Here's what stations say they are looking to buy in 1995 based on 17 categories of equipment.

The number one priority for stations in 1995 is audio and video monitors. That news shouldn't surprise you. Monitoring equipment has been the highest category of purchases for many years. Approximately 57% of TV stations plan on buying monitors, which is little change from last year.

The number two equipment priority has shifted radically from last year. In 1994, the second-

most desired item was graphics equipment. This year, it's new VTRs. Graphics hardware falls to the number six slot on this year's shopping list.

Test and measurement remains in the number three position, followed by editing equipment. Routing and production switchers hold the number five slot.

Signal processing and cameras hold the ninth and tenth slots, which has been the case for the past two years.

In general, buying patterns are similar between the different-sized markets. That's especially the case for the top five equipment categories. It's not surprising that a larger percentage of major market stations plan on buying from each equipment category than do smaller markets. Equipment buying plans by type and market size are shown in Table 2.

Before we leave the buying trends, it's worth

Table 1.

FORECAST BUDGETS			
Market size	1995	1994	1993
Top 50	\$535,494	\$520,914	\$452,942
Top 100	\$261,961	\$246,406	\$293,208
Below top 100	\$187,216	\$135,228	\$136,667
Over-all	\$348,527	\$323,755	\$304,431

Table 1. Equipment budgets for 1993--1995 time frame. Budgets are broken down by market size.

Table 2. 1995 buying plans by market size and type of equipment.

Table 2.

TV SPENDING PLANS FOR 1995				
Type of equipment	Over-all Markets	Top 50	Top 100	Below top 100
ATR	20.7%	29.6%	16.8%	12.9%
Microphones	34.7%	40.8%	37.6%	24.8%
Test equipment	45.3%	55.1%	44.6%	33.7%
Signal processing	27.1%	35.7%	26.7%	16.8%
Audio consoles	21.3%	25.5%	17.8%	18.8%
Automation eq.	24.1%	33.7%	20.8%	14.9%
Monitors (A/V)	56.6%	61.2%	58.4%	49.5%
Transmitters	16.3%	23.5%	11.9%	10.9%
Routing/distribution	37.0%	44.9%	32.7%	30.7%
Antenna systems	11.0%	14.3%	10.9%	6.9%
Editing inc. DTV	44.8%	44.9%	43.6%	45.5%
VTR	53.1%	52.0%	54.5%	53.5%
Graphics/effects	37.7%	49.0%	32.7%	27.7%
Remote pdn. vehicles	13.9%	20.4%	13.9%	5.9%
Video switchers	40.8%	40.8%	39.6%	41.6%
Cameras	26.6%	29.6%	22.8%	25.7%
Other	7.5%	7.1%	8.9%	6.9%
No purchase planned	7.1%	6.1%	8.9%	6.9%



ingly important to good buying decisions.

Just as important as who specifies the brand is who makes the final decision on the brand of equipment to buy. Again, it's the technical managers who make the decision. More than 82% of the respondents in the top 50 markets said their technical managers have the final say when it comes to equipment purchases. Less than one-third of those stations allow a non-technical person to make that decision. Even when looking across all market sizes, almost 76% of respondents said that the technical manager has the *final say* when it comes to brand selection.

### Smarter than ever

So, what do these changes mean to the station engineer? First, the staff cuts we saw in years past are over. Second, automation has replaced about as many people as it can.

Although new technology has enabled one person to do the work of two (in some cases), the person left has to be smarter than ever. This makes the engineers that remain even more important to their station's operation.

Much of the 1980's technology was designed to replace people. It didn't matter whether you worked for an insurance company or were a tape operator at a TV

station. Business looked for technology to reduce overhead and that meant people.

Technology provided the tools to do just that. Many people lost their jobs as machines took over. Although that was a painful period for many, those that survived find themselves with new opportunities.

Modern video equipment is so complex that built-in diagnostics are required. Troubleshooting is often limited to board-level checks and replacements. Although many thought anyone could swap boards, it turns out that such procedures are but a small part of what it takes to create and maintain a quality facility.

### Case story

A contract engineer recently told me of a post house who called for his help. It seems there were gremlins everywhere and the post personnel couldn't identify the problem.

The owner thought he had isolated the problem down to a faulty tape head. The cost of replacement was \$5,000. The contract engineer, after some investigation, found that the VTR wasn't the problem at all.

Because the post house didn't see a need for any regular maintenance, they had left changes and alterations to the operational staff. Minor wiring changes and "tweak-

ing" were permitted whenever the user deemed they were needed.

The result was a facility that was completely out of time, no two levels matched and black wasn't even black. In short, the facility was full of problems.

The contractor reported to the owner his estimate to realign just the basics of the system. The owner looked up at him and said, "It would have been a lot cheaper if it had just been the tape head wouldn't it?"

The moral of this story is that cheap is always expensive. Station owners are beginning to realize that and qualified engineers stand to reap the benefits.

Budgets are up. Actual spending is up. Stations are replacing equipment. The importance of the engineer continues to increase. What more could we ask for? ■

**Acknowledgment:** Appreciation is expressed to M Street Directory for its help in preparing this article.

**Research statement:** The information in this year's survey was prepared by the Intertec Publishing research department. The data is based on responses developed from 2,000 mailed survey forms, of which 590 usable surveys were returned.

**Editor's note:** The complete survey is available in bound form from Intertec Publishing. It contains more than 30 pages of tabular data, detailed spending plans and purchasing authority. Copies of the survey are available for \$150. Contact Chris Lotesto for more information at 312-435-2357.



## VIDEO D A's



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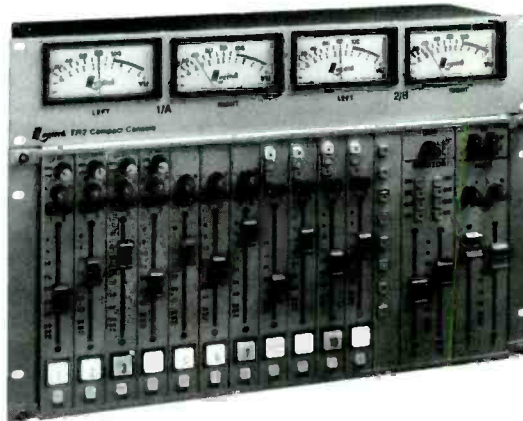
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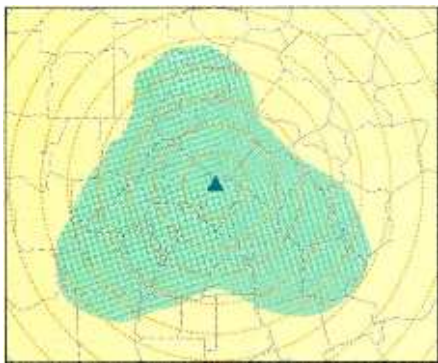
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Perhaps the most quality-limiting section of an older transmitter is the exciter stage. With the exception of the recent use of solid-state MSDC and IOT final amplifiers, little change has occurred in transmitter design stages. Most final stages provide a relatively flat response and can be tuned for maximum gain with little signal degradation. Recent improvements to the broadcast signal have been concentrated in the exciter.

Exciter upgrade kits are available for most UHF and VHF transmitters. Fortunately, the exciter/driver stages are primarily responsible for the signal-shaping function of the transmitter and are easily replaced or improved. If your transmitter is more than 10 years old, it is time to consider an upgrade. The technology used in most original exciter/driver combinations relied on cascaded amplifiers and vacuum tubes to produce sufficient power. Unfortunately, tube designs were often unreliable and incorporated mechanical tuning systems that made repair extremely difficult.

Installation of a new exciter/driver can be streamlined by having the exciter prewired, rack-mounted and tested by the manufacturer. The new rack can then be placed near the original transmitter. This allows the outdated equipment to remain in place, thereby simplifying the installation. Consider having the new exciter wired in as the main exciter and then use the old exciter as a backup. The exciter manufacturer can provide the necessary switching as a part of the system, which will greatly facilitate installation.

So, outside of visual improvement, why retrofit?

#### Reasons to retrofit

Most transmitters were originally purchased with only one exciter to save money. In many cases, the original manufacturers of these transmitters have gone out of business. As many transmitter maintenance engineers know, the lack of product support and escalating costs for the unique components often require repairs that are much more difficult. In this case, an exciter retrofit means greater reliability, manufacturer sup-

## Exciter retrofit

port and lower repair costs.

