

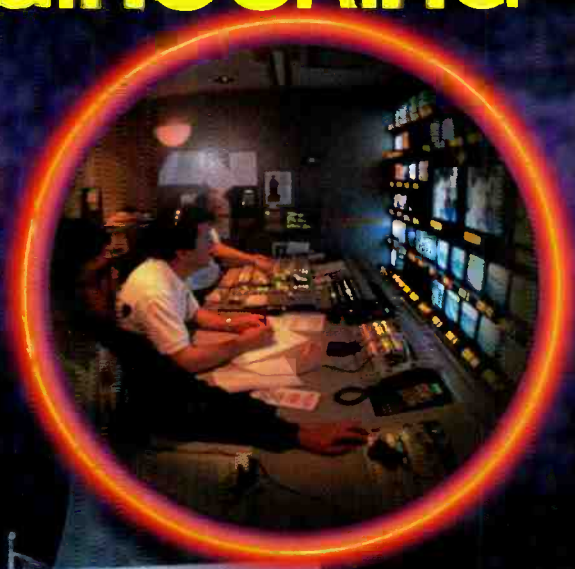
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Volume 39, Number 1

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ON THE COVER: Covering the Indianapolis 500 requires the latest in technology. Shown on the cover is the Indy Teleproductions remote truck outside the racetrack grandstand. Photos supplied by Sony Broadcast and Indy Teleproductions.



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New year, new opportunities

As I sit at my desk on New Year's Eve, fellow editor Ted Uzzle and I are reminiscing about the earlier days of broadcasting. Ted is editor of *Sound and Video Contractor* magazine and was replaying some of his earliest memories of television and his father's career as a TV chief engineer at WRAL-TV, Raleigh, NC, as well as other stations. The stories brought to mind my own career with broadcasting and how the industry has changed in (what seems to us) a relatively short time.

My first memory of a TV show was an afternoon broadcast of *Mr. Wizard*. I must have been only seven, but I still recall clearly the experiments he conducted and how fascinated I was with the whole process of television.

To this day, I remember one of his demonstrations showing how to attach a string to an ice cube and have shown it to my children.

In our nostalgic recollections of television's early-era local programming, the shows were comical by today's standards. Whether it was Major Astro in his plywood space ship or Captain 5 in his submarine complete with periscope, children (ourselves included) were introduced to television as a friend. Who (over the age of 40) doesn't fondly recall shows like *Wizzo the Clown*, *Sky King*, *Hop Along Casidy*, *Roy Rogers and Dale Evans*, *Captain Kangaroo* or a hundred other black-and-white shows from early television?

Although we now have color and improved images, I still use a B&W television in my den on a daily basis. I admit I wouldn't want to be limited to watching B&W images in my living room, but my little TV set

gets all the shows I want and it has never needed a software update.

This brings me to my New Year's thought. I believe that new doesn't necessarily mean better. Those stations that were the first to adopt color are not all the number one stations in their markets today. There may have been some early gains to being first, especially with the visible difference in B&W and color and the promotion that went with the technology.

But today, the broadcast market is vastly different. Viewers are more sophisticated. More entertainment sources exist providing viewers with more options. Despite all the hype we've seen, I don't believe that simply being first with DTV will translate into high ratings

or guaranteed financial success.

The choice to go color was an easy one. The choice to go DTV isn't quite so clear. The answer is probably yes. The more difficult question is when.

So, will your station be the first to go DTV in your market? Why?



Brad Dick

Brad Dick, editor

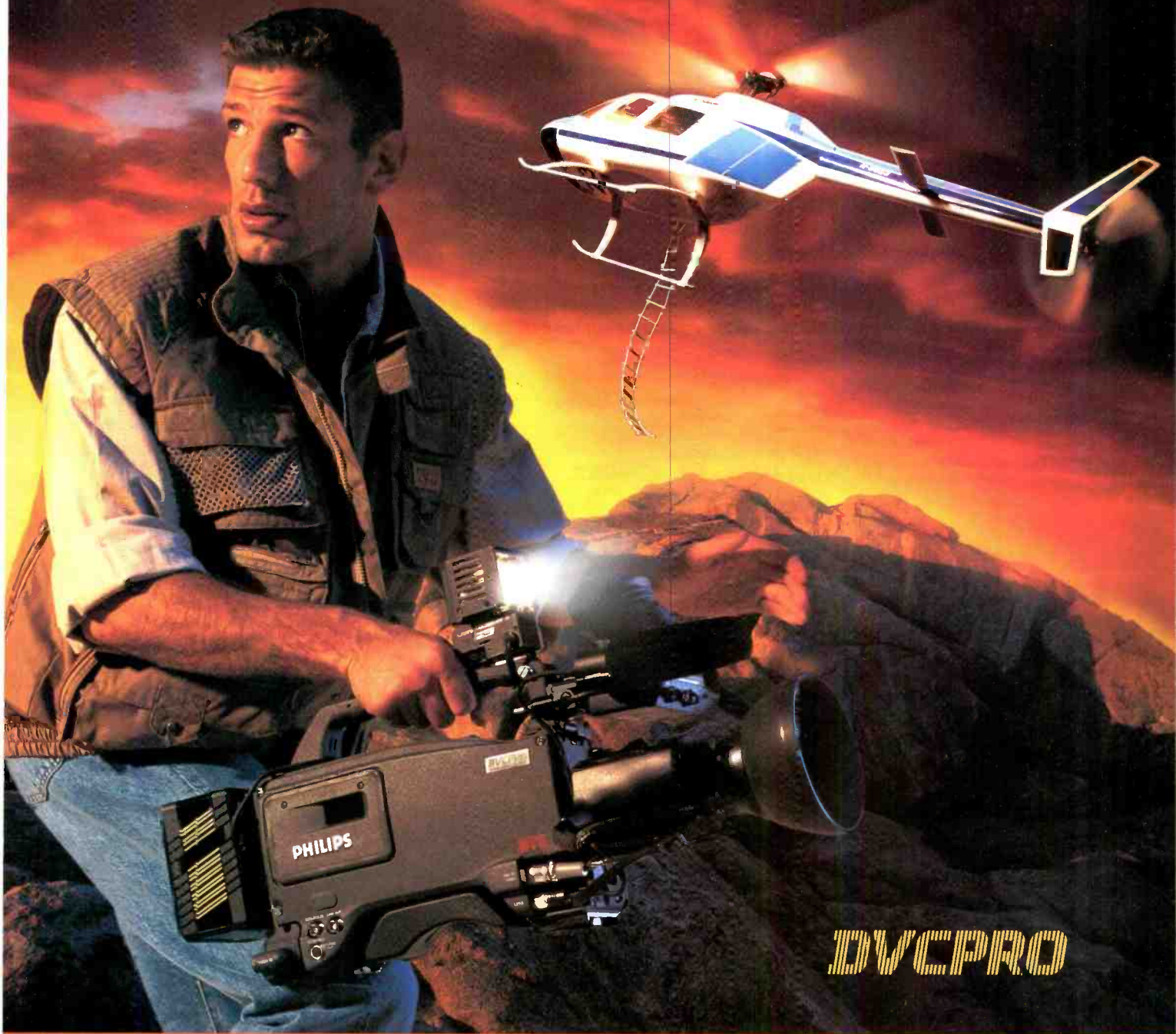
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letters to the editor



ATV vs. the World Wide Wait

Recently, I was on a review committee for a small TV station interviewing candidates for the CE position. We were talking with a 20-year computer veteran who was reluctantly considering changing careers. He said, "Oh sure, some day we'll have millions of colors and full-motion, full-screen video at the touch of a button." He was seated next to a 13-inch TV. I thought to myself, "All he has to do is turn around and touch THAT button, and he'll find out it's been here for years."

In your editorial (BE November 1996), you quoted a reader who claims "the Internet and web technology already supersedes your so-called ATV." If that reader knows the URL, I hope he will invite us all over to his place to watch the Super Bowl on his PC.

DAVE MCFADDEN

Simplify

Oh brother! I truly appreciate the folks who prefer to keystroke their way through software, but hey . . . you're computer-literate! (See "Editorial," BE April 1996.) You're also "computer-friendly," and you're certainly not intimidated by any menacing CRTs. However, there are so many changes in our industry, many or most of which involve computers/software/firmware or whatever, that many of today's operators and technicians are simply overwhelmed! The key word here is "operator," the backbone of our stations, and it's our job as maintenance technicians to keep their job as simple and error-free as possible. One of the devices we use is the simplicity of "plastic poop" . . . uh, er, the mouse.

When we can find a way to eliminate computer-phobia, or better yet, educate everyone who (wants to/ doesn't want to) learn the finer points of DOS/C/ UNIX/whatever, let me know. I want to make some real money in my lifetime!

DAVE MORRISON,
MAINTENANCE TECHNICIAN, WQED, PITTSBURGH

Cable connectors

I read with great interest the article "Connecting in the Analog/Digital Audio World" in your September issue (see main article "Distributing Digital Audio," p. 32). Mr. Weingartner makes a number of important points regarding cable and connector quality when handling AES/EBU digital audio.

However, I must disagree with his description of a good digital audio cable having "a tightly wound spiral shield with at least 97% persistent coverage." None of Belden's digital audio cables have spiral shields for a number of reasons.

First, we believe that spiral shields act like inductors, because they are continuous coils of wire. This inductance limits them usually to analog audio cables (below 20kHz). Spiral (also called serve) shields are notorious for "opening up" when the cable is bent, reducing shield effectiveness. It's also impossible to get a single spiral with 97% coverage as Mr. Weingartner suggests.

Perhaps he's thinking of the so-called Reussen shield, common in European cables, which is two spiral shields wound in reverse direction one over the other. This design does reduce the inductive affect, reduce (but not eliminate) the opening of the shields when the cable is bent, and can approach the 97% coverage that Mr. Weingartner desires.

The one key failing of a Reussen shield is high-frequency shielding, which is surpassed at 10MHz by a simple foil shield. Foil is 100% coverage, a lot cheaper to apply, and makes the cable smaller in diameter. All of Belden's AES/EBU cables are foil shielded with one exception, the 1696A, which is foil-and-braid construction, for good low- and high-frequency shielding.

Thanks for an otherwise excellent article and an always interesting magazine.

STEPHEN H. LAMPEN
BELDEN TECHNOLOGY DEVELOPMENT MANAGER



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ATSC applauds FCC DTV decision

The Advanced Television Systems Committee (ATSC) applauded the FCC's decision to adopt the major elements of the ATSC digital TV standard for the next-generation of broadcast television. Under the decision, video and audio compression, packetized data transport structure, and the modulation and transmission system specified in the ATSC standard are mandated by the commission for use by terrestrial broadcasters. The specific video formats to be used will be the subject of voluntary industry standards.

According to Robert Graves, ATSC chairman, "With an approved standard and voluntary agreements on picture formats firmly in hand, broadcasters, manufacturers and consumers can invest in digital television with confidence that a universal, cost-effective digital system will be deployed, preserving the benefits of free over-the-air television for decades to come."

Although the standard has been adopted, the FCC's work is not yet complete. It will need to finalize channel assignments early next year and issue service rules so that the implementation of DTV can begin in earnest.

SCTE submits standards to ANSI

The digital video transmission standard for cable television has been adopted by the Society of Cable Telecommunications Engineers' digital video subcommittee and approved by the SCTE's standards supervisory group, the engineering committee. The standard will be submitted to the American National Standards Institute (ANSI) for recognition as a new American National Standard. The standard, SCTE DVS 031, describes the framing structure, channel coding and channel modulation for a digital multiserve TV distribution system that is specific to a cable channel.

The system can be used transparently with the distribution from a satellite channel, as many cable systems are fed directly from satellite downlinks. The cable channel, which is typically distributed over optical fiber, is primarily regarded as a bandwidth-limited linear channel, with a balanced combination of white noise, interference and multipath distortion. The quadrature amplitude modulation technique used, together with adaptive equalization and concatenated coding, is well-suited to this application. The specs cover the 64 and 256 QAM. Most features of both modulations schemes are the same. The design of the modulation, interleaving and coding is based upon testing and characterization of cable systems in North America.

To obtain a copy of the standard, contact SCTE

director of standards Ted Woo at 610-363-6888 or via fax at 610-363-7133. Meeting schedules for SCTE standard developing subcommittees are listed on the society's web site at www.scte.org.

Take a course on phased array antennas

The University Consortium for Continuing Education (UCCE) is sponsoring a three-day course on phased array antennas from Feb. 26-28 in San Jose, CA. For additional information and a course brochure, call Joleen Packman at 818-995-6335 or fax 818-995-2932 or E-mail info@ucce.edu.

American technology and consumers achieve victory in digital TV battle

The Consumer Electronics Manufacturers Association (CEMA) applauds the December DTV agreement. According to CEMA president Gary Shapiro, "This historic agreement clears the way for final FCC adoption of the ATSC digital TV standard by the end of this year. This, in turn, will give TV receiver manufacturers the clarity and certainty they need to bring the first digital HDTV receivers to market beginning in 1998."

The parties agreed that the FCC should adopt all but one-half page of the six-page standard. To obtain computer industry support for the standard, the parties agreed that they would not recommend that the FCC formally adopt the section on setting the 18 video formats for interlaced and progression scanning.

Beyond the video formats, the ATSC standard assures compatibility for the industry in digital compression techniques, MPEG and other technical areas. More importantly, the standard assures consumers that the television they purchase will work with all broadcasts across the country.

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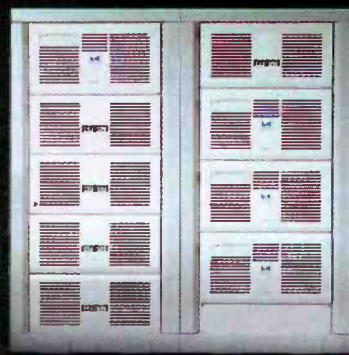
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FCC adopts DTV standard

On Dec. 24, the FCC adopted a standard for digital television (DTV), which reflects a consensus agreement among the broadcasting, equipment manufacturing and computer industries. The standard allows transmission of one or two high-definition TV programs; four, five or more standard definition TV programs at a visual quality better than the current analog signal; many CD-quality audio signals; and the delivery of large amounts of data. The standard doesn't include requirements with respect to scanning formats, aspect ratios and lines of resolution.



Harry Martin

By adopting the DTV standard, the commission concluded that it will serve the public interest and bring benefits to American consumers. This decision was based on a careful weighing and balancing of the following goals and objectives previously articulated in the FCC's DTV proceedings:

1. To ensure that all affected parties have sufficient confidence and certainty in order to promote the smooth introduction of a free and universally available digital broadcast TV service;
2. To increase the availability of new products and services to consumers through the introduction of digital broadcasting;

Adoption of the DTV standard is the first in a series intended to usher in the next era of broadcast services.

3. To ensure that the rules encourage technological innovation and competition; and
4. To minimize regulation and assure that any regulations adopted remain in effect no longer than necessary.

The FCC's December action is the first in a series intended to usher in the next era of broadcast services. Future actions will decide various policy issues created by the introduction of digital broadcast service, provide for channel allotments and determine the assignment of channels to eligible parties.

Kid-vid obligations began in January

Commercial TV broadcasters are reminded that some, but not all, of a TV licensee's obligations under the recently adopted children's TV guidelines, went into effect in January.