Power savings can also be realized from an exciter retrofit. Many older transmitters used mod-anode pulsing as a way to save power. This was a process that never seemed to be realized. This older technique has been surpassed by low-voltage sync pulsing and the ability to retune the klystron for lower gain and yet realize improved efficiency. The improved linearity correction capability and greater stability provided by a new exciter will permit the klystron to operate closer to its saturated power level. Along with an improved picture, this also allows the tube to be biased to operate at a lower beam current. The combination results in increased transmitter efficiency and reduces power costs.

Some TV stations have not been able to convert to stereo because of their transmitter. Although their transmitter's final amplifiers and RF networks may have originally met the specifications of the new BTSC standard, the exciter was typically unable to generate the stereo signal and the new subcarriers. Most new exciters come equipped with full BTSC capabilities. Some stations have even been able to augment their services or increase income by adding the SAP capability.

#### What to look for

Manufacturers now offer a variety of features in their retrofit packages to meet almost any need. However, it is important to know what to look for in a new exciter to make sure the performance and features match your needs.

Older exciters were susceptible to temperature changes. Many of the stages changed in gain and performance during warm-up and with temperature changes. Most new exciters use combinations of ALC and AGC

stages to ensure rock solid stability throughout operation.

Early transmitters did little to correct for distortion that was introduced in the RF stages of the transmitter. ICPM correction that was unavailable in early models was added to improve BTSC performance. The linearity and frequency response correction ability has also been greatly improved over early exciter designs.

Older transmitters also used temperature-controlled crystal oscillators to generate the IF reference frequency. Some exciters used both an aural and visual oscillator, which sometimes created intercarrier differences. Newer models use a single master oscillator/multiplier system that eliminates intercarrier offset problems. Most newer circuits provide excellent phase noise performance and precise frequency offset capability. Today's exciters come equipped with a wideband low distortion aural modulator for BTSC stereo/SAP/PRO capability. They also include SAW/VSB filters that allow for precise sideband shaping with little envelope delay distortion.

The newer UHF exciters provide comprehensive pulsing systems. This new approach is more user friendly when you have to change from a pulsed to non-pulsed mode. They also add phase, gain, timing, and linearity correction controls to stabilize the pulsing process.

A double-balanced mixer visual modulator is used in most modern exciters. This design provides linear modulation over the full video range from sync down to zero carrier.

Be sure the driver system of your new exciter has a conservatively rated solid-state driver amplifier. The exciter TPO should be sufficient to replace all but the final visual, and in some cases the complete aural, amplifier.

As in the case of any new RF equipment, the circuit design and board layout should be well shielded. Also, check to see that all circuits are operational with the shielding removed. This permits easy repair and adjustment. Look for slide-mounted tray construction with a system harness mounted on retractors. This makes repairs much easier. Metering should also be understandable and comprehensive.

In these days of ATV/HDTV uncertainty, it could be a good time to replace your exciter. This would allow you to update your transmitter for a fraction of the cost of a new transmitter, while waiting for the political dust of ATV to settle. ■

#### New exciter/driver checklist

1. ALC/AGC loops for maximum stability.
2. Improved IF correction circuitry
3. Solid-state oscillator/multiplier stages
4. BTSC, SAP-capable
5. Double-balanced mixer design
6. SAW VSB filter
7. Upgraded pulser control (UHF)
8. Solid-state driver amplifier
9. Maintenance-friendly construction
10. Manufacturer support

Table 1. Items to consider when purchasing a new TV exciter.

Steve Rowell is chief engineer at WOFL-TV, Lake Mary, FL.



Continued from page 53

digitized signal to true storage of a broadcast video signal. It all depends upon the power and capacity of the computer in question and the way the computer stores the pixel information.

It used to be that when someone mentioned computer video it was the video that the user worked with to interact with the computer. The video was difficult to record using standard video recorders for the reasons described earlier.

Computers soon gained the ability to capture, process and output "broadcast" video. However, there were concerns at first that computer people did not understand how to work with video. The sync signals were square waves instead of shaped waveforms. Video termination did not match video standards, and the timing signals, like serration and equalization, did not conform to published recommendations.

Eventually, computers were able to capture and display video, but there were problems with the processing limitations of the computer — the video could not be stored as a "movie" because there was too much video information. The main bus of the computer could not move enough information fast enough to handle the video.

This is where compression entered the picture for computers. It enabled computers to throw data away selectively until the remaining data was manageable by the main bus of the computer and it could be saved to internal storage systems.

The cost was a dramatic reduction in the quality and the size of the video image the user would see on the screen. But as compression means improved, and digital disk recorders became more affordable, non-linear editing applications emerged. The linear videotape recorders were replaced with non-linear random access disk recorders. This was not merely an option to traditional editing, but an entirely new way to edit video.

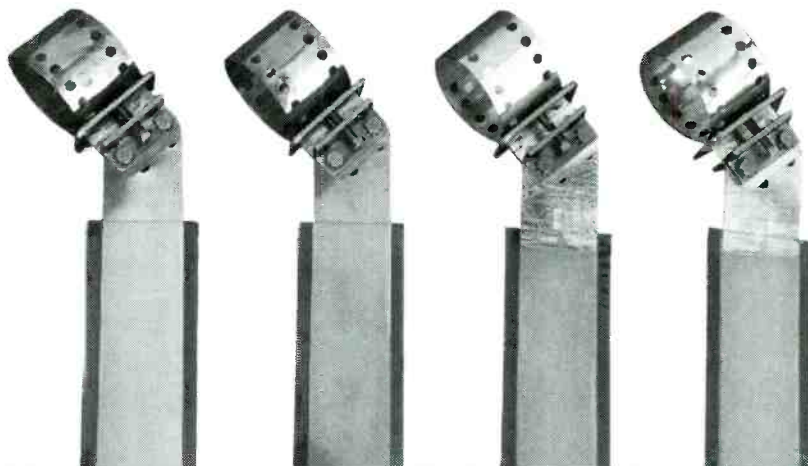
Compressed video products have become less dependent upon general-purpose computers and have migrated to many dedicated, microprocessor-controlled applications. These applications include video phones, CD-I, Video CD and others with standards and formats for each specialty application.

Today, MPEG-compressed satellite distribution is competing with cable, and feature film releases may soon be available on Video CDs as well as VHS tapes. It appears compressed video has become "good enough." But has it?

In February we will look at the issues surrounding compression and what factors influence its quality and performance. ■

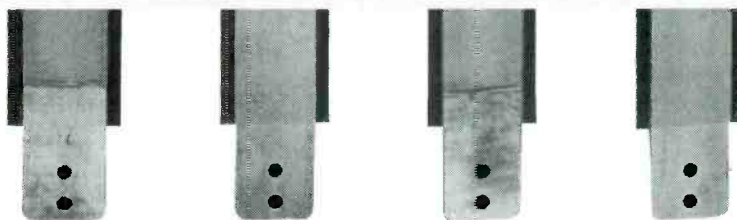
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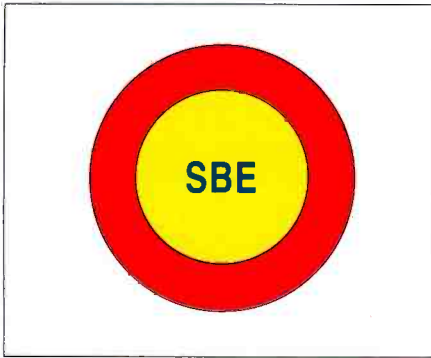
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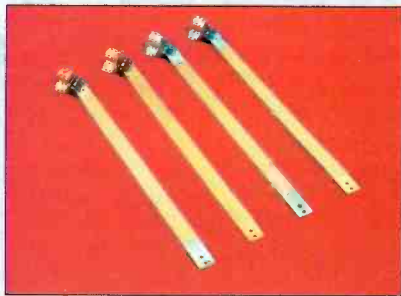




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► Uni-Kit 2: improves the method of cable and tower-leg grounding; four combinations to address specific grounding needs and applications, such as aluminum or copper coaxial lines and galvanized tower legs to copper, brass or galvanized buses; kit variations include copper to copper, copper to tin, tin to tin, and tin to copper; fits ¼- to 2-inch diameter cable and elliptical waveguides up to EW28; standard weatherizing materials are included to seal connection.

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## Direct digital synthesizer EMCEE

► DDS: designed for the wireless cable industry; interfaces with the atomic referenced signals available from the Global Positioning Satellite (NAVSTAR) system to control the frequency of a 31-channel wireless system to within less than 50 parts per trillion accuracy; the ability to control and change the transmission frequency to within increments of 1Hz causes the interference to be hidden within the horizontal scan lines, thereby rendering the undesired artifacts less visible.

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## Ultralow distortion function generator Stanford Research Systems

► DS360: uses direct digital synthesis (DDS) to provide waveforms from 1MHz to 200kHz with total harmonic distortion (THD) less than -100dB (<20kHz); functions include sine, square, two tone (SMPTE, DIM, CCIF, etc.), white noise, pink noise and bandlimited white noise; BNC, XLR and banana output connectors provide easy interfacing to virtually any system; balanced outputs range from 25mVrms to 28Vrms (unbalanced from 12mVrms to 14Vrms); features linear and log frequency sweeps, 1MHz frequency resolution and 25ppm frequency stability; standard RS-232 and GPIB computer interfaces as well as AES-EBU and SPDIF/EIAJ digital outputs are provided.

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## Solid-state A/V delay Prime Image

► Audio/video delay: self-contained, solid-state unit delays video and audio for up to 30 seconds without data compression, switches in alternative A/V feeds as required; audio/video signals can be replaced, recorded or rerouted as necessary; video I/O is composite Y/C, T/U/V or Y/R/B, unit is fully compatible with component signals; features built-in gen-lockable synchronizer, controls for video, color, setup levels and H-phase adjustment.

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## Pedestal adapter Rademec

► RP4 pedestal adaptor: clamp-on drive unit allows full XY control of existing non-robotic pedestals via Rademec's range of control interfaces; allows robotic control of all camera features including position, height, pan, tilt, zoom and focus when combined with the Rademec EPO Elevator unit; offers same navigation control as the RP2-CCD line-scan camera and secondary dead-reckoning system, allowing precise and repeatable positioning on the studio floor.

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## Single-rack encoder ULTECH

► EDS400: encodes closed-caption, text, EIA extended data services, teletext, telemetry and private data in a single 1¼-inch rack unit to save space, produce a cleaner signal, increase reliability and conserve power; compatible with existing caption encoders and supported by all major captioning agencies; unit's multitasking operating system handles data services simultaneously; broadcasts network IDs, call letters, time of day and programming information using EDS data that is entered from the front panel of RS-232 interface; stores station information in non-volatile memory with user presets; additional features include easy hookup to news wire/teleprompters, optional modem for remote data, optional caption-monitor output, master/slave operation for multiple network feeds and NTSC/PAL/SECAM operation.

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## Software for ProDisk Otari

► Version 4.4: features GUIDE editing screen that allows users to record, edit, playback and mix multiple channels of audio without changing screen settings or the active window; improved library system allows for cataloging of as many disks or magneto optical platters; offers support for the time compression/expansion option and magneto optical drives, direct sync-to-video, VITC and more.

Circle (356) on Reply Card

## Broadcast transmission control Maddox Broadcast

► Autoplay II: consists of Windows workstation controlling a scheduler control engine; modules available to allow for matrix and VTR control, a tape library, ad insertion, GPI switching for auxiliary equipment and an automated scheduler; support of system functions can be given remotely via a modem.

Circle (357) on Reply Card



## Custom panels GEPCO International

► Will design panels from a sketch or CAD drawing, can accept CAD disks; panels from ¼ inch, aluminum or laminate; laminate and anodizing available in a variety of colors; engraving is done on computerized CAD/CAM equipment and can be color filled to identify different functions; graphics for steel and plastic finishes can be silk screened or photographed; customer approval prior to fabrication.

Circle (358) on Reply Card



**Character generator**  
Knox Video



► **Studio 40:** single self-contained, easy-to-use keyboard device; combines several post-production functions in a single package; includes a high-resolution multifont character generator with built-in black burst, insert keyer, 2-way fader, 2-input switcher with audio-follow-video and handles NTSC and Y/C video; offers PC interface for storing banks of pages on disk or controlling Studio 40 via RS-232; can be programmed to automatically execute a pre-arranged sequence of events from power-up; features a 32 color palette by character and line, 64 pages of non-volatile memory and 9-speed roll and crawl.  
Circle (359) on Reply Card

**Digital signal processing camera**  
Panasonic Broadcast



► **WV-F565 DSP:** uses three ultrasensitive 1/2-inch 400,000-pixel FIT CCDs that produce 850 lines of horizontal resolution, a high sensitivity of F8 at 2,000lx and less smear while maintaining a wide dynamic range (comparable to 2/3-inch CCDs); advanced 10-bit digital processing allows for S/N of 65dB with its digital noise reduction circuit, and a signal-to-noise ratio of 60dB when the camera's gain setting is at 9dB; offers multicore and coaxial multiplex control systems for flexibility in ENG/EFP or studio use.  
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# AP41-SW

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# AUDIO/RADIO SUPERVISOR

The Disneyland Broadcast Services Department is looking for a talented professional with a wide range of audio-for-broadcast skills and motivated by working in a fast-paced broadcast environment.

As Area Supervisor for Audio/Radio, the successful candidate will have responsibility for technically producing routine radio broadcasts originating from the Magic Kingdom, as well as planning and producing simultaneous radio remotes for large, multi-station media events. You will also be responsible for audio as it relates to TV broadcasts and video production.

A minimum of 7 years experience in radio/TV broadcast engineering with an astute understanding of satellite, fiber optics, ISDN and Switch 56 broadcast methods are required. Experience in management and audio system design are highly desired.

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## **Integrated A/V DA Broadcast Electronic Engineering**

► **AVDA 2412:** designed to interface directly to broadcast videotape machines or other professional equipment; able to drive 12 videocassette machines; video section with one input and 12 outputs; audio section with two inputs, each with 12 outputs; video input has common-mode rejection with a floating ground to minimize hum and noise pickup on the incoming line; audio amplifiers have high-impedance balanced inputs on XLR connectors with a passive loop to XLR output connectors.

Circle (361) on Reply Card

## **Digital video component analyzer Rohde & Schwarz**

► **VCA:** digital waveform monitor and analyzer in one unit; detects errors in signal transmission and interference sources; provides innovative and comprehensive measurement facilities for operation, servicing and development of digital studio equipment; monitors camera signals, signal generation and signal distribution in the studio; features parallel and serial I/O, data frame analyzer and data contents analyzer functions, which enable it to monitor the digital video signals at all transfer points of a TV studio.

Circle (362) on Reply Card

## **Digital encoder BAL Broadcast**

► **DRX4660:** 10-bit broadcast specification serial digital component partners the upgraded composite-to-serial digital component decoder; includes serial digital component inputs and three output versions — serial and parallel digital composite outputs only, PAL/NTSC outputs only or digital composite and analog PAL/NTSC outputs; uses sample-rate conversion techniques to remove the need for any intermediate analog processing, ensuring maximum accuracy and stability with automatic PAL/NTSC operation determined by the input-data-stream standard.

Circle (363) on Reply Card

## **Graphical Multimeters Fluke Corporation**



► **860 series:** designed for troubleshooting, maintenance, installation and calibration of industrial, medical and production equipment, repair of computers and office machines, and repair and maintenance of telecommunications and home entertainment systems; combines advanced multimeter capabilities with the visual power of waveform display, in-circuit component testing, trend plotting and logic-activity detection in one easy-to-use, hand-held instrument; selectable display modes allow users to view information in the form best suited for their application for fast, effective troubleshooting.

Circle (364) on Reply Card

## **Hand-held photometer Tektronix**

► **TekLuma Color II:** applications include color matching and color balance for TV studios, TV manufacturing, display manufacturing, CRT repair and display services; creates real-time color measurements when used with the J1810 chromaticity head; performs any light measurement — luminance, illuminance, radiance or irradiance — with available single-sensor head; features backlit display with metric and English readout selections; has full RS-232 control and can output light measurements in RS-232 or analog format.