Although the obligation to provide at least three hours of children's programming doesn't take effect until September 1997, the obligation to comply with the new guidelines began in January. Included in these obligations are the following requirements for commercial TV licensees:

- Stations must have an on-air identification at the beginning of each program designed to meet the educational and informational needs of children. Although the major networks held meetings in an effort to reach agreement on a logo for this purpose, they failed to do so.
- Provide to the publishers of TV program guides information regarding the station's core programming, alternative children's programming and the age of the target audience of such programs.
- Place completed children's TV programming reports in the station's local public file on a quarterly basis, by no later than the 10th day of the quarter following the quarter to which the report applies.
- Each station periodically must make on-air announcements indicating the existence and location of its children's programming reports.
- The quarterly children's TV programming report, reflecting the licensee's children's programming efforts during the preceding quarter, will be prepared on FCC Form 398. Form 398 has been designed by the FCC, but hasn't yet been approved for use. TV licensees would be advised to rely on the proposed FCC Form 398 in meeting their record-keeping requirements. ■

Harry C. Martin and Richard Estevez are attorneys with Fletcher, Heald & Hildreth, PLC., Rosslyn, VA.

DATELINE

TV stations in Kentucky and Tennessee must file their renewal applications on or before April 1, 1997. Commercial TV stations in the following states must file their annual ownership reports by April 1, 1997: Delaware, Indiana, Kentucky, Pennsylvania, Tennessee and Texas.

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JPEG: What's it all about?

Virtually all applications of video and visual communication deal with an enormous amount of data. Because of this, compression is an integral part of most modern digital video applications.

A number of existing and proposed video compression systems employ a combination of processing techniques. Any scheme that realizes widespread adoption can enjoy economies of scale and reduce market confusion. Timing is an element that is critical to market acceptance of any standard. If a standard is selected well ahead of market demand, more cost-effective or higher-performance approaches may become available before the market takes off.

A standard can be similarly academic if it's established after alternative schemes have become well-entrenched in the marketplace.

These forces are shaping the video technology of the future. Any number of scenarios have been postulated as to the hardware and software that will drive the digital facility of the year 2000. One thing is certain, however: they will revolve around compressed video and audio signals.

In the following months in this column, we'll examine some of the better-known video compression schemes. The examination, while not complete or exhausting, is designed to provide the reader with a starting point for further investigation. The area of video compression is rapidly developing and numerous technical documents are available from the sponsoring standards-setting organizations. For more info see:

1. "Video Compression 101," February 1996, by Steve Epstein.
2. "Video Compression," October 1995, by Lee J. Nelson.

We begin our discussion on video compression with the standard produced by the Joint Photographic Experts Group, better known as JPEG.

JPEG: The standard

Because the JPEG standard is the product of a committee, it's not surprising that it includes more than one fixed encoding/decoding scheme. It can be thought of as containing a family of related compression techniques from which designers can choose, based on suitability for the application under consideration. The four primary JPEG family members are: sequential DCT-based; pro-

gressive DCT-based; sequential lossless; and hierarchical. Additional JPEG schemes have come into practice as a result of adapting JPEG to other environments.

JPEG is designed for still images and offers reduction ratios between 10:1 and 50:1. The algorithm is symmetrical, making the time for encoding and decoding essentially the same. There is no need for motion compensation, and there is no provision for audio in the basic standard.

The JPEG specification, as well as the MPEG-1 and MPEG-2 specifications, are often described as a "tool kit" of compression techniques. Before looking at specifics, it will be useful to examine some of the basics.

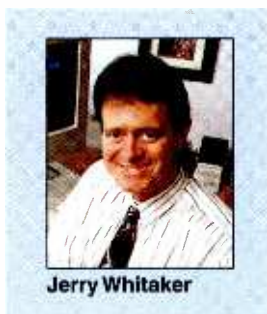
Compression techniques

A compression system reduces the volume of data by exploiting spatial and temporal redundancies and by eliminating the data that cannot be displayed suitably by the associated display or imaging devices. The main objective of compression is to retain as little data as possible, but sufficient to reproduce the original without causing unacceptable distortion. An image compression system consists of the following components:

- *Digitization, sampling and segmentation:* Conversion of analog signals on a regular grid of picture elements; division of video input first into frames and then into blocks.
- *Redundancy reduction:* Decorrelation of data into fewer useful databits using some invertible transformation techniques.
- *Entropy reduction:* Representation of digital data using fewer bits by dropping less significant information. This component causes distortion and it's the main contributor in *lossy* compression.
- *Entropy coding:* Assignment of code words (bit strings) of shorter length to more likely image symbols and code words of longer length to less likely symbols in order to minimize the average number of bits needed to code an image.

Key terms include the following:

- *Motion compensation:* The coding of video segments with consideration to their displacements in successive frames.
- *Spatial correlation:* The correlation of elements within a still-image or a video frame for the purpose of bit-rate reduction.
- *Spectral correlation:* The correlation of different color components of image elements for the purpose of bit-



Jerry Whitaker

rate reduction.

- *Temporal correlation*: The correlation between successive frames of a video file for bit-rate reduction.
- *Quantization compression*: Dropping the less significant bits of image values to achieve higher compression.
- *Intraframe coding*: The encoding of a video frame by exploiting spatial redundancy within the frame.
- *Interframe coding*: The encoding of a frame by predicting its elements from elements of the previous frame.

The removal of spatial and temporal redundancies that exist in video imagery is essentially a lossless process. Given the correct techniques, an exact replica of the image can be reproduced at the viewing end of the system. These methods usually only realize about a 2:1 compression efficiency. For video, a much higher compression ratio is required. By exploiting the inherent limitations of the *human visual system* (HVS), compression ratios of 50:1 or more can be realized. These limitations include:

- limited luminance and color response;
- reduced sensitivity to noise in high frequencies, such as at the edges of objects; and
- reduced sensitivity to noise in brighter areas of the image.

The goal is to discard all information in the image that isn't absolutely necessary from the standpoint of what the HVS is capable of resolving. Such a system can be

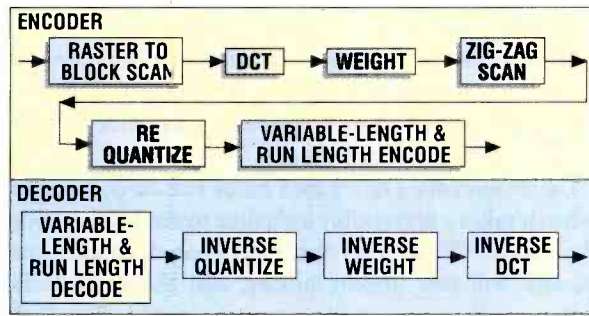
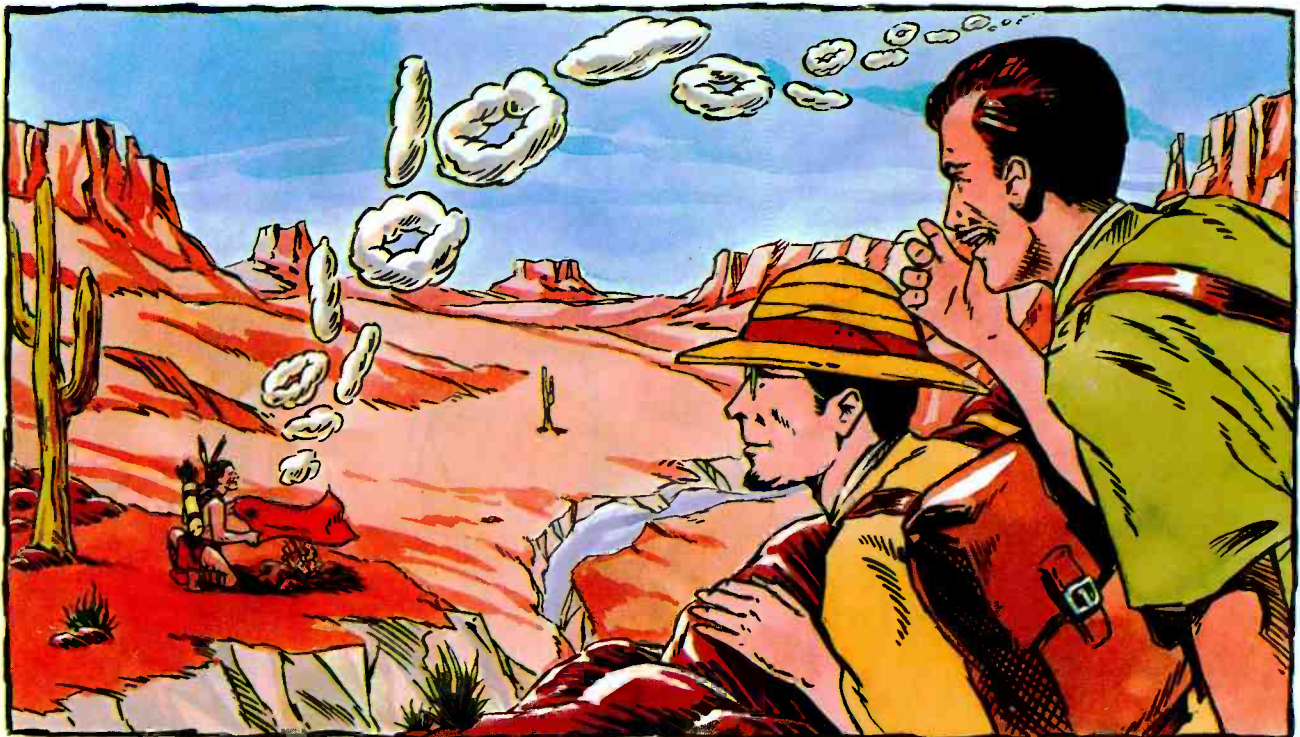


Figure 1. Block diagram of a sequential DCT codec.

described as *psychovisually lossless*.

DCT and JPEG

The *discrete cosine transform* (DCT) is one of the building blocks of the JPEG standard. All JPEG DCT-based coders start by portioning the input image into non-overlapping blocks of 8x8 picture elements. The 8-bit samples are then level-shifted so that the values range from -128 to +127. A fast Fourier transform is then applied to shift the elements into the frequency domain. Huffman coding is mandatory in a base-line system; other arithmetic techniques can be used for entropy coding in other JPEG modes. The JPEG specification is independent of color or gray scale. A color image is typically encoded and decoded in the YUV color space



“LOOK WILCOX, THE DIGITAL COMMUNICATIONS TREND IS CATCHING ON EVERYWHERE,” WHISPERED SNELL.

transition to digital

with four pixels of Y for each U, V pair.

In the *sequential DCT*-based mode, processing components are transmitted or stored as they are calculated in one single pass. Figure 1 provides a simplified block diagram of the coding system.

The *progressive DCT*-based mode can be convenient when it takes a perceptibly long time to send and decode the image. With progressive-DCT-based coding, the picture will first appear blocky, and the details will subsequently appear. A viewer can linger on an interesting picture and watch the details come into view or may move onto something else, making this scheme well-suited, for example, for the Internet.

In the *lossless* mode, the decoder reproduces an exact copy of the digitized input image. The compression ratio varies with picture content. The varying compression ratio is not a problem for sending still photos, but presents significant challenges for images that must be viewed in real-time.

The efficiency of JPEG coding for still images led to the development of *motion-JPEG* (M-JPEG) for video applications, primarily studio use. Motion-JPEG uses intraframe compression, where each frame is treated as an individual signal, and a series of frames is basically a stream of JPEG signals. The benefit of this construction is easy editing, making the standard a good choice for

non-linear editing applications. Also, any individual frame is self-supporting and can be accessed as a stand-alone image. The intraframe system is based, again, on DCT. Because a picture with high-frequency detail will generate more data than a picture with low detail, the datastream will vary. This is problematic for most real-time systems, which would prefer to see a constant data rate at the expense of varying levels of quality. The symmetry in complexity of decoders and encoders is another consideration in this regard.

The major disadvantage of motion-JPEG is bandwidth and storage requirements. Because stand-alone frames are coded, there is no opportunity to code only the differences between frames (to remove redundancies).

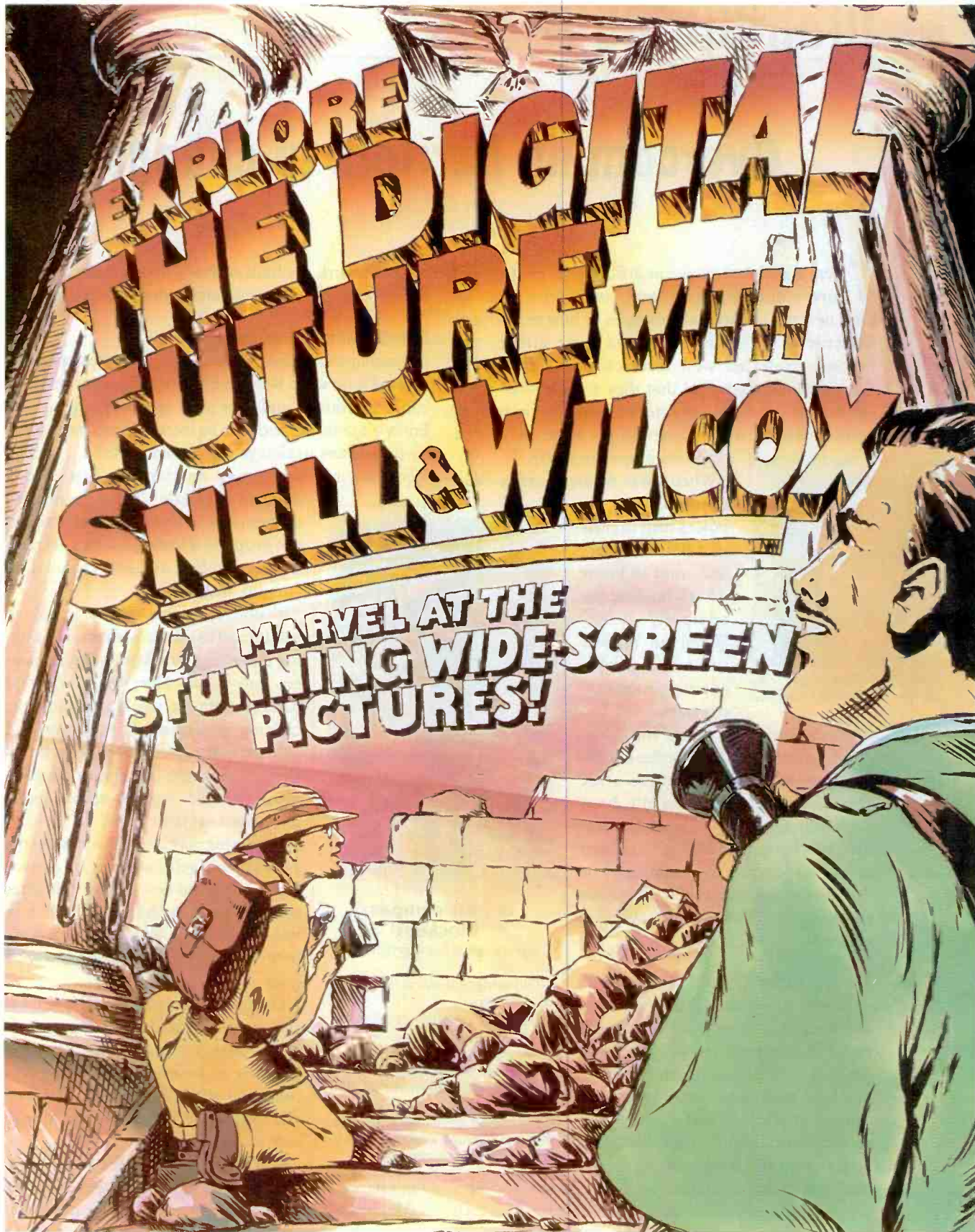
The motion-JPEG standard in its basic form addresses only the video component. Many problems experienced by users concerning portability of M-JPEG streams stem from the methods used to include audio in the datastream. Because the location of the audio may vary from one unit to the next, decoder problems aren't uncommon.