Circle (368) on Reply Card

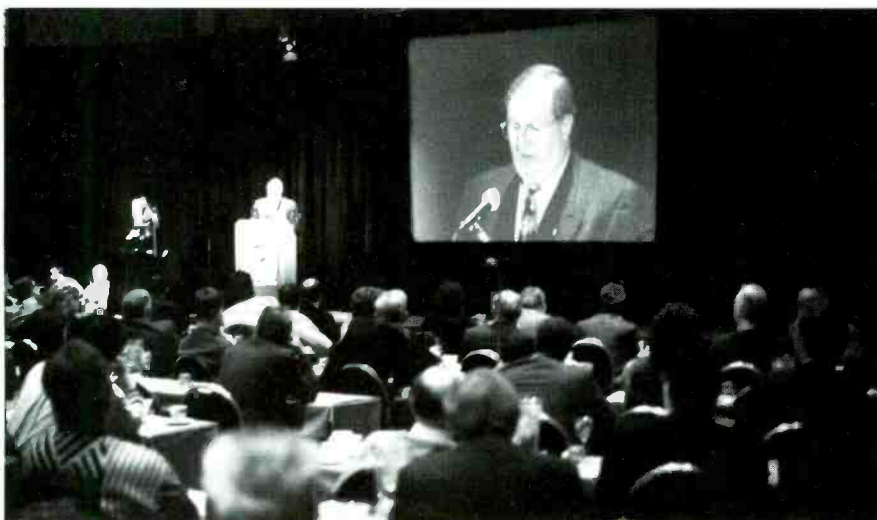
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**February 9-11, 1995**

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*(the technologies that are changing the face of the television industry)*



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Consistent with Canon's reputation for outstanding lens quality the IFplus utilizes a new and improved glass, which is stronger by design and able to provide extremely low dispersion, while correcting chromatic aberrations. Wide angle images, with substantially reduced distortion, is just one benefit of this technology.

### **Meets The Demands of 16 : 9.**

You can depend on Canon's IFplus technology to meet the challenges of new formats that require increased screen line density. Outstanding performance is also achieved in 4:3). Offering the highest MTF required, the J15ax8B IRS will meet and exceed your expectations.

### **Canon's J15ax8B IRS features:**

- The shortest MOD in a standard ENG lens: 0.65m
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# NEW PRODUCTS

## Video, sync and test pattern generator

### Compuvideo

► Series 7000: available in six models and supports numerous outputs including S-VHS, composite and component; suited for editing, production, post-production and maintenance applications and provides stable, drift-free operation; consists of 12 test patterns, six blackburst outputs, sync and subcarrier outputs and an audio generator, allowing user to configure editing systems in different ways.



Circle (365) on Reply Card

## TDM support and software update

### Lexicon

► TDM daughterboard: option for NuVerb Macintosh-based 20-bit professional reverberation system; adds support for Digidesign's TDM system; TDM package includes the daughterboard and software Version 1.5, which also is available separately to registered owners; NuVerb systems without the new daughterboard can operate with TDM systems via the standard AES/EBU digital interconnection provided with NuVerb.

Circle (366) on Reply Card

## Two-piece slim line units

### Tally Display Corporation

► LMS-1018S, LMS-1013S, LMS-1009S: units separate the display module from the electronics so displays can be mounted to production control room monitors; system provides source identification, error indication, source status and messaging capabilities for studios and production control rooms; measures 5/8-inch deep.

Circle (371) on Reply Card

## Component digital video transmission service

### Vyvx

► ImageNet: provides U.S.-based film and production houses, TV network production facilities, advertising agencies and corporate communications centers with the ability to communicate interactively between high-end graphics and production equipment; trans-

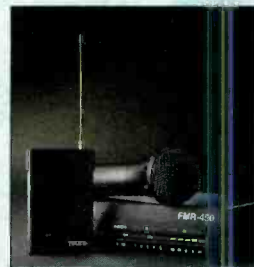
mits 45Mb/s component digital video in real-time from point-to-point, allowing for contribution-quality video with no artifacts or degradation from analog-to-digital conversion; supports nationwide transport of digital component video using the Alcatel 1740 proprietary coding algorithm; also supports extra audio, time code and remote machine control capabilities via 1.554Mb/s dataports provided on the codec.

Circle (367) on Reply Card

## UHF wireless microphone system

### Telex Communications

► FMR-450: designed to operate up to 50 simultaneous systems, using hand-held or belt-pack transmitters; operates from 524- to 746MHz (UHF TV channels 23-60); receiver features RF, audio and diversity LED indicators, and a transformer isolated balanced mic level output with attenuation control.



Circle (372) on Reply Card

## Label printing software for Windows

### Panduit Corporation

► PAN-MARK: designed to create labels for identifying wires, cables and components in electrical and electronic applications; provides full Windows functions and uses all laser and dot matrix printers supported by Windows; provides alpha, numeric and combination serialization, octagonal and hexadecimal serialization; includes a bar-code tool and supports all Windows fonts, including True-Type (sizes from six to 300 points); imports bit-map images (BMP), tagged image format (TIF) and Window Metafile (WMF) into a label; standard editing functions include copy, cut and paste, copying multiple labels, removing and inserting labels and search functions; furnished on 3.5- and 5.25-inch disks and is mouse or keyboard driven.

Circle (369) on Reply Card

## Digital video system

### Data Translation, Multimedia Group

► Media 100 version 2.0: enables users to create broadcast-quality (NTSC or PAL) video programs directly from a Mac computer; POWER option allows for high-capacity, draft-mode editing and high-quality on-line mastering in one system — All-On-One; Quick-Time Codec allows for instant "click and drag" transfers of Media 100 media files and clips; HDR option offers the highest image quality and up to 150KB (NTSC) and 180KB (PAL).

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## Small routers from Sierra Video Systems — quality you can lean on.

If you're looking for a small routing switcher with big performance, take a look at the Sierra Series.

- Composite video/stereo AFV models: 16x1, 32x1, 8x2, 4x4
- Component video models: 5x1, 8x2, 4x4
- Local and remote control panels available
- Compact 1 RU design, with plug-in construction
- RS-232 serial control
- In stock & ready to ship
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# NEW PRODUCTS

## Digital audio editing software The Synclavier Company



► **EditView 4.0:** fourth generation user-interface software; industry's first completely object-oriented, cross-platform audio editing interface; interchangeable on Synclavier PostPro systems and Digidesign Pro Tools, Sound Tools and Audio Media cards; allows user to affect multiple events simultaneously — even when non-adjacent.

Circle (373) on Reply Card

## Camera stabilizing system Cinema Products

► **Master Series:** features technical innovations that allow a camera operator to move easily with a film or video camera; includes a monitor with bright, high-contrast images and a 16:9 ratio, patented gimbal system, camera stage with manual and motor-driven control of X and Y axes; stabilized arm and 5-amp, nickel-cadmium battery pack.

Circle (374) on Reply Card

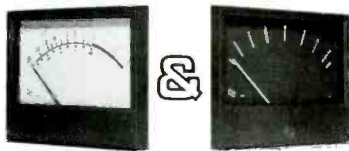
## AUDIO LEVEL INDICATORS



These high-quality, audio level meters give you near-spec performance at a very favorable price. Rugged, space-efficient core magnet design with fault-band suspension is ideal for broadcast or recording equipment in studio, stage, or location applications. Dials are buff with black and red markings. Styles are available for front- or back-of-panel mounting, with and without bezels. Request catalog today.

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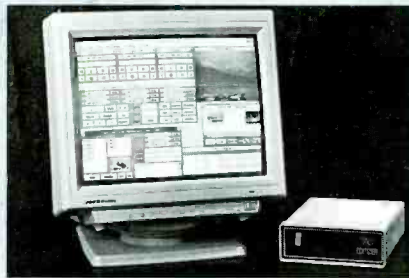
Circle (23) on Reply Card

## RGB patching system Trompeter Electronics

► **J25W:** 75Ω (.090 center pin) patching system for component video; compact system — two rack units high — offers patch cords with flexible triple coaxial cable, BNC inputs and Trompeter's proven plug design to complete the circuit between the inputs and outputs; offset patch locations of RGB ports avoid component mismatching but allows the system to accommodate 24 J25W jacks with 12 component circuits on the panel.

Circle (375) on Reply Card

## Broadcast video software Technical Aesthetics Operations, TAO



► **Editizer 3.0:** redesigned version with new software infrastructure; features "Fit & Fill" control of dynamic tracking and slow-motion VCRs, editing control software for selected digital video recorders, support for standard EDL formats, video on time line and video images in the tape logger, tape library search and more; new interfaces available include full control of Pinnacle's Alladin Media Printer, Hotronic AS-11 switcher card, Videonics MX-1 A/V mixer, Chyron Codi/PC character generators, Mackie Designs 1604 audio mixer and Alesis ADAT audio deck.

Circle (376) on Reply Card

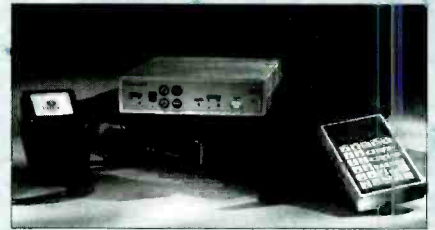
## Reportphone and ISDN codec EELA Audio



► **S24 PLUS Reportphone:** versatile Reportertool with soft-key menu operation; equipped with two mic inputs, one mic/line input and four output modes; ISDN codec offers G.722 (20Hz to 7.5kHz), Musicam A. at 48kHz sampling frequency, Musicam B at 24kHz sampling frequency.

Circle (377) on Reply Card

## Digital audio codec Intraplex



► **Series 4400 switched audio codec:** includes a simultaneously operating ISO/MPEG-2 encoder/decoder, G.722 encoder/decoder, ISDN terminal adapter, BONDING (r) compatible inverse multiplexer, and an interface that promotes call setup on a single stroke; remote software upgrade function allows new feature enhancements and changes to be sent to the codec remotely; compact unit can fit in a briefcase.

Circle (378) on Reply Card

## High-magnification ENG-style lenses Fujinon



► **A36X10.5ERD and A36X14.5ERD:** zoom lenses combine long focal length with broad wide-angle coverage; A36X10.5ERD has a maximum focal length of 378mm and wide angle of 10.5mm; A36X14.5ERD has a maximum focal length of 525mm and wide angle of 14.5; lenses incorporate Aspheric Technology (AT), which reduces spherical aberration and improves overall optical performance; lenses have inner-focus designs and integral lens-support plates, provide servo control of zoom and focus.

Circle (379) on Reply Card

## 1995 full-line catalog HMC

► **Technical supply catalog:** detailed and illustrated buying guide of electrical tools, test equipment and technical supplies for the assembly, testing and repairing of electronic products; features brand-name items, including precision tools, test instruments, datacom/telecom equipment, toolkits, soldering/desoldering, lamps and magnifiers, static control products, industrial chemicals and adhesives, measurement and inspection instruments, workstation and PC board handling equipment.

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EVW-300 3-CCD Hi-8 Camcorder

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



EVW-300 with Canon 13:1 Servo Zoom Lens, VCT-12 Tripod Mounting Plate and Thermodyne LC-422TH Shipping/Carrying Case .....\$5495.00

sachtler VIDEO 14/100 FLUID HEAD

- Sachtler Touch and Go System
• Integrated sliding battery plate
• Strengthened dynamic counterbalance in 2 steps
• Frictionless leak proof fluid damping with three levels of drag
• Vibrationless vertical and horizontal brakes
• Built-in bubble for horizontal leveling
• Compatible with wide range of tripods series 100

HOT POD TRIPOD SERIES

Especially developed for use in ENG, the Hot Pod tripod is the fastest in the world. The central locking system is activated on all three legs at the same time, while the pneumatic center column easily makes it possible to have the lens at a height of over 7 feet. The elevation force of the center column is factory set and doesn't require any setup. When moving to another location it can be carried by its handle located at the center of gravity.



ENG TWO-STAGE TRIPOD SERIES

Sachtler two-stage tripods have an enlarged height range (lower bottom and higher top position) so they are more universal. Legs can be locked in seconds with Sachtler's quick clamping. There are also heavy duty versions for extra stability. The heavy duty aluminum has a 20mm diameter tube vs. 16mm and the heavy duty carbon fiber has a 24mm diameter tube vs. 22mm. Also all heavy duty two-stage tripods have a folding tripod handle.

SACHTLER SYSTEM 14 PACKAGES

- SYSTEM 14 PRO I - Economic standard with two-stage aluminum tripod video, includes: 14/100 Fluid Head + ENG 2D Two-stage Aluminum Tripod + SP100 spreader + ENG 2 Padded Bag
SYSTEM 14 PRO II - Light standard system with two-stage carbon fiber tripod video, includes: 14/100 Fluid Head + ENG 2 CF Two-Stage Carbon Fiber Tripod + SP100 spreader + ENG 2 padded bag
SYSTEM 14 PRO III - Quickest tripod system, extremely high extension possible by the pneumatic center column, includes: 14/100 Fluid Head + Hot Pod Tripod + Padded Bag 100 II



Quick-Draw Professional FOR CAMCORDERS OR STAND ALONE CAMERAS



The Quick-Draw Camera Case provides a convenient way to carry and protect your camera on the ground, in your car and in the air. While much lighter and more compact than shipping cases, this padded nylon case has hard-shell construction and an aluminum viewfinder guard for 100% protection and security. It is particularly designed for working out of the back of a van or the trunk of your car. The top loading case has a wipe-open fold back top that stays out of the way.

- FEATURES:
• Heavy-duty shoulder strap and comfortable leather hand grip.
• Crush proof aluminum guard protects viewfinder.
• Fits into back seat and fastens securely with seat belt.
• Holds camera with on-board battery attached.
• Lid closes with Velcro for quick opening or secures with full-length zippers.
• Two trim exterior pockets and clip board pocket.
• Dual purpose rear pouch is an expandable battery chamber or all-purpose pocket.

antonbauer

Logic Series DIGITAL Gold Mount Batteries

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



DIGITAL PRO PACS

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

- DIGITAL PRO PAC 14 LOGIC SERIES NICAD BATTERY 14.4v 60 Watt Hours. 5 1/8 lbs. Run time: 2 hours @ 27 watts, 3 hrs @ 18 watts
• DIGITAL PRO PAC 13 LOGIC SERIES NICAD BATTERY 13.2v 55 Watt Hours. 4 3/4 lbs. Run time: 2 hours @ 25 watts, 3 hours @ 17 watts

DIGITAL COMPAC MAGNUM

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

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

GOLD MOUNT BATTERIES

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

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

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

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

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

Vinten



THE ADVANCED RANGE OF VISION LIGHTWEIGHT HEADS AND TRIPODS

Vision SD 12 and SD 22

Pan and Tilt Heads with Serial Drag

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

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

Vision Two Stage ENG and LT Carbon Fibre ENG Tripods

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

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

Vision 12 Systems

All Vision 12 systems include #3364-3 SD 12 dual fluid and lubricated friction drag pan/tilt head, single telescoping pan bar and clamp with 100mm ball base.

SD-12A System

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

SD-12D System

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

SD-12LT System

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

Vision 22 Systems

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

SD-22E System

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

SD-22 LT System

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

SD-22 ELT System

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

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## TASCAM DA-88 Multi-Track Recorder



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

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

- OPTIONS**
- **RC-808** - Single Unit Remote Control
  - **RC-848** - System Remote Control
  - **MU-8824** - 24-Channel Meter Unit
  - **SY-88** - Complete SMPTE/EBU Chase Synchronizing and MIDI Machine Control interface

## Fostex

### RD-8 Multi-Track Recorder



This digital multitrack recorder is designed specifically for the audio professional. Fostex has long been a leader in synchronization, and the RD-8 redefines that commitment. With its built-in SMPTE / EBU reader/generator, the RD-8 can stripe, read and jam sync time code - even convert to MIDI time code. In a sync environment the RD-8 can be either Master or Slave. In a MIDI environment it will integrate seamlessly into the most complex project studio, allowing you complete transport control from within your MMC (MIDI Machine Control) compatible sequencer.