Next month, we will examine in some detail *transform coding*, which forms the basis of M-JPEG and MPEG compression systems. ■

Jerry Whitaker is a consulting editor for Broadcast Engineering magazine.



“CLEARLY THE RESULT OF AN EARLY EXPERIMENT IN COMPRESSION...” MUSED WILCOX.



ち SNELL & WILCOX ㊦

Engineering with Vision

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Overcoming barriers to change

There are a lot of magazine articles with examples of how companies have won competitive victories with new organizational strategies or new technology. Upper-level managers often read these articles and become frustrated with their own facilities. These frustrated managers feel that they are spending equal amounts of money on new technologies or trying new work methods without getting the edge that other companies seem to enjoy.

When these feelings strike, what happens? The big bosses turn to their middle managers and want to know what's holding the company back. When an answer isn't found, a scapegoating process often starts.

Before putting the blame for disappointing results on staff or the middle manager, they should explore other reasons why victory hasn't been achieved. One cause could be that life-cycle barriers to change have been erected. A second explanation may be that a few managers or workers are resisting new technology or new work methods.

Are you facing life-cycle barriers?

Life-cycle processes occur over time and usually go unnoticed on a daily basis. These barriers can be related to a generation of managers and workers that have become entrenched in the organization. They created a culture that protects them from the outside world.

Years pass and the world changes as new competitors emerge, markets mature and economic conditions shift. People become trapped in their culture of denial and don't see what's really happening around them. (Refer to "Is your company blocked?" to see if your company is facing barriers.)

Another possible barrier is that many people resist change in passive and active ways. In the passive vein, they don't seek new and improved ways to manage or work. In the active vein, they sabotage efforts to

improve work methods or bring about innovations in the way people communicate or make decisions.

Bringing in new perspectives

Bringing about change often requires new perspectives toward how work is done. Existing managers and staff can be retrained and new staff with the appropriate knowledge and attitude can be recruited into the company or resisters to change can be replaced.

Focused retraining may be the best first step a company can take. Training, however, is expensive and often ineffectual if not properly selected. Sources of training need to be carefully evaluated on content and results.

It's doubtful that a singular approach is sufficient to reform a company. Training alone won't make existing managers into gurus. Nor will new blood succeed without working within the existing organization structure and culture. Entry-level staff may not know enough about the business or management to effect organizational metamorphosis on their own.

Retraining may create some converts. New upper-level managers may already be believers and new college graduates may be zealous. But both will face resistance unless the quest for a competitive advantage is a company-wide goal.

The biggest lesson we can learn from the last three decades is that organizational change doesn't come easy. Rebuilding to be more competitive is a long and difficult task, but the real challenge is dealing with the human side of the equation.

Much of the burden for implementing change often falls on middle managers. Change takes time, patience and hard work. It also requires that somebody take action to identify life-cycle barriers. Be realistic, honest and diplomatic. Even though doing nothing seems easy, in the long run, it's the harder of the roads. ■

Michael Erbschloe is a management consultant, author and technical editor and teaches management courses at Oklahoma State University.



Michael Erbschloe



Is your company blocked?

1. Are new ideas being generated by your staff?
2. Do managers respond by supporting new ideas?
3. Do staff respond by accepting and trying new ideas?
4. Are new work methods frequently tried in your company?
5. Are new technologies evaluated for use in your company?

If you answer no to these questions, then you may have a cultural block to innovation in your company.

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It's all about change

This is the first installment of a new column in *Broadcast Engineering* titled "Computers and Networks." My name is Brad Gilmer, and I've been a broadcaster most of my life. In this column, we'll explore the technical and business aspects of computers and networking that continue to change and reshape the TV industry.

I don't know about you, but in the mid '80s, my life changed. That's when my company got its first real computer network. Before that, I had fiddled with computers both personally and professionally. But the year that we got a network, things changed. The ability to exchange files between computers, to store files in a central location and to develop shared databases gave us a whole new set of tools to support our business.

The list of possible uses for computers and networking continues to expand as speeds increase and costs fall. The technology has affected the way we create, move and store media. It has changed the dominant companies

in the market, the people we hire and the jobs that they do. It has the potential to change our core business itself.

Video networking brings many unique challenges to the computer world, some of which we cannot easily deal with using current technology.

What's different about video?

There are three aspects of video that make it challenging. The first is that it's big. The computer world has dealt with big files in the past. Large databases can approach several gigabytes, but there are only a few files of this size in a typical system. Video applications can produce hundreds of files this size or larger. When you start moving a number of large files through a computer or over a network, it's pretty easy to exceed the capabilities of a system.

The second is that video is impatient — it can't wait. Some people refer to this characteristic as being isochronous, meaning that it's a continuous stream. For many applications, computer designers and programmers have been able to momentarily suspend one task while they dealt with another, an occurrence computer designers refer to as an interrupt. Interrupts have allowed computer designers to take care of

critical housekeeping tasks, such as refreshing the screen or updating the system clock. However, when the programmer puts the computer on hold to take care of another task, it can produce a glitch in the video that the average viewer would notice. An interesting sidelight is that human beings are much more sensitive to glitches in audio than video. Unfortunately, audio processing and switching issues seem to be much more difficult to resolve than video issues.



Brad Gilmer



Broadcast facilities like this one at TNT in Atlanta have rapidly assimilated computer and networking technology. Photo by Mark Hill, TBS Inc.

A third characteristic that makes video challenging is that it seldom travels alone. It usually must be synchronized with multiple audio files, closed-caption files, edit decision lists and other material. Because few computers are truly multitasking, this synchronizing issue can be one of the most difficult to overcome.

The three characteristics of video — large size, its isochronous nature and multiple synchronous streams — make it a particularly challenging medium to deal

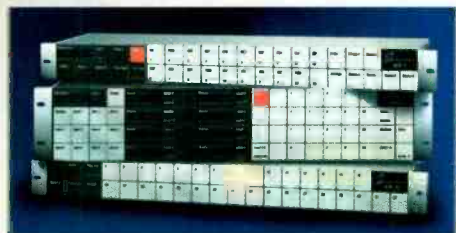


It's easy to see the rapid evolution of computer and networking technology at two of our networks, Turner Classic Movies and the Cartoon Network. At TCM, 10BaseT is used to allow full station automation. At Cartoon Network, fibre channel is used to move video between servers. Photo by Mark Hill, TBS Inc.



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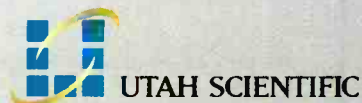
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with in the computer domain. Most computer people have become much more aware of the special nature of video, but there are some out there who still think that video is business as usual. They can really steer you down the wrong path if you're not careful. The best medicine is education. It's up to you to determine whether the computer vendors you talk to understand the

unique characteristics of the broadcast environment, and that their solutions will really work for you.

The difficulty computers have with video is temporary. If computers become fast enough, they can put video and audio on hold just as they do screen and print processes. If computer manufacturers and programmers develop new architectures and structures

to deal with our medium, then the issues stated above won't be a problem. For the moment, computer and network hardware designers definitely have their hands full.

Given all of the above, it might look as if this pre-arranged marriage between the computer world and the video world is premature, but this surely isn't the case. Many applications for computers and networking can be implemented today. These implementations can produce useful benefits for your business and mine. The point is that we have to educate ourselves so that we know what questions to ask to protect our business. We also have to keep asking ourselves about the impact of the decisions we make on our business and our people.

Computers and networks are tools that make all sorts of new things possible in the broadcast world. ■

Brad Gilmer is director of advanced network operations & technology for Turner Entertainment Networks.

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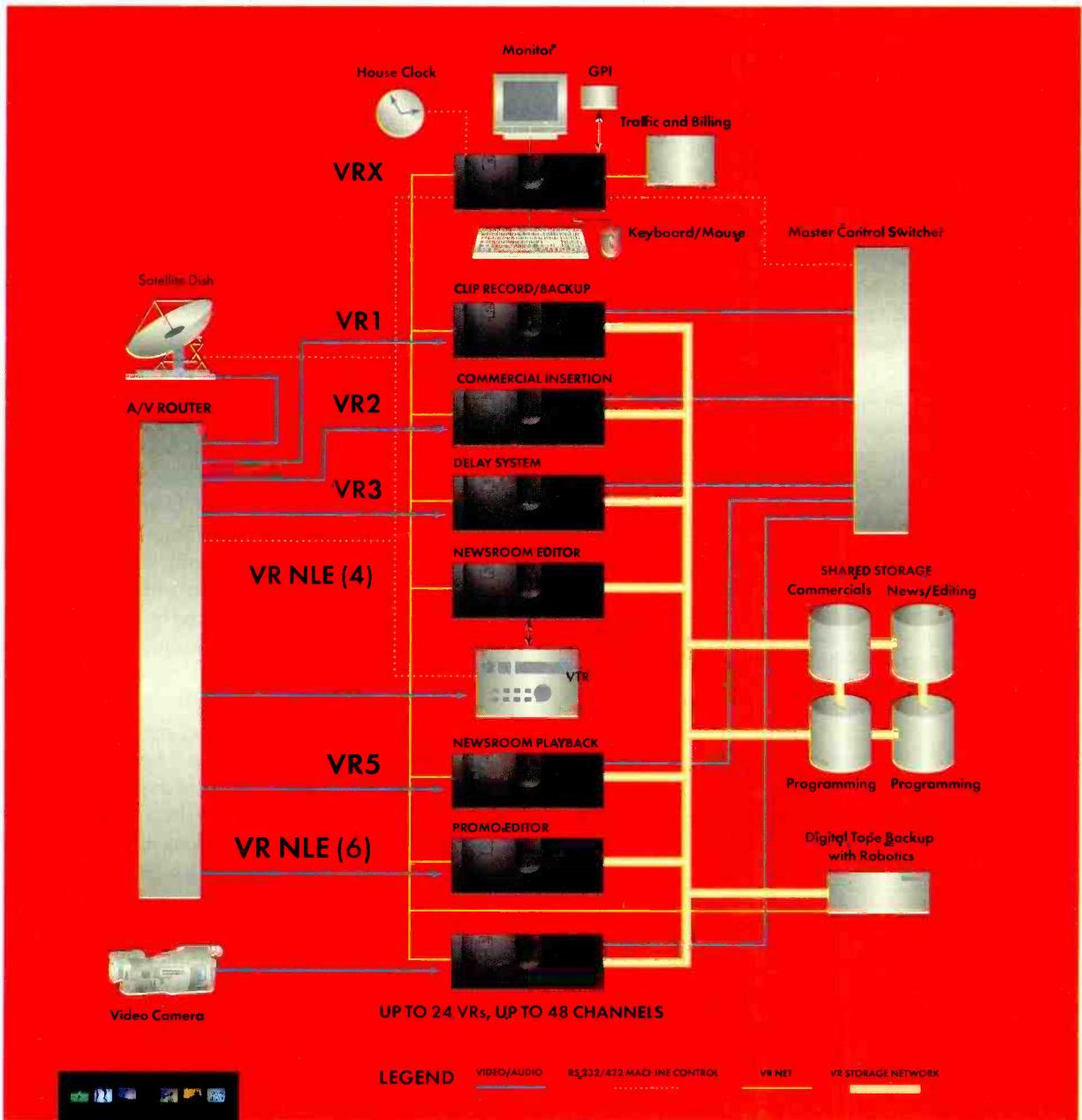
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Broadcast Engineering has run many excellent articles on computers and networking. Refer to the following articles:

- "From Single to Multichannel, Step by Step," October 1996, p. 26
- "Networking your Newsroom," Part 1, July 1996, p. 60
- "Networking your Newsroom," Part 2, August 1996, p. 76
- "Designing for Multichannel DTV," August 1996, p. 14
- "EDH: Monitoring Networked Video," April 1996, p. 46
- "Networking your Facility," April 1996, p. 40
- "The Future of Networking," April 1996, p. 34
- "Managing Multiformat Signals," May 1995, p. 12
- "Automation for Multicasting," April 1995, p. 42

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Handling 5.1-channel audio

The move to 5.1 channels of discrete digital audio for television is a process, not an event, and it's already under way. Since the introduction of stereo audio for television or *multichannel television sound* (MTS) in the mid-1980s, broadcasters have enjoyed production, playback and transmission of multiple channels of audio as a natural part of their programming processes.

The inclusion of matrixed "surround-sound" programming encoded into a mono- and stereo-compatible TV audio signal began expanding audiences' listening pleasure in the late '80s. Almost by accident, TV releases of major motion pictures included the same encoded surround information on their two-channel audio tracks as these films' cinematic versions held in their Dolby Stereo optical soundtracks.

Broadcasters and listeners continue to enjoy the benefits of this matrixed surround technology today. About 10 years have passed since the airing of the first surround movie, yet this technology still defines the high-end of broadcast TV audio. New surround production techniques in the TV industry continue to enhance the listening experience beyond that of cinematic soundtracks alone.

The next step

The establishment of *Dolby Digital* (the consumer name for Dolby's AC-3 coding process, the sound system specified in the Grand Alliance ATV format) as the TV audio format of the future will move the TV listening experience a step further to 5.1 discrete, digital audio channels.

In this system, the phase encoding, noise reduction and frequency-response restrictions faced by the analog surround format are eliminated. The matrixed system's band-limited, single surround channel is replaced by a pair of full-range, discrete stereo surround channels. A discrete low-frequency effects channel is added as an independent program source (the .1 in 5.1). Dynamic range is no longer limited by analog constraints. The signal is perceptually coded (virtually undetectable to the ear) to fit within a manageable bandwidth (typically 384kb/s) of the available recording medium or the future transmission format. It provides essentially CD-quality multichannel sound for a dramatic and visceral sonic experience.

For broadcasters, this new digital format requires little change from the monitoring systems used in matrixed surround, but it will present challenges to a facility's routing infrastructure.

The AC-3 coding algorithm is also used in the cinematic system known as *Dolby Stereo Digital*. Its nominal 384kb/s data rate is about one-eighth the bit rate of an AES3 (or AES/EBU) channel, which is the standard professional digital audio interface format. Even though stations will be able to monitor the format with a new decoder on existing surround amps and speakers, the routing of this new format may be cumbersome at first. Nevertheless, it can fit nicely into future plans for station upgrading.