- Full transport control is available via the unit's industry-standard RS-422 port, providing full control right from your video day. The RD-8 records at either 44.1 or 48KHz and will perform Pull-Up and Pull-Down functions for film/video transfers. The Track Slip feature helps maintain perfect sound-to-picture sync and the 8-Channel Optical Digital Interface keeps you in the digital domain.
- All of this contributes to the superb sound quality of the RD-8. The audio itself is processed by 16-bit digital-to-analog (D/A) converters at either 44.1 or 48KHz (user selectable) sampling rates, with 64X oversampling. Playback is accomplished with 18 bit analog-to-digital (A/D) and 64X oversampling, thus delivering CD-quality audio.
- The S-VHS transport in the RD-8 was selected because of its proven reliability, rugged construction and superb tape handling capabilities. Eight tracks on S-VHS tape allow much wider track widths than is possible on other digital tape recording formats.
- With its LCD and 10-digit display panel, the RD-8 is remarkably easy to control. You can readily access 100 locate points, and cross-lade time is fully controllable in machine to machine editing. Table of Contents data can be recorded on tape. When the next session begins, whether on your RD-8 or another, you just load the set up information from your tape and begin working. Since the RD-8 is fully ADAT compliant, your machine can play tapes made on other compatible machines, and can be controlled by other manufacturers ADAT controllers. Your tapes will also be playable on any other ADAT deck.
- In addition to familiar transport controls, there are a number of logical, user friendly features. This is the only unit in its class with an on-board, back-lit variable contrast LCD display that provides all of the information you'll need to keep track of offsets, punch points, generator functions and other pertinent data. Three function keys, combined with HOME, NEXT and UP/DOWN buttons, enable you to navigate the edit menus effortlessly. If you do not have access to the front panel controls, the optional model 8312 remote control gives you remote command of the most common functions.

## SENNHEISER

### RF SERIES CONDENSER MICROPHONES

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

#### MKH 20 P48U3 Omnidirectional

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

#### MKH 40 P48U3 Cardioid

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

#### MKH 60 P48U3 (Short Shotgun)

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



#### MKH 70 P48U3 (Shotgun)

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

#### MKH 416 P48U3 Supercardioid/Lobe (Shotgun)

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

#### MKH 816 P48U3

#### Ultra-directional Lobe (Shotgun)

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

## CHYRON Graphics

### PC-CODI TEXT and GRAPHICS GENERATOR

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

- Standard PC/AT ISA bus interface; 2/3 length form factor
- Fully-antialiased displays
- Less than 10msec. effective pixel resolution
- 16.7 million color selections
- Fast, realtime operations
- Character, Logo and PCX image transparency
- Display and non-display buffers
- Bitstream typeface library selection
- Variable edges: border, drop shadow and offset
- Variable flush
- Precise position and justify control of character & row
- User definable intercharacter spacing (squeeze & expand)
- Multiple roll/crawl speeds
- Automatic character kerning
- User definable template fields
- Shaded backgrounds of variable sizes and transparency
- User definable red effects playback, wipes, pushes, fades
- High quality composite & S-video (Y/C) encoder
- Integral composite and S-video linear keyer
- NTSC or PAL sync generator with genlock
- Module switchable NTSC or PAL operation
- Software controlled video timing
- Board addressability for multi-channel applications
- Auto display sequencing
- Local message/page memory
- Preview output with safe-title/cursor/menu overlay
- Composite & S-video input with auto-genlock select

## SONY COLOR MONITORS

### PVM-1350

#### 13" Presentation Monitor

- Employs a P-22 phosphor fine pitch CRT to deliver stunning horizontal resolution of 450 horizontal lines.
- Equipped with beam current feedback circuit which eliminates white balance drift for long term stability of color balance.

- Has analog RGB, S-video and two composite video (BNC) inputs as well as 4 audio inputs.
- Automatic Chroma/Phase setup mode facilitates the complex, delicate procedure of monitor adjustment. Using broadcast standard color bars as a reference, this function automatically calibrates chroma and phase.
- Chroma/Phase adjustments can also be easily performed with the monochrome Blue Only display. In Blue Only mode video noise can be precisely evaluated.
- Factory set to broadcast standard 6500K color temperature.
- Provides an on-screen menu to facilitate adjustment/operation on the monitor. The on-screen menu display can be selected in English, French, German, Spanish or Italian.
- On power up, automatic degaussing is performed.
- There is also a manual degauss switch to demagnetize the screen.
- Sub control mode allows fine adjustments to be made on the knob control for contrast, brightness, chroma and phase. The desired level can be set to the click position at the center allowing for multi-



### PVM-1351Q

#### 13" Production Monitor

- Has all the features of the PVM-1350 PLUS.
- Is also a multisystem monitor. It accepts NTSC, PAL and NTSC video signals. NTSC 4.43 can also be reproduced.

- Equipped with a SMPTE 259M Serial Digital Interface. By inserting the optional serial digital interface kit BKM-101C for video and the BKM-102 for audio the PVM-1351Q can accept SMPTE 259M component serial digital signals.
- Equipped with RS-422 serial interface. With optional BKM-103 serial remote control kit all of the monitor's functions can be remotely controlled with greater confidence and precision.
- Equipped with input terminals such as component (Y/R-Y/B-Y), analog RGB, S-video, 2 composite video (BNC) and 4 audio terminals for complete flexibility. Aspect ratio is switchable between 4:3 and 16:9 simply by pressing a button.
- Underscan and HV delay capability. With underscan, entire active picture area is displayed. Allows you to view entire image and check the picture edges. HV delay allows viewing of the blanking area and sync burst timing by displaying the horizontal and vertical intervals in the center of the screen.
- Color temperature switchable between 6500K/9300K/User preset. 6500K is factory preset. 9300K is for a more pleasing picture. User preset is 3200K to 10,000K.

### PVM-1354Q/PVM-1954Q 13" and 19" Production Monitors

All the features of the PVM-1351Q PLUS:

- SMPTE C standard phosphor CRT is incorporated in the PVM-1354Q/1954Q. SMPTE C phosphors permit the most critical evaluation of any color subject. Provides over 600 lines of horizontal resolution.
- The PVM-1354Q mounts into a 19-inch ISA standard rack with the optional MB-502B rack mount bracket and SLR-102 slide rail kit same as PVM-1351Q. The PVM-1954Q mounts into a 19-inch EIA rack with the optional SLR-103 slide rail kit.

## SHURE



### FP32A PORTABLE STEREO MIXER

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

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

## MACKIE



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

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

### CR-1604 16-Channel Audio Mixer

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

## TASCAM



### 688 Midistudio

The 688 MIDISTUDIO is a compact, 20 input audio mixer combined with an 8 track cassette recorder system. Designed for the MIDI-based studio, this unit will work well for both the production facility and the individual artist. In the MIDI environment, sources can be selected, destinations assigned and routing designated, all from the remote MIDI controller. With its wide input range and ability to be remotely synchronized, the 688 can be the heart of a high tech, compact 8 track studio.

- Full featured 20 input mixer (10 balanced XLR inputs)
- 8 x 2 cue monitor mixer
- Built-in dx noise reduction system (defeatable)
- Unique "Scene Display" system to monitor MIDI-controlled setups
- Gateless auto punch-in/out and rehearsal modes
- Serial interface for external synchronization



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## HORITA

### WG-50 Window Dub Inserter

- Makes burned-in SMPTE TC window dub copies
- Indicates drop-frame or non-drop-frame time code
- Also functions as play speed SMPTE time code reader
- Adjustments for horizontal and vertical size and position
- Dark mask or "see-thru" mask surrounds display
- Provides reshaped time code output for copying TC
- Displays time code or user bits • Display on/off
- Field 1/field 2 indicator • Sharp characters
- Always frame accurate (on time)

\$269

### TG-50 Generator / Inserter

Combination time code generator and window dub inserter. It includes all features of WG-50 PLUS—

- Generates SMPTE time code in drop/non-drop-frame format
- Jamsync mode jams to time code input and outputs new TC
- Simple "on screen" press of time code and user bits
- Run/stop operation using front panel momentary switch
- Selectable 30/60/90/120-second automatic generator back-time
- Make a window dub copy while recording TC on source tape

\$349

### BSG-50

#### Blackburst/Sync/Tone Generator

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

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

\$269



### CSG-50

#### Color Bar/Sync/ Tone Generator

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

\$349

### TSG-50

#### NTSC Test Signal Generator

- The TSG-50 generates 12 video test signals suitable for setting up, aligning, and evaluating the performance of various video equipment found in a typical video editing system, such as video monitors, distribution amplifiers, VCRs, switchers, effects generators, TBCs, etc. In addition to the video signals, the TSG-50 also generates composite sync and, with a video DA such as the Horita VDA-50, becomes a high quality, multiple output, house sync generator.
- Fully RS-170A SC/H phased and always correct. No adjustments ever required
- Built-in timer automatically switches video output from color bar pattern to black after 30 or 60 seconds. Makes it easy to produce tape leaders of color bars followed by black.
- Video signals generated are in accordance with industry standard EIA RS-170A video timing specification
- Audio tone switches to silence and color bars change to black when using 30/60 second timer
- Convenient pattern selection - 12 position front panel switch
- Includes crystal controlled, 1 kHz, 0dB audio tone output
- Generates precise oscilloscope trigger output signal one H-line before start of color field 1
- Outputs: video, sync, ref frame, 1kHz, 0dB

\$439

#### WE STOCK THE FULL LINE OF HORITA PRODUCTS INCLUDING:

- WG-50 - Window Dub Inserter
- TG-50 - Generator/Inserter
- TRG-50 - Generator/Inserter/Search Speed Reader
- TRG-50PC - Has all of the above plus RS-232 control
- VG-50 - VITC Generator, LTC-VITC Translator
- VLT-50 - VITC-To-LTC Translator
- VLT-50PC - VITC-To-LTC Translator / RS-232 Control
- RLT-50 - Hi8 (EVO-9800/9850)TC to LTC translator
- TSG-50 - NTSC Test Signal Generator
- SGT-50 - Serial Control Titrer "Industrial" CG, Time-Date Stamp, Time Code Captioning
- SAG-50 - Safe Area, Convergence Pattern and Oscilloscope Line Trigger and Generator

## SONY

### NEW! SVP-5600 and SVO-5800 S-VHS Player/ S-VHS Editing Recorder

#### SVP-5600 and SVO-5800 features:

- By combining the high resolution (400 horizontal lines) of S-VHS with high quality signal processing techniques like Digital Field Filter DFC and Chroma Process Improvement, they deliver the consistent picture quality so essential to editing. They also incorporate a wide video head gap and track width (58mm) for stable and faithful picture reproduction.
- Each has a built-in TBC plus an advanced Digital Noise Reducer (DNR) for both the chrominance and luminance signals to eliminate noise during playback. At the same time, a field memory incorporated in the noise reducer removes jitter to provide sharp, stable pictures. The field memory, also includes a Digital Field DFC (Dropout Compensator), which replaces signal dropout with information from the previous field.
- They also incorporate Chroma Process Improvement circuitry for excellent color picture quality in the playback mode. This advanced circuitry greatly improves the chroma bandwidth, thus enabling sharper and clearer color picture reproduction.

#### FOUR CHANNEL AUDIO SYSTEM

- They each incorporate four-channels of high quality video
- There are two channels with Hi-Fi (AFM) tracks and two with longitudinal (normal) tracks. The Hi-Fi tracks provide a wide frequency response from 20Hz to 20kHz and a superb dynamic range of 90dB. The normal tracks incorporate Dolby B noise reduction for high quality sound reproduction. XLR connectors are used for the inputs and outputs for all four channels.



#### MULTIPLE INPUTS AND OUTPUTS

- Both machines employ composite and S-Video connectors. With optional SVBK-170 Component Output Board, they provide component signal output through BNC connectors. With the board, the VCRs can be integrated into Betacam SP editing systems.

#### USER FRIENDLY OPERATION

- They have a built-in character generator which superimposes characters on the "video monitor output" signal. This allows time code data, control track, menu setup and VCR function status to be shown on a monitor.

#### ADVANCED EDITING FUNCTIONS

- For frame accurate editing, both machines enjoy a sophisticated servo system, an improved quick response mechanism and built-in LTC/VITC time code capability. This makes them ideal for animation and computer graphic recording, where a frame-by-frame editing function is indispensable.
- They are equipped with industry standard RS-422 9-pin serial interface. The 9-pin connector carries edit commands and time code data between the VCR and the edit controller.
- When connected to an RS-422 equipped edit controller, the SVO-5800 functions as an editing recorder. It performs assemble and insert functions and also provided audio split editing capability of normal audio tracks 1 and 2. In the insert mode, video, audio and time code can be inserted independently, or in any combination.

#### FOR MORE EFFICIENT OPERATION they have an on-screen setup menu which allows a variety of customized VCR mode operations. Programmed in the form of a layer structure, you simply go through the menu and initialize VCR operation.

- All parameters of the TBC, such as luminance level, chroma level, setup, hue, YC delay, sync phase and SC phase are easily controlled from the front panel, and can be remotely controlled from the optional UVR-60 TBC Remote Control. The UVR-60 also accesses field freeze function in the still mode and allows on/off control of the chroma and luminance noise reducer.
- Quick and smooth picture search can be performed by either using an RS-422 equipped edit controller or the optional SVRM-100 Remote Control Unit. Recognizable color pictures are provided at up to 10x normal speed in forward or reverse.

### REBATES: Buy an SVP-5600 or SVO-5800 Professional S-VHS VCR or UVW-1600, UVW-1800, Betacam SP VCR with:

- Sony PVE-500 A/B Roll Edit Controller and receive \$500 instant rebate!
- Sony FXE-100 A/B Roll Edit Controller/SEG and receive \$1000 instant rebate!

## FXE-100 ALL-IN-ONE VIDEO EDITING SYSTEM

The new FXE-100 is an A/B roll editing system designed for quicker, easier video editing, and is well-suited for today's professional audiovisual communications. It is at once an edit controller which controls basic VCR functions, a special effects generator which cuts, mixes, wipes and composites the video sources with stunning effects; and an audio mixer; with various fading and switching abilities. There is no longer a need to configure multiple devices for video editing. With either Hi-8 or S-VHS VCRs and the FXE-100, an ideal professional editing system can be easily configured.



- Switchable machine control of three RS-422 equipped VCRs or three RS-232 equipped VCRs. Basic VCR functions, such as play, stop, still, fast forward, rewind and record are controlled through these interfaces. Variable speed control is also possible for VCRs equipped with Dynamic Tracking.
- Accepts time code, control track (CTL), and 8mm time code as editing references. These can be set separately for each VCR.
- Performs assemble and insert editing (Video, Audio 1, Audio 2). The first EDIT mode, which allows you to record sufficient timecode for synchronization to a new tape is also featured.
- Features a split audio edit function which allows setting of audio and video in-points separately. This permits you to bring in the audio source before a visual transition.
- Store up to 99 scenes, including effects settings, in memory.
- Edit list data can be saved and downloaded to an IBM-compatible PC, allowing you to review or modify edit data at any time.
- The FXE-100 has two program buses, the A- and B-bus. Each bus provides: Player, Play, 2-Aux Inputs and Background Color. Both composite and S-Video signals can be input.
- Taking advantage of the freeze function, two machine editing with effect transitions is realized by freezing the recorder OUT point picture. Also, by selecting the same video source in both A and B bus, wipe or mix In/Out of the digital effects is possible without picture transition. This "Self A Roll" function is another feature which allows effective two machine video editing.

#### SWITCHER AND SPECIAL EFFECTS GENERATOR

- Multiple wipe patterns, including picture scroll and slides, are programmed in. Wipe patterns are easily accessed, and transition rates can be set. Soft edges or a choice of 15 color borders can be added to most wipes and effects.
- Variety of mix effects, such as mosaic mix, black and white mix, posterization mix and picture-in-picture (PIP). Also fade to black and fade to white effects.
- Digital effects, such as mosaic, paint, pixel trail, multi-picture, monochrome, and zoom. Picture freeze function is also featured in frame or field mode.
- Because all the special effects can be set separately to the video sources of each bus, wipes or dissolves of the sources with the digital effects can be executed. It is also possible to combine multiple effects to create stunning images, such as wiping the multi-picture effect with the paint effect and dissolving color corrected picture with mosaic effects.

#### ADJUSTABLE TRANSITIONS

Transitions are done using the fade lever, or they can be automatically set. Transition time can be set from 0 to 999 frames. Transition can also be passed and reversed. Other parameters such as GPI timing, wipe selection and pre-roll time can be set.

#### CHROMA KEYS

The FXE-100 features chroma and luminance keys to superimpose characters, figures, or video sources onto a background. Clip and gain levels can be adjusted to give clean and sharp key edges. Color correction is done via the joystick for both buses with memory to hold a favorite setting for storage and recall.