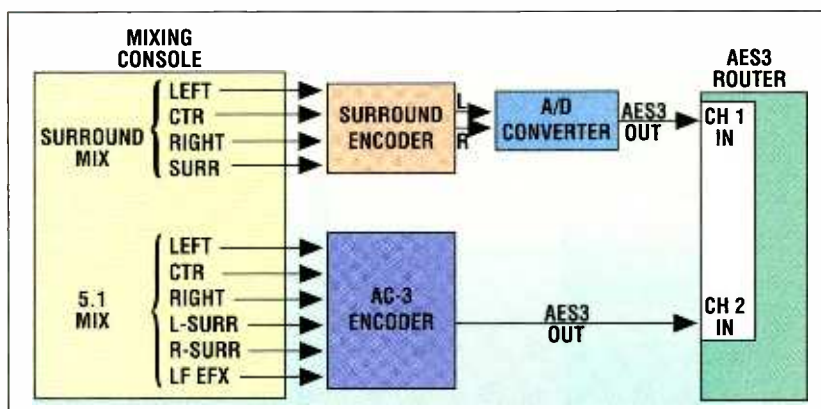


Figure 1. Block diagram of routing scheme proposed for multichannel production audio using AES3.

All a TV station had to do to "go surround" was to pass a clean stereo signal and have a surround-compatible monitoring environment somewhere in the facility to Q/C programming. Operators also needed to get used to allowing the partially out-of-phase rear-channel information to pass without concern.

Meanwhile, TV viewers who converted to stereo were enjoying stereo imaging and an increased frequency range, often by augmenting and/or rearranging parts of an existing hi-fi system. Upgrading to a "Dolby Surround" decoder (the name given to home versions of the "Dolby Stereo" cinema decoder) added a mono rear channel and perhaps a derived subwoofer feed. Dolby Pro Logic decoders came later, providing a "hard" center channel. Dialog was now steered to the screen, always following the picture wherever you were in the room.

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Consider your future

The digital TV revolution has spawned new video formats that will precipitate a station's move to a more digital (if not an all-digital) facility. As technology for picture moves from analog to digital, upgrades for audio are an accompanying step. Routing can be handled by the SMPTE 259M composite or component serial-digital interface (SDI), using its embedded digital audio features or a separate AES router can be used to distribute digital audio signals.

Once a digital routing plan has been established, the 5.1-channel, compressed AC-3 signal can pass through the facility on a portion of an AES3 channel, using a proposed "AC-3-to-AES conversion" scheme. AC-3 monitoring can be maintained in key quality control areas much like surround monitoring, minimizing the need for conversion and decoding. The decoding capabilities of this same Q/C facility can be used to add station voice-overs to AC-3 audio signals from outside (i.e., network) sources, if necessary, while the audio signals are in a discrete decoded form. After voice-overs are added, the audio program can be reconverted back to an AC-3 signal.

New groundwork

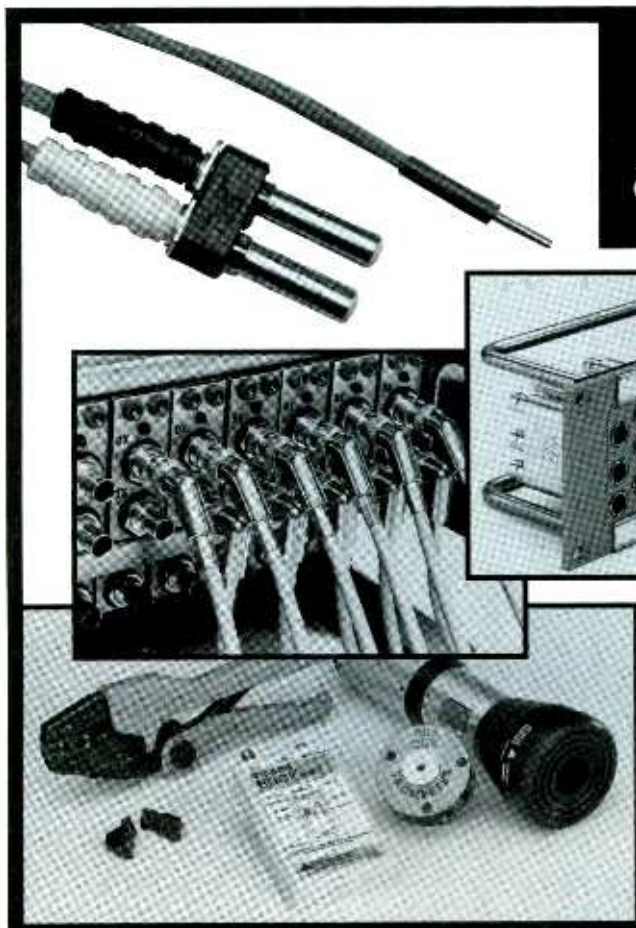
To handle the typical digital VCR's four 20-bit digital audio channels, two AES3 channels will be used.

(AES3 can handle up to 24-bit digital audio signals.) With your facility upgrading to two AES3 channels as a standard I/O complement for audio routing, the two audio signals making up AES Channel 1 could be the left and right channels as they are today, passing stereo and matrixed surround information well into the late 1990s.

Based on station requirements and availability of compatible programming, the two signals comprising AES Channel 2 could be a second audio program channel (SAP) and an AC-3 signal, with space left over. The multichannel audio/video source for this programming may be a movie playing back directly from a videodisc or digital VCR, an incoming network feed or live 5.1-channel programming coming from a studio via an encoder and converter. (See Figure 1.)

Considering the rapid advancements in digital audio, the possibilities in production are as fascinating as those projected for tomorrow's transmission schemes. These advancements will determine how future audiences will receive and enjoy digital audio for picture at home. ■

Jim Starzynski is a project engineer at NBC Headquarters in New York.



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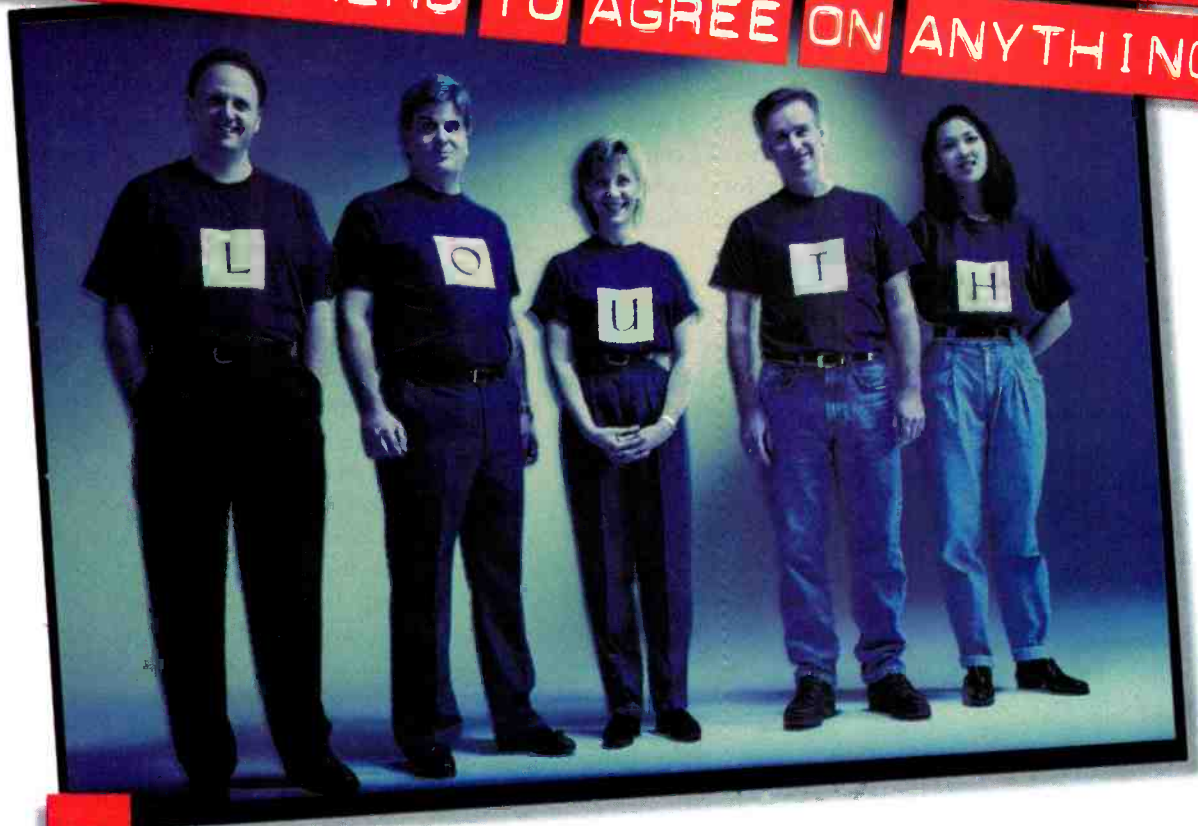
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The standards game

In the previous two issues, we presented the concept of a Residential Gateway (RG) — a box with multiple interfaces for different data networks coming into the home, and once inside, a router for data between a variety of consumer electronic devices (telephone, VCR, PC, etc.).

Lest you think we merely described the ultimate gear-head fantasy, it's time to put the concept in more sober terms: without such a rationalization of the consumer side network, most of the next-generation telephony, video and data services will not become a financial success.



Mark Dillon and Steven M. Blumenfeld

The rules have changed

Until recently, our first-generation data and device standards have proved remarkably resistant and persistent. Almost from the days of Alexander Graham Bell, the fundamentals of the

POT (“plain old telephone”) have barely changed. Even today, you can take a 75-year-old telephone, connect an RJ-11 jack, and make a call — though it may require hand flashing your numbers with the switchhook. Similarly, the backward compatibility of NTSC has been a blessing and a curse for more than 60 years.

But now, whether you work in broadcasting, telecommunications or Internet services, the growth and competitive vigor of your industry will require greater bandwidth, a wider variety of products and services and new devices in the customer's home. In the foreseeable future, the evolving data protocols, hardware and software standards will change at a furious pace. If the consumers are not protected from this accelerating obsolescence, they will stop buying. At the same time, network providers cannot be strapped with the capital costs of constantly upgrading the infrastructure end-to-end.

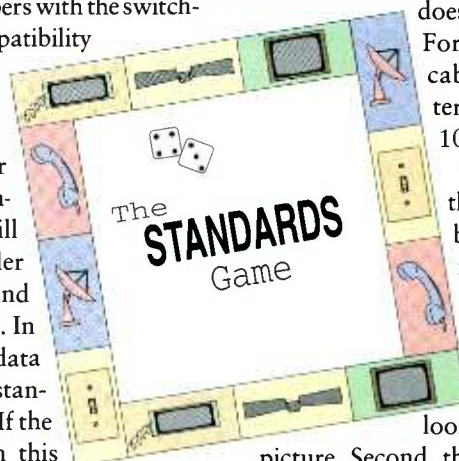
Now that we're converting all these old analog signal pathways into digital datastreams, generational changes have begun occurring at the logarithmic rates more characteristic of operating system software and CPUs, because that's what the telephone and the television

have become: *computers*. What is the one thing all computers love to do? *Network*.

And so we come to the problem as perceived by the consumer. Consider what is stacked on the average household TV stand. There's a television, a VCR and perhaps a cable box and even a video game. What happens when the owner of this creaky entertainment tower wants to add a DBS satellite receiver or some other new video source? There is no easy way to connect a new source — or select among existing ones. The problem can be temporarily eliminated after an A/V stereo tuner amplifier is purchased. But this \$70-per-month service can only be watched on that one television. Not to worry, our consumer is good friends with the nearby Radio Shack salesperson. With just a few feet of coax, some hand-crafted F-connectors and an RF amplifier, he or she can feed the DBS signal upstairs to the bedroom and out to the garage. This home-brew network performs fine (except on rainy days).

Our early adopter next becomes excited when the cable company lights up the fiber-optic cable they trenched six months ago and begins offering “superior digital TV” signals for only \$24.95 a month. Question: Should he or she now get rid of the DBS box? Nah. The cable company doesn't offer all-you-can-eat football. For another \$34.95 per month, a cable modem with access to the Internet at speeds between 500kb/s to 10Mb/s can be added.

During the \$300 installation of this premium video/data package, both of the installers (one to connect the digital set-top box, the other to configure the computer for the high-speed modem) announced three items of bad news. First, the digital TV signal will look worse than the current analog picture. Second, the cable modem will not perform near the promised 500kb/s. Third, and most terrible, this is all the owner's fault. Why? Because what he or she built, with all the handmade F-connectors and A/V amplifiers, is an unterminated Ethernet inside the house. Oh yes, there was one more thing. . . . Because the cable company could not yet cope with data going upstream from the computer, another phone line needs to be installed next to the PC for the cable modem to work properly.



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Uniting the players

The Residential Gateway is not perceived by the consumer as a sexy new piece of equipment to buy because it doesn't really do anything like play music, display video or tune in stations. Consequently, it will be a hard sell through consumer electronic outlets.

The RG makes it possible for network service providers, content providers and consumer electronics companies to sell new products and services into the household. What makes it hard to accept is that the RG also makes it easy for their competitors to do the same. Because the utilities' (phone and cable) principle competitive edge has been their monopolistic control of access, such an enabling technology is viewed with suspicion.

It's an enabling technology situated in the middle of the critical path. It is not just that the RG makes things better, it makes things possible. Similar competition via standards exists as a tradition in the personal computer industry, though in a slightly different form. (What do the names Microsoft, Apple, Netscape and Sun bring to mind in this context?)

Only the consumer electronics industry really understands the need for open standards and the way in which such openness affects competition: To compete for the consumers' dollar, you must manufacture and market a more appealing product and not depend upon technological barriers to making you the consumers' sole source.

In the digital domain, we are at the same point the railroads were when they lobbied to rationalize time zones in this country. Before railroads, every city, town and farm set its clock by observing the position of the sun at noon. As a consequence, "noon" changed as you traveled east or west. This was of no consequence when individuals set off on foot or by slow carriage.

But when the railroads came, they created time tables, and time tables needed "time" to be the same everywhere. Without this common standard (a.k.a. "data protocol") every train stop would have to be calculated differently — time elapsed from prior stop minus local offset. (And what is the local offset anyway?)

It quite literally took an act of Congress to agree upon our four continental time zones. Yet in fact, standards do evolve within industries over time. What makes this particularly challenging is the number of different industries that must find agreement in areas fraught with uncertainty. Each player is concerned that one standard may extend unwarranted advantage to a competitor.

We are in an age that abhors acts of Congress or any regulation. If we are to avoid the involvement of this outside referee (does "universal access" have meaning to anyone?), then the industry players will have to come together and cobble a solution that works for all. Such a turn of events would be a win-win for everyone. Except your friend at Radio Shack. ■

Steven Blumenfeld is vice president of technology and studio operations, and Mark Dillon is vice president, on-line services with GTE, Carlsbad, CA.

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An agreement at last

After exhausting rounds of bargaining sessions, representatives of the broadcasting, consumer electronics and computer industries reached an agreement on technical standards for advanced television.

As all parties had hoped, the new digital transmission technology agreement will allow broadcasters to deliver high-definition picture, CD-quality audio and data transmissions. As promised, the FCC will adopt the Advanced Television Systems Committee (ATSC) standard, except for the video formats. This means that full flexibility will be available to broadcasters on video formats, all the way from high-definition pictures to low-resolution images. The agreement will also permit the use of data broadcasting, which will allow broadcasters and others to apply part of the 6MHz channel for other services.



Louis Libin

A quick review

The Grand Alliance DTV system is based on the Moving Picture Experts Group MPEG-2 video compression and transport protocol. The system includes the ability for multiple transmission formats, Dolby AC-3 digital audio and vestigial sideband digital modulation.

There is no question that the Grand Alliance system will supply the home with superb images and spectacular sound while also, as part of the National Information Infrastructure (NII), relaying digital data. The new digital technology involved is expected to create new business activities and stimulate key industries, such as semiconductors, computers, communications and displays. Therefore, this DTV system using multiple transmission formats, digital compression, packetization and modulation techniques is a significant advance over our current NTSC TV standard.

An important function of the Grand Alliance DTV system is format selection. Many TV applications have different performance requirements. This fact, combined with the fact that the transmission will be digital and there will be space for other data, provides the appeal of multiple formats. The multiple formats allow trade-offs specific to each family of program material. Digital representation and processing in a DTV system allow the support of more than one scanning format, while facilitating interoperability among formats and different video services and applications.

The Grand Alliance system provides well for the different format selections. MPEG-2 syntax from the Moving Picture Experts Group is used. The MPEG-2 tool-kit supports most of the compression algorithms used by the system proponents. The video encoder has been designed to support 1,080-line interlaced and 720-line progressive formats. It also supports bidirectional-frame (B-frame) prediction, wide motion-estimation ranges, field and frame motion vectors, and adaptive field and frame DCT coding, as well as forward analysis with localized quantization-level control and automatic film detection for high picture quality.

A new technical budget

The existing analog NTSC broadcaster is restricted to taking a standard video signal, modulating it and adding an audio subcarrier. A second audio channel is usually added for stereo sound and possibly a third if a secondary audio program signal is broadcast. The single video channel and audio subcarriers take up the whole of the 6MHz bandwidth.

The digital broadcaster, on the other hand, will be transmitting only data through its network, leaving it to make the choice of services to occupy the almost 20Mb/s. Although broadcasters typically use the space for audio and video services, it can also be filled, or partially occupied, with data services, like video games and Internet access. This is possible because the data are structured to the MPEG-2 standard. Table 1 illustrates the possible uses of the ancillary data space that could be made available during the digital transmission. These are estimates only, listed for demonstrative purposes. These estimates are based on limited samples of converted material. The maximum video rates in megabits per second do not include audio and control data requirements.

This ability to broadcast a range of services means that the broadcaster can draw up a shopping list of programs and services for transmission. The broadcaster actually has a "broadcaster budget" that the broadcaster can choose to spend up to the technical limit of around 20Mb/s for each multiplex on the transmitted signal. For instance, the broadcaster might choose to broadcast simultaneously: six lower-grade VHS channels at 2Mb/s each; or three film channels at

Continued on page 91

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A daring shift in cable modem strategy

As the Internet grows into a billion-dollar business, operators of subscription TV services feel frustrated watching potential revenues being lost to local and national Internet access providers. The widely accepted way for cable system operators to enter the Internet market is with cable modems, which can send and receive data up to a thousand times faster than phone-line modems. But the price of admission is not cheap, upwards of \$500 per modem, which seemingly will take forever to repay at the amounts operators can charge for monthly rental and access fees.



Ken Freed

A range of products

The cable modem price tag scares off the smaller systems that barely achieve any profit margins, and when they add in the expense of head-end improvements to handle digital data services, the dream of becoming an Internet provider fades into a fiscal nightmare.

In an attempt to bring down the cost of cable modems to ensure faster product distribution, cable modem manufacturers have launched modem products lines with a range of speeds, options and prices. Bucking the herd, however, Scientific-Atlanta (S-A) has announced plans to manufacture and market only one modem, the Data Xcellerator, priced at \$199 per modem for orders of 50,000 units or more.

Attaching to a PC's Ethernet card, the S-A Xcellerator uses a 3MHz signal for downstream transport at about 2Mb/s. The S-A modem uses a phone line return at either 28.8kb/s or 33.6kb/s with an upgrade down the road to the midband range of 56kb/s. A phone line return is viable, says S-A, because most people download far more data than they upload. The Xcellerator is much slower than the other cable modems with a phone line return, including a 27Mb/s General Instruments SURFboard cable modem and the 10MB LANcity modem being used by National Digital Network for the wireless cable modem trial in Wash-

ington, DC, and San Francisco.

But S-A is betting its \$200 price will appeal to the smaller cable and wireless systems that can't afford the faster modems. Will their gamble pay off? Mark Weiss, director of field marketing for the broadband data networks group of Scientific-Atlanta, says the change in strategy came about after S-A reviewed all the cable modem studies available and then talked to major MSO and telcos about the revenues they thought they could earn. "We realized that the four or five years needed for payback just was not a good business model for our customers," he says, "which meant it's not a good business model for us.

Seeking a less-expensive technology, S-A took a second look at the quadrature phase response (QPR) modem being built into the data transmission system for the Sega Channel and Digital Music Express, which sends 30 channels of digital music over cable. A QPR modulator operates at about T1 speed in 3MHz of bandwidth, half of a regular 6MHz video channel, and can squeeze a robust signal into the rolloff of cable and wireless systems already at capacity. A QPR modem

also is half the cost of QAM or QPSK modem technologies. Another deciding factor was the "simple network management protocol" (SNMP) for the QPR modems. An open standard for defining a network management information block in the data signal, SNMP lets operators interrogate a modem remotely. Expensive specialists in network management are not needed at the head-end.

Because only 15% of U.S. cable systems to date are being

rebuilt as hybrid fiber-coax (HFC) cables, says Weiss, "We wanted to address the other 85% of the system operators with a low-cost modem that fits their existing systems and which they can manage with existing staff."

Will S-A's daring switch in cable modem strategy pay off? Time alone will tell. ■



The Data Xcellerator cable modem from Scientific-Atlanta is one way that service providers can enter the Internet market.

Ken Freed is a media trade journalist specializing in cable and interactive television, and is based in Denver.



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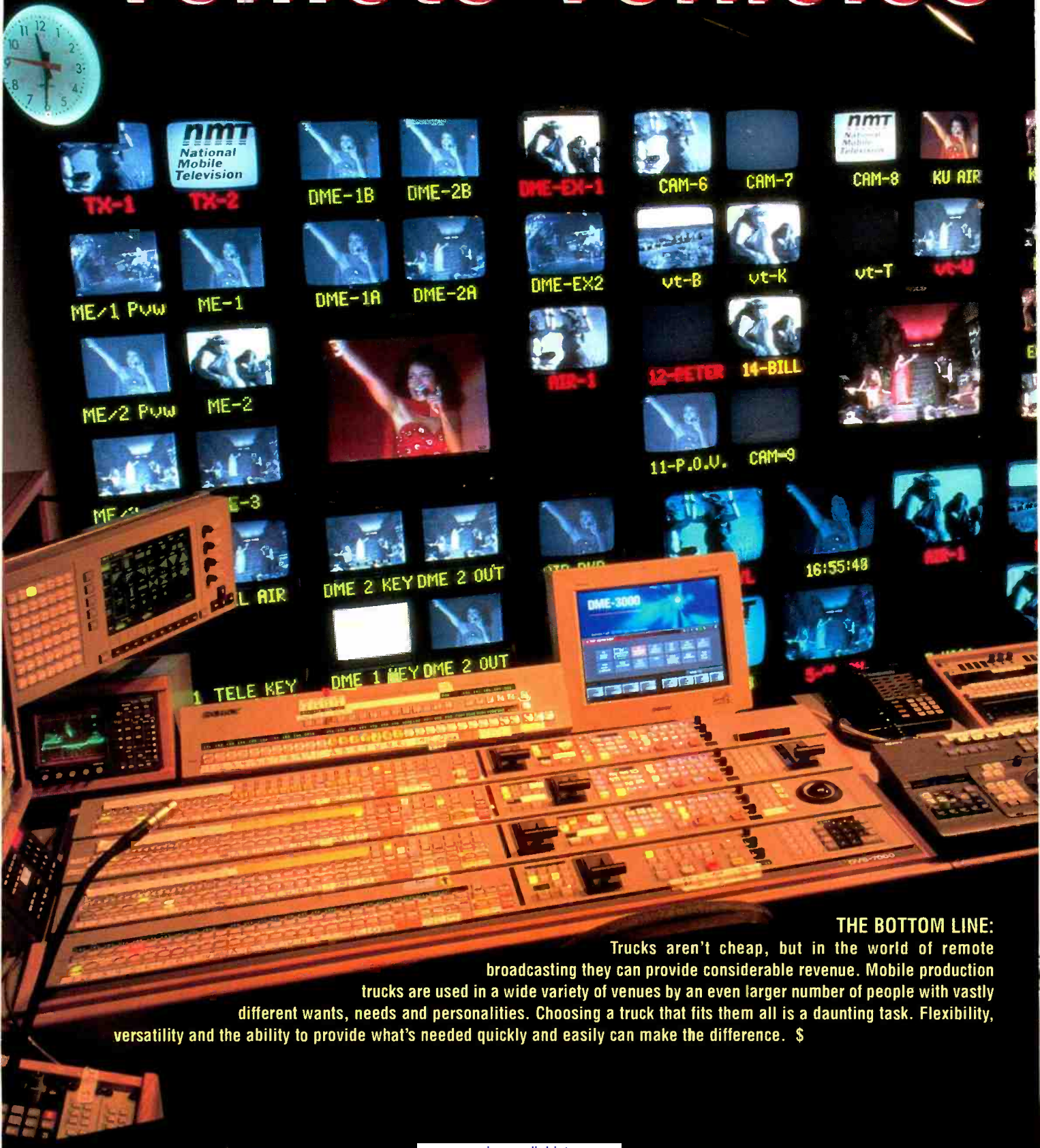
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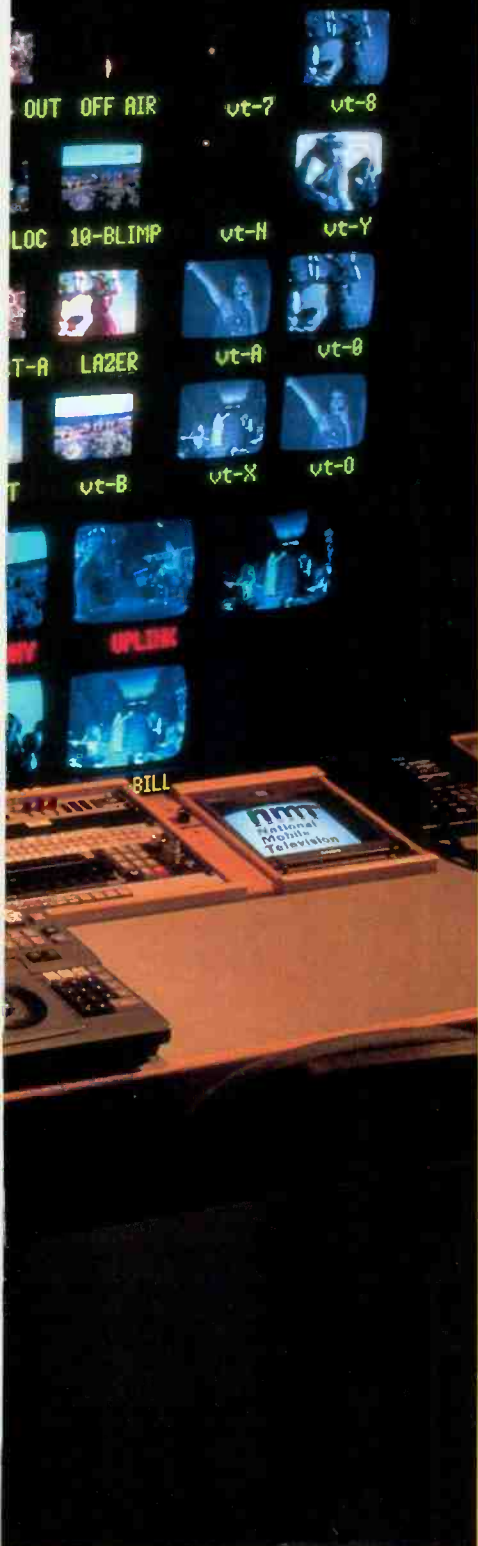
Choosing remote vehicles



THE BOTTOM LINE:
Trucks aren't cheap, but in the world of remote broadcasting they can provide considerable revenue. Mobile production trucks are used in a wide variety of venues by an even larger number of people with vastly different wants, needs and personalities. Choosing a truck that fits them all is a daunting task. Flexibility, versatility and the ability to provide what's needed quickly and easily can make the difference. \$

With today's exploding selection, money can be saved or wasted by the fistful.

By Bennett Liles



Today's array of amazingly handy, but often costly, features has turned picking a remote truck into a formidable operation requiring long-range, detailed planning and some intuitive guessing. Because trucks are usually rented for a specific production, their features can be tailored to the task quite easily. However, when a vehicle is bought to be used on a local production and rented out to other clients, more factors enter into the mix. Long-term local production goals have to be considered, along with trends in the expected rental market. Fortunately, many of today's mobile production trucks have flexible features, which allow them to serve several different production roles.

What is the planned use? Will the truck be doing ENG live shots and handling simple A/V feeds to microwave and/or will it be rented out for covering live, eight-camera symphonies? If the answer is both, then it may be more economical to use two separate vehicles. Within those extremes, however, a properly equipped remote truck can demonstrate surprising versatility.

Power and convenience

What features will the vehicle need? Some features are handy on just about any size truck. First, however, nothing happens without power. Can you al-

Photo: This truck, owned by National Mobile Television, features a Sony DVS-7000. Active tally system on the monitors can be programmed with a laptop or hard patched. Some of the consoles are mounted on rails for easy access. During production, consoles can be locked in place.

ways rely on local AC or will you need a generator? Few big production units have internal power generators, making the occasional generator rental necessary. If lighting is to be powered from the same source as the truck, it typically requires three-phase AC — something not all portable generators can supply. It may sound surprising, but there are many fancy trucks out there with no power regulator on board. With the exacting power needs of modern digital gear, a power regulator is no longer a luxury, it's basic equipment.

If you need a smaller ENG van that can easily go where there is no power, an on-board generator will usually be part of the package. The smartest thing when buying a generator is to build thorough operator training into the cost. Power is no place for on-the-job training. If the equipment complement has been changed after the generator was picked, it's a good idea to go back and add up the power requirements and make sure you have at least 50% surplus generator capacity. Don't depend on the builder-seller to do this. You may want to add more equipment later and extra lights drink up lots of juice. Many late-model trucks actually have a power schematic printed on the wall of the power bay with switches and meters mounted at their locations in the schematic. This way, even those operators with little or no experience with the truck can throw the right switches at the right time and know exactly what the meters are indicating.

Now for the back-savers. You can quickly tell if those who have actually lugged cameras and cable have had a

Choosing remote vehicles

say in the truck's design. Look at the equipment bays. Do they have sleds? These are actually heavy-duty drawers that slide out of the bay and allow heavy equipment, such as cameras, to be easily placed on them and locked down, then returned to the bay with a one-armed push. If the truck has lad-



Breakout panel has lights and an intercom station with speaker on this truck owned by All Mobile Video and built by BAF. This simplifies setup and allows hands-free operation while connecting cables. A panel VU meter allows line and mic level signals to be checked easily. Switches allow pin 1 to be lifted on individual audio cables.

ders, note their locations and see if they block any of the bays. If they do, those bays will be inaccessible once the ladders are in position, especially if the bay doors are hinged to open toward the top. Don't laugh. A slew of trucks are on the road with this problem, possibly bought by execs more interested in the color of the carpet and paint than in the position of access ladders.