#### WIPE CONTROL

By moving the location stick, you can move the closed wipe patterns such as square, circle and heart, around the screen. This function also enables you to start the wipe transition from any desired position on the screen.

#### AUDIO MIXING

Audio-follow-video editing can be performed with the FXE-100. Two channels are assigned to each player VCR's input and one channel for the recorder VCR's input. Two channels of AUX inputs and a mix input are available for mixing background music with voice-over. All audio input levels can be adjusted separately. Two Program output channels and one monitor channel are provided. A switch for -7.5dB and -4.0dB is provided for flexibility in choosing input levels for VCRs with either RCA or XLR connectors.

#### USER FRIENDLY OPERATION

All keys and buttons are logically grouped by function, and are color coded for quick identification and economy of keystrokes. Permits one monitor operation. No need for multiple monitors. Various editing data, such as edit mode and time code address of each VCR, can be monitored on the same screen.

#### VERSATILE SYSTEM INTEGRATION

- No need to configure multiple devices. By simply connecting three VCRs, a professional video editing system is formed.
- Two frame synchronizers allow perfectly synchronized wipes and dissolves without time base corrector.
- Equipped with two GPIs for control of external devices, such as character generators and audio mixers. Also has a GPI input, allowing it to be controlled from an external edit controller.
- Has four black burst outputs to distribute internally generated sync signal, synchronizing connected devices. There is no need for an external sync generator.

## MAGNI



### MM-400

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

#### FEATURES:

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

### WVM-710

#### Automated Video Signal Monitor

The WVM-710 is the first high performance, high resolution waveform monitor/vectoroscope with real-time auto-measure capability. Designed for broadcast and cable stations, production and post-production facilities, the WVM-710 allows the engineers to easily set signal measurement limits, while letting suite users monitor signal quality against the pre-set limits. With its auto-measure capability, the WVM-710 provides immediate and visible warnings whenever an out-of-limit condition is detected. This frees producers and editors from interpreting waveforms of graphs and to focus solely on creative content - with the confidence that any signal problem will be flagged immediately.

#### APPLICATIONS INCLUDE:

- Checking cameras and lighting in video production
- Ensuring multi-source video signal integrity through routing switches
- Checking FEC compliance in transmission
- Assessing level and color validity in graphics generation

#### FEATURES:

- Simplifies signal measurement by allowing limit ranges to be set for each parameter. Measurement limits can be set numerically (through menus) for peak video, sync level, H-ref timing, SC/H phase, color frame, etc.
- Once limits are set, you can view continuous signal status reports via on-screen prompts.
- Full-function, highly accurate waveform/monitor/vectoroscope. Provides separate waveform and vector displays, combines displays, separate video, auto-measure displays, and more.
- Unique "venetian blind" picture display which alternates between video and reference every 32 lines. This allows quick setting of timing, luminance, chrominance and color hue. For example, if the video signal timing does not match the reference signal, segments of the display will offset from each other and change color. This error can be easily corrected without consulting a waveform or vector display.
- Like the MM-400, the WVM-710 does not include a CRT, but rather, provides waveform/vector and measurement displays on standard video monitors. In fact, its 10-bit internal resolution produces displays that are sharper than other rasterizing monitors and are as clear and accurate as conventional CRTs.
- Offers supreme flexibility with multi-standard capability (composite, component, S-Video).
- The WVM-710 is also equipped with electronic gratitudes. An engineer can switch between waveform and vector displays, and the gratitudes will change accordingly. There are no CRT linearity problems and no etched lines to deal with.
- The WVM-710 can be controlled serially from a PC or modem, with transfer of waveforms or measurements back to the computer. A printer can also be connected to obtain a hard copy of either a question-based signal parameter, or the complete signal waveform for off-line analysis and troubleshooting.
- Its small size and operating characteristics make it ideal for

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## BUSINESS

Solid State Logic, Oxford, England, has sold consoles to CBS, New York; CBS Television City, Los Angeles; National Public Radio, Washington; NBC, New York; and Unitel, New York.

Acrodyne Industries, Blue Bell, PA, has been acquired by Acrodyne Holdings, formerly Decision Capital. The acquisition will allow Acrodyne Industries to broaden its current manufacturing capabilities, to further address the HDTV needs of the industry, and to provide additional working capital.

Pro-Bel, Berkshire, England, has sold the TX-220 digital master control switcher to the BBC for its World Television Arabic programs.

Cycle Sat, Beverly Hills, CA, has reached an agreement with MPO Videotronics, Newbury Park, CA, to acquire the operations of its New York subsidiary TFL.

Varian, Palo Alto, CA, is seeking a buyer for its Electron Devices operations, the smallest and oldest of its four core businesses.

Audio Precision, Beaverton, OR, has delivered a System One PC-based audio test and measurement system to the Moonhwa Broadcasting Corporation, Seoul, Korea.

Otari, Foster City, CA, has sold Concept I consoles to Varitel Video, Los Angeles, and Telescene, Salt Lake City.

Sonic Solutions, San Rafael, CA, has sold digital audio systems to Broadway Video, New York.

Also, Opcode and Sonic Solutions have announced an OEM arrangement to make Opcode's Studio Vision Pro software available for the Sonic Solution line of digital audio workstations.

Panasonic, Secaucus, NJ, has sold digital component studio recorders to Creative Technology, Akron, OH.

## PEOPLE

Michael Arbuthnot has been named president of da Vinci, a member company of Dynatech's video division.

Richard H. Leet II has been named vice president and chief operating officer at Cycle Sat, Beverly Hills, CA. Other promotions at Cycle Sat include Theodore L. Henry, vice president, sales and marketing; William B. Grandy, vice president, chief financial officer/chief information officer; Mark C. Stanton, vice president, human resources and administration; Tom O. Mikkelsen, vice president, chief technology officer; and Joycelyn Steil, vice president, customer service.

Randy Lloyd has been named national distribution sales manager at Pesa Switching Systems, Huntsville, AL.

Thomas M. Jordan has been hired as vice president, sales and marketing for Leitch, Chesapeake, VA. ■

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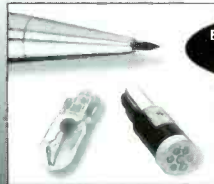
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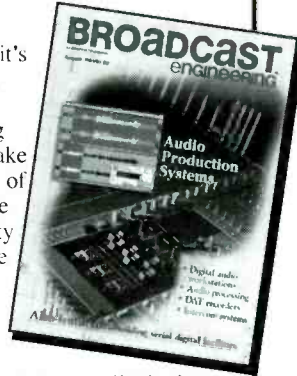
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**CHIEF ENGINEER** - For two New York City AM suburban radio stations located in northern New Jersey and Long Island, New York. Must have proven track record and experience in AM directional systems. Send cover letter and resume, including salary requirements to: General Manager, WVNJ, 1086 Teaneck Road, Suite 4F, Teaneck, NJ 07666 or FAX to (201) 837-9664 EOE

**RF ENGINEER** - Experience in high power antennas, transmission design, fieldwork. EE and PE preferred. Contact Dept. 12A, LBA Group, Box 8026, Greenville, NC 27835. EEO/M/F

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**WAGM TV** Seeking experienced maintenance engineer to perform general maintain on various studio, production, videotape equipment and microwave systems. 2 yrs experience in TV broadcasting required. SBE or FCC license preferred. Must be able to work full time and on call hours. Starting rate of pay is dependent on experience. Send resume to WAGM Box 1149 Presque Isle, ME 04769.

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**MASTER CONTROL OPERATOR** Minimum 5 years experience and FCC license required. Midnight shift. Send resume to: Broadcast Engineering, Dept 753, 9800 Metcalf, Overland Park, KS 66212. EOE.

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**ENGINEER:** Full time Studio Operations position in television station engineering department. Applicants must have at least two years experience in studio operations including TD, Audio, Camera and Font. Additional experience in videotape operations preferred. A technical background is expected. Send resume to: Walter C. Nichol, Chief Engineer, KMOV Television, One Memorial Drive, St. Louis, MO 63102. EOE.

**MAINTENANCE ENGINEER** TV. Station UHF transmitter and studio exp. Maintain 24-hour on-air station. Assist with camera maintenance, transmitter, microwave and Sony Beta Cam SP/Sony LMS. Burbank. Send resume to: Broadcast Engineering, Dept. 752, 9800 Metcalf, Overland Park, KS 66212

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