Any bay doors that may be blocked by a ladder should open like a garage door by sliding up into the truck, that is, flush with the roof of the bin. Other doors can be hinged to open up and out, thereby providing a convenient rain awning if they are chain-braced open from above rather than rod-braced from below. Weather tarps should be included. These snap along the edge of the open door to keep rain out of the breakout panel and bins.

Outside access doors are also a handy feature. If equipment mounted along outside walls gets sick during the production, it's much better to have the maintenance people reaching the back of the machines from outside rather than crawling over producers and au-

dio people to slide it out of the rack. If you expect to use your truck for many shoots within a small time period, it may be smart to pay extra for motorized cable reels. A great deal of strike time is spent dragging, coiling and stowing camera cables. This feature, though costly, really speeds up the job. Another feature you may have to specify is outside work lights. These need to run off the truck battery or other internal power so they can still be used after external power is disconnected. If the outside lights use the truck's battery, make sure a separate battery or some other reserve is available to start the engine when you are finished.

Communication needs

Although it's a much-overlooked feature, don't skimp on the intercom. Communication is basic. Modern, lower-priced digital systems offer features that production people have long yearned for. One of the most director-appreciated tricks is remote mic closure. This lets the director or producer close camera op and other mics that have been left on. If the truck will be traveling a lot, it makes sense to install an RTS-to-Clearcom interface module. It will pay for itself after only a half-dozen shoots where it didn't have to be rented. Interface modules have enabled many lighting directors to avoid struggling with two headsets; one for television and the other one for the theater system. Live remotes require a

telephone interface for the intercom. Properly installed and used, the interface will head off some physically awkward situations. A surprising number of otherwise state-of-the-art remote trucks still have people inside wrestling with phone cords and multiple headsets.

Just prior to a live show, lots of conversation may need to go on between director and talent while the audio op needs to have a steady tone on the line. It can be good, especially with sports, to have talent

talkback. This allows talent to talk at will to the director with a momentary contact button that takes the talent mic off-line and connects it to the intercom. Multipoint teleconference formats, such as "Nightline" and "News Hour with Jim Lehrer," also benefit greatly by having free, two-way talk between producers, talent and guests in all locations without involving the main sound mixer or its operator.

These teleconference formats also use a good many mix-minus feeds and require an audio board with six or eight auxiliary sends on each input channel, all switchable between pre and post fader. Switching to the "pre" position prior to a program lets the hosts and guests in many locations talk between themselves while keeping them off the program line. Before getting into cameras, effects generators and more exotic gear, consider every foreseeable communication scenario and equip your truck for it.

Monitoring multiple feeds

Among producers, directors and TDs, video monitoring represents a personal preference. Sources are usually assigned by patching, but some of the larger trucks now sport routers on many of the monitors themselves. This is the ultimate in video-monitoring versatility. On the audio side, the ability to fold back a designated channel of audio directly into the intercom can be useful. With line audio in the background, or better yet, on one camera headphone channel and intercom on the other, cam-



This Euphonix CS-2000 56-channel audio board is complemented by a digicart and surround-sound capability. Video monitor at center can display all setup and working menus, waveforms and selected metering. Each input channel features two direct stereo outputs and eight auxiliary outputs. (Photo courtesy of Lin Productions.)

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era people can get quick reaction shots based on talent comments, which are especially valuable during a live sports event. Also, if televising a musical event where the TV crew needs to rehearse a selection all the way through, while on-stage the group is constantly starting and stopping, an audio recording can be easily played into the intercom headsets allowing an independent and unin-



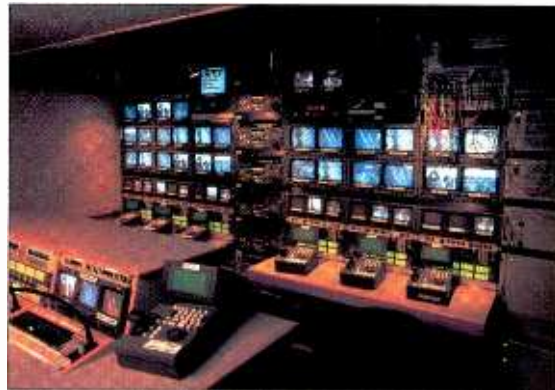
The production area of the In Touch Ministries Digital Mobile Unit, designed and built by A.F. Associates, Northvale, NJ.

errupted rehearsal for the truck.

Most intercom systems feature a program audio input, but it should be fed by an otherwise little-used auxiliary send on the audio board that can either follow program sound or not. Some trucks have been delivered with program audio to the intercom fed by the program audio DA.

This isn't good. Among other things, it frequently results in tone blasted into the intercom accidentally. If you are buying or contracting a small truck without a transmission router, some alternate method of separately monitoring input and output signals may be needed. Many small trucks must simply turn down the sound monitor when tone is on-line.

The main breakout panel



Slo-mo controllers are a must for trucks used in sports applications. Each controller can be patched for use with any of the tape machines located in the center of the monitor wall.

should include camera inputs, mic inputs and tie lines, and should also have frame sync inputs and outputs, as well as an intercom station, modular telephone jack and connection for a color monitor. Also, the tone generator should have frequency sweep or a number of selectable frequencies, not just standard 1k tone. Always have a triax checker somewhere near the camera breakout panel. These little hand-held widgets are

Linking digital switchers

By Steve Epstein, technical editor

If two production switcher control panels can control a single chassis, can one control panel control two chassis? If you read the December article about the World Series, Fox Sports and Sony, you know the answer is yes. But how's it done, and how easy is it? And, why would you want to do it?

The technical details

Here's a quick look at some of the details involved.

For the World Series, two switcher chassis were tied together to provide a complete domestic feed and a "clean" international feed free of any Fox branding. Two Sony DVS-7000 switchers along with associated DMEs were controlled from a single control panel. Because of the architecture used in Sony's switchers, the task was relatively straightforward. A single operator controlled both switchers, and the broadcast happened without any major mishaps.

Inputs on both switchers were identical with a few exceptions. For instance, on the international feed switcher the announce booth camera was replaced by a secondary feed from the blimp. Also, many of the keys on the "clean feed" were simply blank. As cross-points and keys were selected on the primary switcher, the slave switcher followed. Some graphics used for the domestic feeds were modified for use in the clean feed, but the

second feed required only minimal additional resources beyond the second switcher.

To enable the dual control, the RS-422 control line from one control panel was simply fed to both switcher chassis. For those familiar with RS-422, four conductors are used, two for transmit and two for receive, because both the transmit and receive circuits are balanced. In this case, the transmit wires were sent to both chassis, with the control panel receiving commands only from the master chassis. Because there was no receive circuit from the slave chassis, any problems that cropped up could not be reported to the control panel. Not exactly the best way to do things, but acceptable.

Currently, Sony is working on an outboard box that allows dual chassis control in a more desirable and elegant fashion using any two Sony switchers. The outboard box will provide a receive path from all the chassis, as well as covering other

details, such as restoring crosspoint and key selections in the event one chassis lost power or had to be reset.

This method of operation could come in handy in the future, for instance with HDTV/NTSC simulcasts, as well as PAL/NTSC or even component/composite switching. In addition, the Sony architecture allows for control of almost any number of chassis from a single control panel if the need arises. ■



Despite the complexity of hooking up remote trucks, linking their switchers was really quite simple and only required a single cable.

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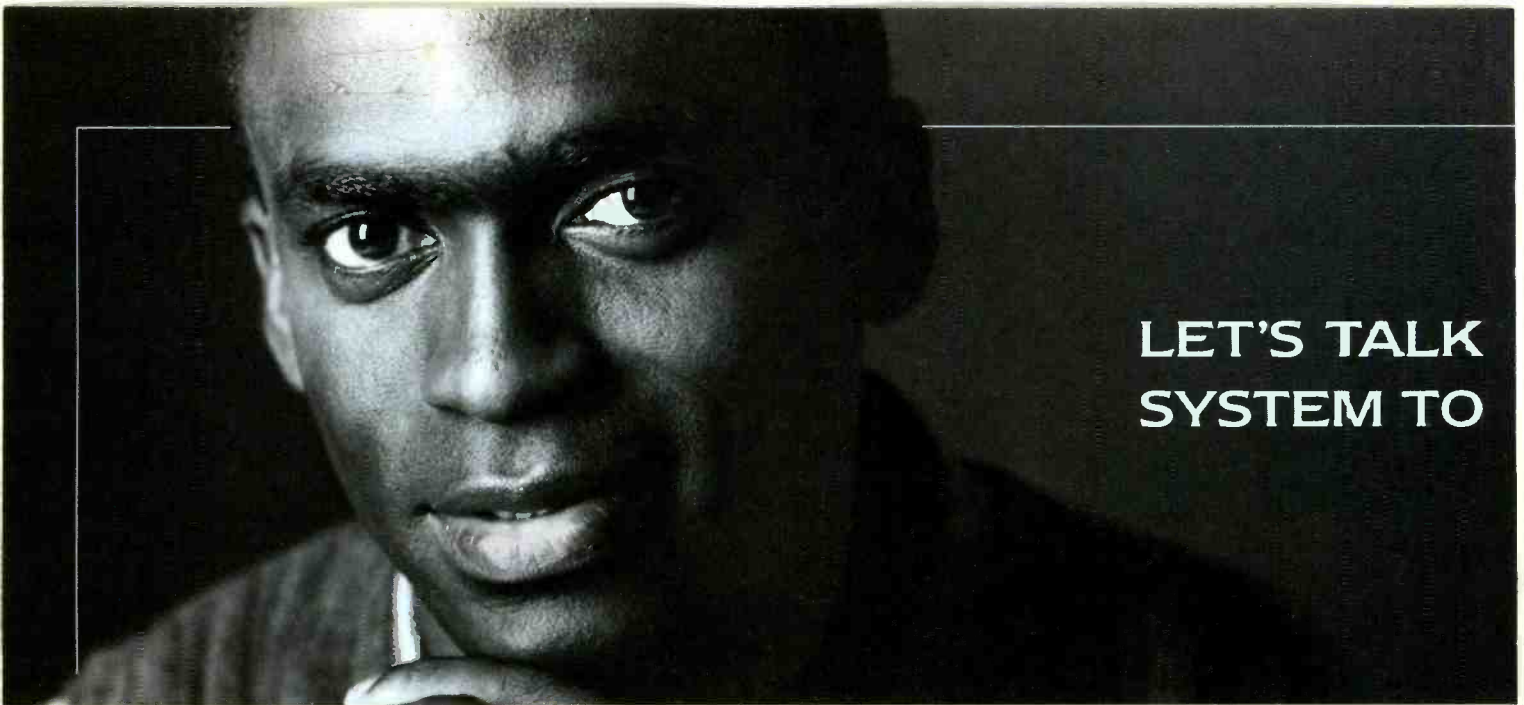
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worth their weight in gold, as are head-phone belt packs with mic pre-amps. With these, any mic or line-level sound cable can be disconnected from its destination and directly monitored.

For multicamera shoots, particularly sports, ISO tallies are a must. These consist of a second tally light, usually green or blue, that indicates to the

operator that although the camera may not be on the air, it's still selected on one or more of the isolated camera recorders. ISO tallies are also a big help on live music shows being shot for post-production. If isolated cameras and slo-mo are going to be needed, and the slo-mo operators are going to be in the tape room rather than at remote controls in the production room, video ops and videotape cannot be located in the same room. It's still done on many medium-

sized trucks, but the video operator's station needs to be small, dark and intimate. The tape room needs to be bigger, more open and brightly lit with room for many people, particularly if slo-mo ops are stationed there. Leave room for plenty of expansion in the tape area. Extra shelves, cabinets and counter space are a must.

On the audio side of the ISO situation, a big consideration is whether multi-track sound recording will be needed. If so, an audio board with direct outs from each input channel or submaster will be required. Interstage patch points are frequently normalised into modular digital multitrack recorders (MDMs). The patch points must be wired so that patching the outputs does not interrupt the signal path, while patching to the input side does lift the normal signal. This enables compressors, limiters and noise gates to be inserted.

Some audio boards have a one-jack insert point where pushing the quarter-inch TRS connector one click into the jack results in a direct out and pushing in two clicks interrupts the signal for a processor insert. These are not good for broadcast and are better suited for stage-monitoring consoles. The MDMs each have eight tracks and may be the Tascam DA-88 using DAT tape or an ADAT unit, such as the Alesis, which uses S-VHS tapes running at three times normal SP speed. These machines are synchronized to each other and to input time code by a daisy-chain connection along all the sync connectors on the stacked units. These digital tape machines can be used for more than a hundred digital audio tracks. They also are so economical and easy to use that no truck should ever attempt to record a musical format show without them.

The most important step, and often the most difficult, is to determine exactly what types of formats the vehicle will need to be capable of handling. From there, it's only a matter of matching costs to individual features. As in any project, there will be trade-offs. Be careful, just because you don't need a feature doesn't mean someone else won't. If you have any plans for renting out the unit, make sure the features you give up won't hurt your potential in the rental market. ■

Bennett Liles is an audio engineer for Georgia Public TV, Atlanta.

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Video compression

For many, it's the holy grail for digital media transport.

By Ken Freed

THE BOTTOM LINE:

As compression systems become common, engineers and managers become more comfortable with their use. When properly implemented, today's sophisticated algorithms can deliver high-quality video using reduced bandwidth. Because compression systems can offer cost-effective video delivery over new and existing channels, their use should be considered whenever appropriate. \$

Digital set-top boxes and high-speed cable modems are commercial at last. The FCC finally has approved a standard for digital television. And digital compression, squeezing more stuff into less space, is becoming a proven technology.

Which types of compression equipment are best-suited to what applications? Compressed video in a production setting has different requirements than signals backhauled for uplink elsewhere. Compression standards and techniques vary, but the basics remain the same. Digital video typically contains pixels that remain constant from frame to frame, like the stationary background in a talking head shot. Compression reduces or eliminates much of this redundant information.

MPEG-2

The Moving Picture Experts Group (MPEG) of the International Standards Organization (ISO) first adopted MPEG-1 and then MPEG-2 as international digital compression standards for transmitting video. The original MPEG-1 standard handled transport of signals at CD-ROM rates of 1.5 to 4Mb/s. Limited TV applications for MPEG-1 prompted development of MPEG-2 (ISO 13818). The

M P E G - 2 E N C O D I N G T E C H N O L O G Y



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Video compression

MPEG-2 datastream can be divided into two or more coded bitstreams, which is vital for multichannel transmissions.

MPEG-2 is capable of coding interlaced source video at full bandwidth while reducing storage and bandwidth costs. This is one reason MPEG-2 has been adopted for head-end transmitters and receiver terminals in DSS and DVB satcasting, cable and wireless cable systems and the new digital TV standard. However, MPEG-2 remains a less-than-ideal choice for production because individual frames are hard to access due to larger groups of pictures

our MPEG system is a textbook application of the cost saving and increased programming options available with digital video compression," said Dwight Duke, president of satellite television networks at Scientific-Atlanta. "By increasing the amount of programming without driving up their transponder costs, Cancom has great potential for increased growth in revenue."

Studio Profile MPEG-2

For anyone involved in video production, from local stations to world-class post houses to global network operations centers, the biggest and perhaps best compression news at the start of 1997 is the 4:2:2 Studio Profile at main

it finally goes out to viewer's homes."

ABC Television deployed the MPEG-2 4:2:2 Studio Profile at main level in its national broadcasts from the Republican National Convention in San Diego. Transported over AT&T long-distance fiber lines from the convention center to network studios in New York City, the technology allowed ABC to double its transmission capacity. Using Sony equipment and MPEG-2 4:2:2 compression, two broadcast-quality video channels were sent on a single 45Mb/s DS3 fiber line. Alternatively, the system could be used to send one video channel over DS3 at twice the speed.

For the San Diego broadcast, Sony provided the prototype of two new products, the DSM-M1 multiplexer and its companion unit, the DSM-D1 demultiplexer, which were used with a prototype "LinkRunner" box from Lucent for protocol transfer into DS3 framing. AT&T media industries marketing director Jack Gelman says that the 4:2:2 system is a "vast improvement" over an NTSC codec using a 45Mb/s line to carry a composite analog video signal. "When you can get two digital component video signals in the same bandwidth or when you can use a 45Mb/s pipe in half the time, such as an ENG crew sending a 30-minute tape in 15 minutes, you not only can reduce transmission costs, but you can get recorded footage to the network faster than ever before."

PROFILES

	SIMPLE PROFILE	MAIN PROFILE	SIGNAL TO NOISE RATIO	SPATIALLY SCALABLE	HIGH PROFILE	STUDIO PROFILE
HIGH (1820 LINES)		4:2:0			4:2:0/4:2:2	
HIGH (1440 LINES)		4:2:0		4:2:0	4:2:0/4:2:2	
MAIN (720 LINES)	14:2:0	4:2:0	14:2:0		4:2:0/4:2:2	4:2:0/4:2:2
LOW (352 LINES)		4:2:0				

The MPEG-2 compression standard includes different tools for different applications of increasing complexity. The options are expressed as a matrix of profiles and levels with complexity increasing from left to right and from top to bottom. This simplified chart of the matrix specifies the MPEG-2 chrominance sampling options. The most frequent compression scheme for television is main profile, main level. The new 4:2:2 Studio Profile compression takes place at main level.

(GOPs). The 4:2:2 Studio Profile was designed to address this issue.

A prominent example of MPEG-2 deployment is the new \$20 million digital upgrade to the broadcasting network of Canadian Satellite Communications. Cancom uses station feeds from Boston, Detroit, Minneapolis, Seattle, Edmonton and Hamilton, along with the network feeds of ABC, NBC, PBS, CBS and Fox to create regional programming packages for 2,500 cable head-end operators.

The MPEG-2 system is replacing Cancom's analog transmission network. Cancom now distributes analog programming to Canadian cable companies from 25 uplinks across the top of North America to about 14,000 Scientific-Atlanta MPEG-2 digital satellite receivers in subscriber homes. Its new Scientific-Atlanta network management system enables the company to control 15 uplinks and 25 encoding systems from one location. "Cancom's use of

level. Content producers have long complained that MPEG-2 video lacked sufficient quality for studio applications.

Dave Elliot, vice president of engineering services for the ABC Television Network explains, "Standard MPEG and MPEG-2 use a 4:2:0 sampling scheme, which means it takes a full sample of the luminance, but it tosses out half of the chrominance information, specifically the color coordinate on one axis of the color grid. Studio Profile MPEG increases the chrominance sample to 4:2:2, thereby accounting for both axes on the color grid by sampling every other element, providing better replication of the original signal. The 4:2:0 sampling is all right if a signal's going straight out because there's little risk of picture degradation from transmission," Elliot says. "But the 4:2:2 sampling is better for multiple iterations of a video signal where the video will be compressed, decompressed and recompressed several times before

Motion-JPEG

The Joint Photographic Experts Group developed JPEG for compressing color or gray-scale images, such as photographs and naturalistic artwork. JPEG generally is unsuited for text and line art because of the amount of image content lost upon decompression. Based on what tests show the human eye can't detect, JPEG uses "color-independent" 8-bit and 12-bit sampling in combinations that can progressively scan frequency, amplitude and other factors.

Motion-JPEG algorithms compress individual video frames without considering adjacent frames in a video sequence. "JPEG is a well-established technology with viable applications in television," says Peter Symes of Tektronix, manager of advanced technolo-

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Video compression

gy for Grass Valley products. "Yet to make the compression technique more useful, the JPEG committee is now in the process of formulating a new JPEG standard that will be published by both the ISO/IEC and ITU." A draft specification is expected this year.

"The new M-JPEG will be backward-compatible," Symes says, "and it will offer more flexibility with the use of basic tools like MPEG. The main improvement will be the quantizing matrices (QMs), which JPEG now defines for the whole image. The new JPEG specification will define different QMs within one picture, so you get different compression in different parts of the picture, according to your needs."

A recent M-JPEG variation is a new "lossless" mode, a mathematical construct for more efficient coding using less bits, which is similar to data compression programs like PKZIP. "The new JPEG lossless mode will allow you to get back exactly what you put in," Symes says. "It uses statistical prediction to compare pixels next to each other and select the shortest code possible to represent each pixel, thereby reducing the amount of code about 2:1."

Symes notes that Tektronix already has a "successful JPEG implementation" in the Profile line of compressed disk recorders, which soon will be enhanced with Studio Profile MPEG-2 at 4:2:2 sampling, which Symes says was a Tektronix initiative. "The Tektronix staff did a lot of the drafting toward the end."

MPEG-4 and beyond

Because high-speed digital transmission remains beyond the fiscal reach of many TV operations, an effort has been made to provide reliable video compression at lower speeds. One valuable answer may be MPEG-4, a standard for coding audio-visual content at low bit rates. Work on MPEG-4 (ISO 14496) officially began at the MPEG meeting in Brussels in September 1993, and the initiative has been approved by unanimous ballot of all national bodies of ISO/IEC JTC1. A draft specification is expected in 1997 with adoption foreseen for November 1998.

Selecting a compression method

When selecting a compression method for a given application, many factors need to be weighed including: infrastructure requirements, network interoperability and capital budget restraints. To nudge your thoughts in a helpful direction, here are a few questions that could be raised in any meeting where the purchase of compression systems are being considered.

Is the compression method scalable for varying transfer rates and memory demands? Is the method well-suited to the type of information being sent? If being used for production, does the compression method support random access for frame-accurate video editing? Does it allow for editing on-the-fly? Does the image update fast enough? Does the method support progressive decoding for fast previews? Does the system properly support progressive and/or interlaced images? What are the sampling structures used (4:2:2, 4:1:1, 4:2:0) and are they consistent with your image and quality requirements?

Given the potential delays from compression and decompression procedures at even the highest speeds, will the codec equipment support essential real-time operations? In the case of interactions on subscription TV services, does the compression technology support information integrity? Is it compatible with favored encryption methods? Is transaction security guaranteed? In the final analysis, when the images are presented to the viewer, do they meet your quality requirements? Will the system save or earn more cash than it costs? ■

MPEG-4 requires engineers to develop fresh solutions. According to J. Ostermann at the University of Hannover, chairman of regional coordinators for the MPEG organization, the techniques considered so far have included model-based image coding, human interaction with multimedia environments and low bit-rate speech coding.

"When completed," Ostermann says, "the MPEG-4 standard will enable a whole spectrum of new applications, including interactive mobile multimedia communications, videophones, mobile audio-visual communication, multimedia electronic mail, remote sensing, electronic newspapers, interactive multimedia databases, multimedia videotext, games, interactive computer imagery and sign language captioning. Because the primary target for these applications is bit rates of up to 64kb/s at good quality, it's anticipated that new coding techniques allowing higher compression than traditional techniques may be necessary.

This effort is in the early stages. Morphology, fractals, model-based techniques are all in the offering." MPEG-4 to date is loosely being defined with a sampling grid having dimensions of 176 by 144 at 10Hz with coded rates between 4,800 bits and 64kb/s. A target application at this rate could be video conferencing or home viewphones over POTS lines.

Reflecting the kind of thinking going into MPEG-4, an important seminar was held in July 1994 in Grimstad, Norway. The meeting brought together

er experts in media psychology, physiological aspects of vision and hearing, music synthesis, speech synthesis, computer graphics, animation, computer vision, artificial and virtual reality, plus other fields. They contributed ideas for various applications and coding methods for MPEG-4. Conceivably, MPEG-4 could replace CCITT H.261, the most widely used international video compression standard for video conferencing over switched networks, which encode data in a hierarchical block structure format.

MPEG-4 is receiving its most ardent support in Europe. The European Union ACTS project developed software for several parts of MPEG-4, including the successful development in 1995 of software for video encoding and decoding. More recently, the effort to develop MPEG-4 architecture, software and hardware has shifted to a project called Emphasis. Players in the Emphasis project include Thomson, Siemens, Philips, Hertz Institute, France Telecom, Telenor, Ecole Polytechnic, University of Hannover and others.

"The objective of the Emphasis project," says spokesperson Paul Fellows at Thomson Microelectronics Ltd., "is to firmly establish a European lead in software and silicon technology suitable for MPEG-4. The project will actively contribute to MPEG-4 standards by delivering three key technologies — MSDL (MPEG-4 Syntax Description Language), software implementation of MPEG-4 tools and algorithms, and

Continued on page 77

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Penny-wise **automation**

The right design can make a modest automation system pay off big.

By Tom Rush

THE BOTTOM LINE:

There is a growing number of applications for simple automation systems that are required only to insert occasional spots into a program feed that is assembled elsewhere. Unlike full-station automation, these systems require small amounts of storage and relatively simple control features, although they often must manage several channels of programming simultaneously. If properly designed, they can provide substantial return on investment. \$

Today's competitive multichannel environment requires a specialized type of automation system that can handle short-form insertion and long-form pass-through. This allows cable head-ends and secondary broadcast outlets to add a small amount of local content to programming that is assembled upstream by a network distributor or primary station. Growth in ad sales by cable operators and increasing multiple-station operation by broadcasters have made this type of automation system more popular.

When planning such an installation, several factors must be considered in order to create a system that adequately addresses a facility's specific needs.

Traditional approaches

Local insertion systems, as this type of automation is often

Photo: This encoding station handles the upload of spots from U-matic and Betacam tapes to MPEG-2 files on hard disk.



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Penny-wise automation

called, have employed a myriad of tape-based storage in the past. More often than not, 3/4-inch U-matic tape was the workhorse of choice.

Some of the serious problems that exist with such tape-based insertion are limited spot inventory; worn or wrinkled tapes; tracking problems; clipped and miscued spots; poor video quality on air due to multiple generations of tape; inconsistent audio levels; head clogs; worn cables and connectors; and all the other mechanical and electronic problems inherent with tape — multiplied by the number of decks and wiring paths.

Today, just about any digital insertion system will immediately cure many of these ills by its use of non-linear (disk-based) storage. But don't assume that any disk-based system will provide a complete panacea for a particular situation. Each application's concerns must be carefully researched and resolved in the decision-making process of customizing an insertion system.

Parameters to consider

First, think about your physical space limitations and pre-wiring requirements. Some vendors ship their pretested custom units already assembled in their own racks. This provides a streamlined installation, but not all facilities will lend themselves to this luxury. In many cases, space and/or funds may be tight and a complement of existing racks may have to be used. Consider the system's powering needs (including possible electrician fees for any new installation), including power-line conditioning and adequate UPS capacity to support the equipment without damage or failure during power spikes or interruptions.

Uploading spots into the non-linear storage mode is the function of the automation system's *encoding station*. This is typically the most expensive

part of the system, so it should be planned carefully. Issues to consider include: What type of source decks will be required? How will switching of audio, video and serial control be accomplished between the decks? (A small switcher may be required.) Is a waveform/vectorscope combination or VU metering device provided with the encoder? Is an automatic gain control (AGC) for audio levels included or optionally available?

Can the encoder embed a spot's ID number in every frame of the video? This might not be required in every

of crashed hard drives) are highly recommended. Hard drives should be "hot swappable," with a couple of spare drives always on hand. Some operators physically transport large quantities of spots to insertion facilities on these drives, in lieu of using optical disks or when interconnection through high-speed data lines is unavailable.

Getting started

When installing a disk-based insertion system at an existing facility, the process of changeover is another important issue. Get the encoding station running

first, so staff can begin uploading spots while the rest of the system (the on-line insertion hardware) is still being installed. This also provides material to use during testing of the insertion equipment. Running actual schedules and current spots makes the most convincing statement of a system's readiness to launch.

If a staff engineer or a head-end technician

knows some computer programming, *custom filtering* of existing library-reel files (placing spot ID codes, time-code "in" points and other data into the appropriate fields for the encoding computer's software) could save some time in the start-up phase. Encoding directly from active spot reels (as opposed to going back to original spots) can greatly simplify and accelerate the initial upload process. Although the quality of spots on the library reels may suffer from 3/4-inch generation loss, a systematic replacement of those ads from the original tapes at a later date, combined with the natural attrition of outdated spots, will soon right those wrongs.

Multichannel operation

For multiple-channel inserters (more common in cable applications), consider the number of I/Os vs. the actual architecture of the insertion units. A vendor's claim of 16-channel capability may translate into 16 I/Os, but only 12 actual playback cards (decoders) and a "staging" hard drive associated with each card.

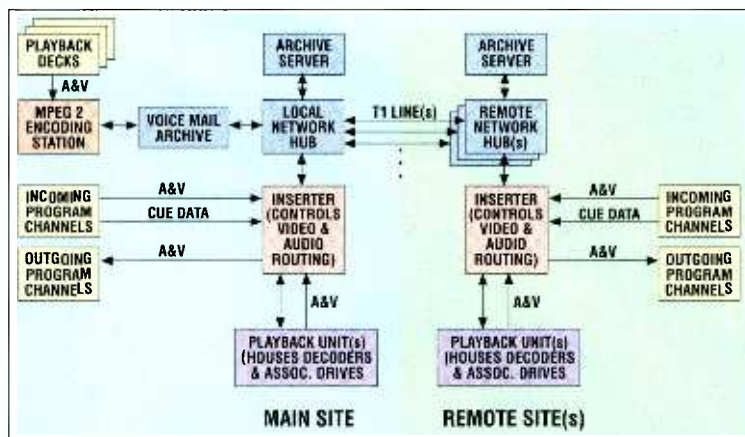


Figure 1. Block diagram of a typical digital insertion system. All connections are via Ethernet except where noted.

system, but frame-by-frame verification is helpful when clients report that their spots are being clipped or upcut when aired. Without such single-frame counting and recording, verification reports may simply state "spot inserted."

Finally, don't forget racks and rack mounts. Overall encoding-station costs may total up to \$70,000 or \$80,000, plus the cost of any additional tape decks that might be required.

Storage

MPEG-2 encoding provides enhanced picture quality and a potential 30% savings in storage space over MPEG-1.5 (which may not even be offered on the latest systems). With MPEG-1.5, a file size of 22MB makes a 30-second spot look nice on the air. With MPEG-2, that same 30-second spot can look even better at a file size of only 16MB.

A major factor to consider is the size, type, configuration and number of archives or hard-drive storage devices. An archive with 32GB storage could hold up to 2,000 spots. RAID capabilities (which allow the automatic rebuilding



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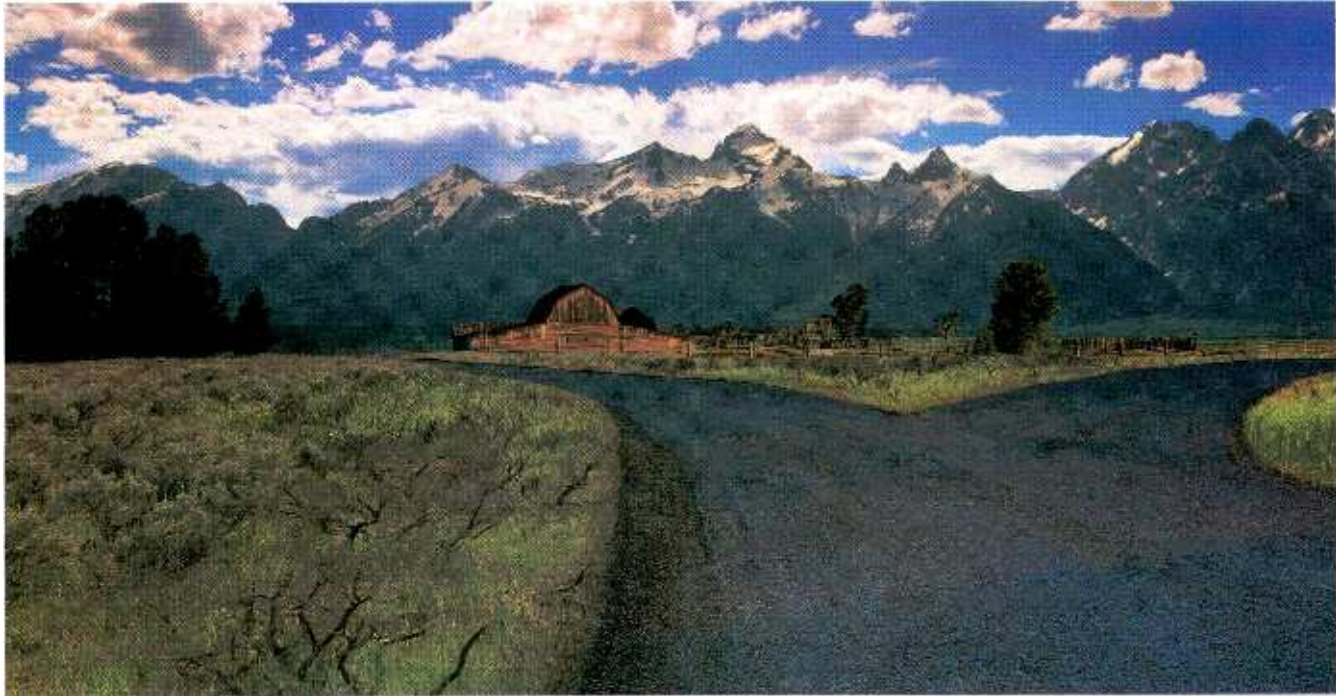
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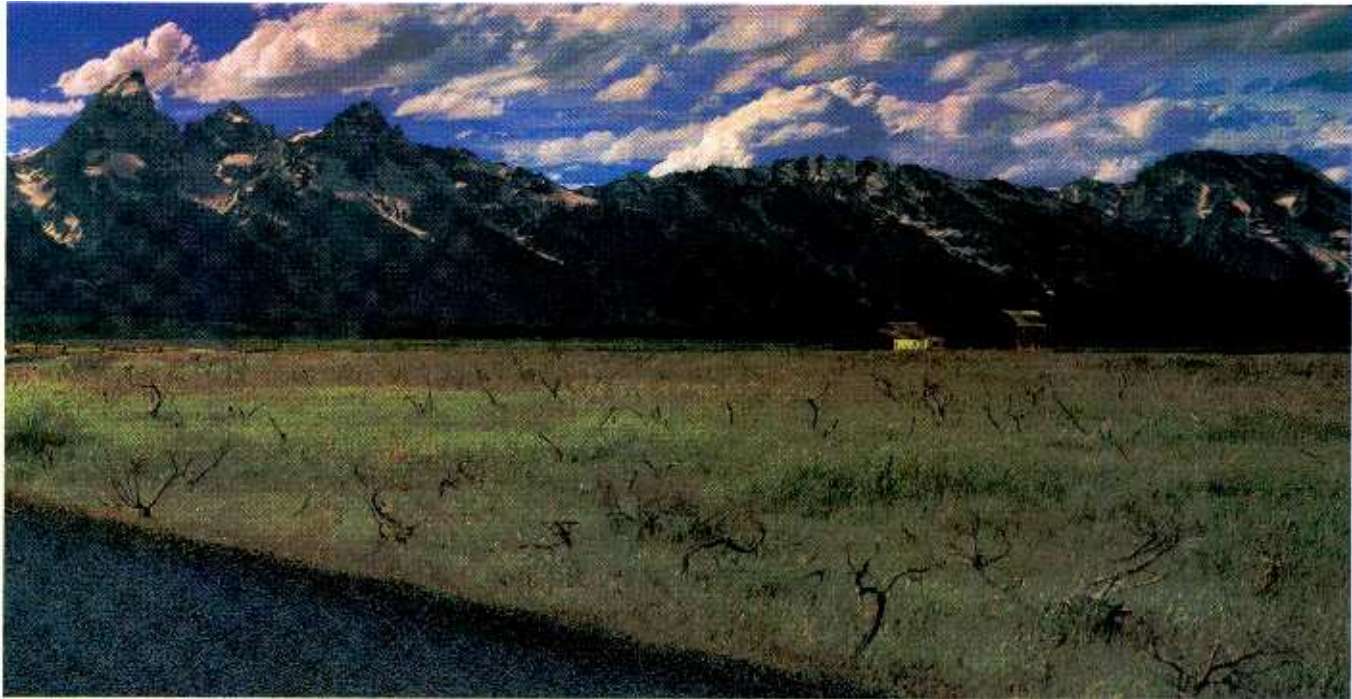
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SONY

Penny-wise automation

Some experimentation is required in pairing networks to avoid "collisions" (i.e., two networks calling for the same breaks at the same time). A "first-come, first-serve" basis may be fine for most installations, but perhaps not all. Some vendors offer inserters with true multi-tasking server capabilities that bypass the temporary "staging" of spots on dedicated playback drives. Examine this issue closely. Be sure to have one or two spare playback cards on hand. Most vendors can overnight-deliver emergency replacement parts, but a lot of spot opportunities can be lost during that time. In a pinch, the pairing of networks can be rearranged or perhaps temporarily implemented to cover a brief shortage of playback cards.

Multiple locations

Networking of multiple sites may also be required. One reliable method of bicycling spots from a single encoder location to multiple insertion sites uses magneto-optical (MO) disks. At 16MB per spot, about 80 spots can be transported on a 1.3GB disk. An alternative to this "sneakernet" approach involves the use of T1 data circuits from telco. Initial cost of T1 terminal equipment at each location may run into the thousands of dollars, and monthly service charges of \$500 or more are common, but such direct interconnection does offer significant efficiencies. Using a single T1 line (1.536Mb/s) to send a new or replacement spot to a remote inserter site can take as little as two-and-a-half minutes. This makes the burden of last-minute scheduling strictly a traffic issue.

Higher-speed interconnections are often available, but their additional cost is generally not justifiable. Some vendors offer routing software to expedite and automate spot distribution by comparing traffic schedules and spot inventories available at each site. If spots need to be added to any insertion site, the software searches a "V-mail" (video mail) archive and automatically sends the spots to the appropriate destinations' archives. If a spot is not available in the V-mail archive, the software sends that spot's

ID to the encoding station to alert the operator. If a spot is not used during a pre-set period of days at a given location, the software offers the opportunity to delete the spot from the site.

Administrative and control functions

Communication between the encoding station's software and the traffic and billing software is a critical component. If a required spot's ID pops up at the encoding station, does it have the client's name, spot title or spot length associated with it? Will the operator need to make a phone call to traffic? Will handwritten insertion instructions still be needed to identify that information? Is additional communication soft-



In three racks, this automation system handles spot insertion for 32 TV channels.

ware provided by the vendor to run routine checks and monitor the inserter sites remotely? Will that software automatically page an engineer with specific error codes?

Third-party software is available and already in use by many facilities to head off serious equipment failures. Monthly charges need to be considered for licensing such software. The ability of an engineer to access the inserters via modem from a computer at home and inspect problems can save an operation revenue, embarrassment with clients and unnecessary travel or overtime for technicians.

Reception of insertion cue tones must also be addressed. In some cases, the automation system vendor offers a feed of cuing data for the popular national cable programming networks. This unified cuing feed is delivered by satellite and allows a single data source to provide control for most or all of the channels managed by the insertion system at a cable head-end. Some additional hardware costs or monthly service fees may be involved. Otherwise, the inserter must be equipped to respond directly to DTMF tones or contact closures from each incoming channel's cuing data.

If other manual or automated insertion equipment is wired into any of these same channels or if the programming feed offers alternate feeds for specific markets, additional cue-sensing equipment may need to be interfaced. This will help avoid accidentally covering other locally inserted programming or spots, as well as avoiding conflict with any unscheduled program extensions (such as overtime sports broadcasts).

Cost analysis

Is digital non-linear insertion automation worth it? Costs for multiple-channel inserters will typically work out to about \$10,000 per channel (excluding the cost of the encoding station). Factoring reduced labor costs, improved inventory management, increased inventory through added channel capabilities, reduced maintenance costs and the like, these systems can pay for themselves in 18 to 24 months if the sales staff is reasonably successful at its job.

More than a few cable ad sales managers (in fact, probably *all* of them) included such digital systems in their 1997 capital budget requests. Naturally, not all will get approval. But if those managers whose requests do get approved have designed an appropriate system, they won't be disappointed. ■

Tom Rush is operations manager for TCI Media Services, Overland Park, KS.

**FOR MORE
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Preparing for **disaster**

Murphy was an optimist. Prepare for the worst; you'll probably get it.

By Jerry Whitaker

THE BOTTOM LINE:

Preparing for the unpredictable is an important part of engineering. Whether facing a natural disaster or an accident, thorough planning will help you get through the event with the least threat to life and property. Being a time-dependent business, broadcasters cannot shut down their operations to effect repairs without suffering a loss of income. Developing detailed contingency plans is the key to minimizing the disruption of operations during an emergency. \$

Major natural disasters, such as Hurricane Andrew and the Northridge, CA, earthquake help us focus on assuring that information systems will work during emergencies. These natural disasters hammer home the weaknesses in the system. They can also be rare windows of opportunity to learn from past mistakes and make improvements for the future.

A plan that has not been fully tested under realistic conditions is not a plan. Emergency management experts specialize in building plans and building exercises to test them. Sometimes called a *tabletop*, plan exercises can be quite realistic. The exercise manager writes a scenario for a likely emergency. Messages are written to stress the plan and the team assignments it makes. One or more referees watch as the exercise unfolds. There is a debriefing immediately after the exercise. The emergency plan is adjusted if necessary. A *tabletop* is, in microcosm,

Photo: Flames roll out of the front of a branch of the Bank of America in Los Angeles. (AP/Wide World Photos.)

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Preparing for disaster

a safe way to close the emergency preparedness loop before a real emergency strikes.

The planning process

It's impossible to separate emergency planning from the facility where the plan will be put into action. Emergency planning must be integral to a functional facility. It must support the main mission and the people who must carry it out. It must work when all else fails. Designers first must obtain firm com-

need to *jump-start* their disaster planning process.

The technical support group must have responsibility or supervision over the environmental infrastructure of your broadcast station. Without oversight, electronic systems are at the mercy of whomever controls that environment. Local emergencies can be triggered by preventable failures in air supply systems, preventable roof leaks or uncoordinated telephone, computer or AC wiring changes. Seemingly harmless acts, such as employees plugging electric heaters into the wrong AC outlet, have downed entire facilities. Successful practitioners of systems design and support must take daily emergencies into account in the overall planning process.

could be triggered by the following:

- threats from present or former employees who may hold grudges;
- external parties who are likely to get mad at your station;
- other factors that could make you an easy target;
- nearby man-made hazards;
- construction of your facility;
- electrical power; and
- other utilities, including buried pipelines.

If possible, seek aid from emergency planning professionals when you finish your list. They can help devise a well-written and comprehensive emergency plan. They can also help with detailed research on such factors as geology and dealing with hazardous materials, such as stored diesel fuel. After there is agreement on the major goals for operations under emergency conditions, you will have a clear direction for refining your emergency plan.

Perform a realistic assessment of the risks that your plan suggests. Don't overlook the obvious. If computers, transmitters or routing equipment depend on cool air, how can they continue to operate during a heat wave when your one air conditioner has malfunctioned?

What level of reliability should a designer build into a broadcast station? Emergencies introduce *chaos* into the reliability equation. Most engineers are quite happy when a system achieves 99.9999% reliability. Although the glass is more than half full, *four nines reliability* still means eight minutes of outage over a one-year period. Reliability is an educated prediction based on a number of factors that may or may not be directly applicable to your particular installation.

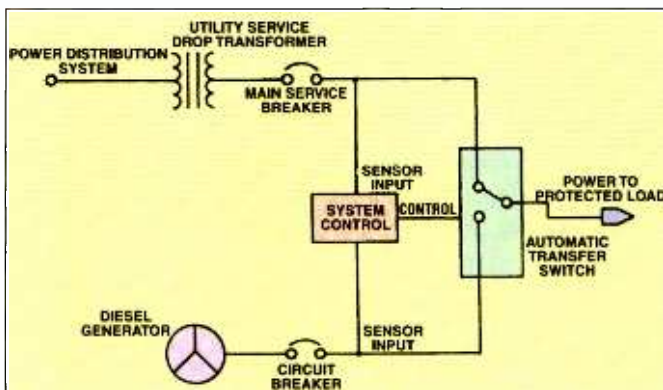


Figure 1. The classic standby power system using an engine-generator set. This system protects a facility from prolonged utility-company power failures.

mitment and backing from top management. Commitment is always easier to get if management has experienced a major earthquake or a powerful storm first-hand. Fear is a powerful motivator.

Disaster planning and recovery is an art, a science and a technology. Like such entities as the Institute of Electrical and Electronics Engineers (IEEE) or the Society of Broadcast Engineers (SBE), disaster planners have their own professional groups and certification standards.

Many states provide year-round classroom training for government disaster planners. Some planners work full-time for the military or in the public safety arenas of government, others have found homes in businesses who recognize that staying in business after a major disaster is smart business. Still others offer their skills and services as consultants to firms who

developed, based on specific hazards identified by local conditions. Such risks include the following:

- regional high-water marks for the 100- and 150-year storms;
- regional social, political and governmental conditions;
- regional commercial electrical power reliability;
- regional weather conditions;
- regional geography; and
- regional geology.

Next, assess specific local hazards that

Identifying realistic risks

Before you can plan for future problems, you must identify what those problems may be. To this end, a list of *realistic risks* should be de-

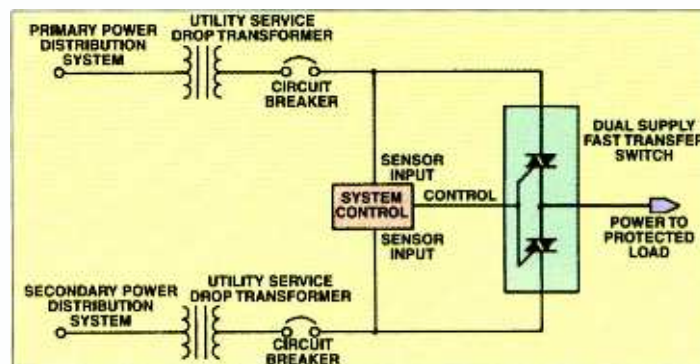
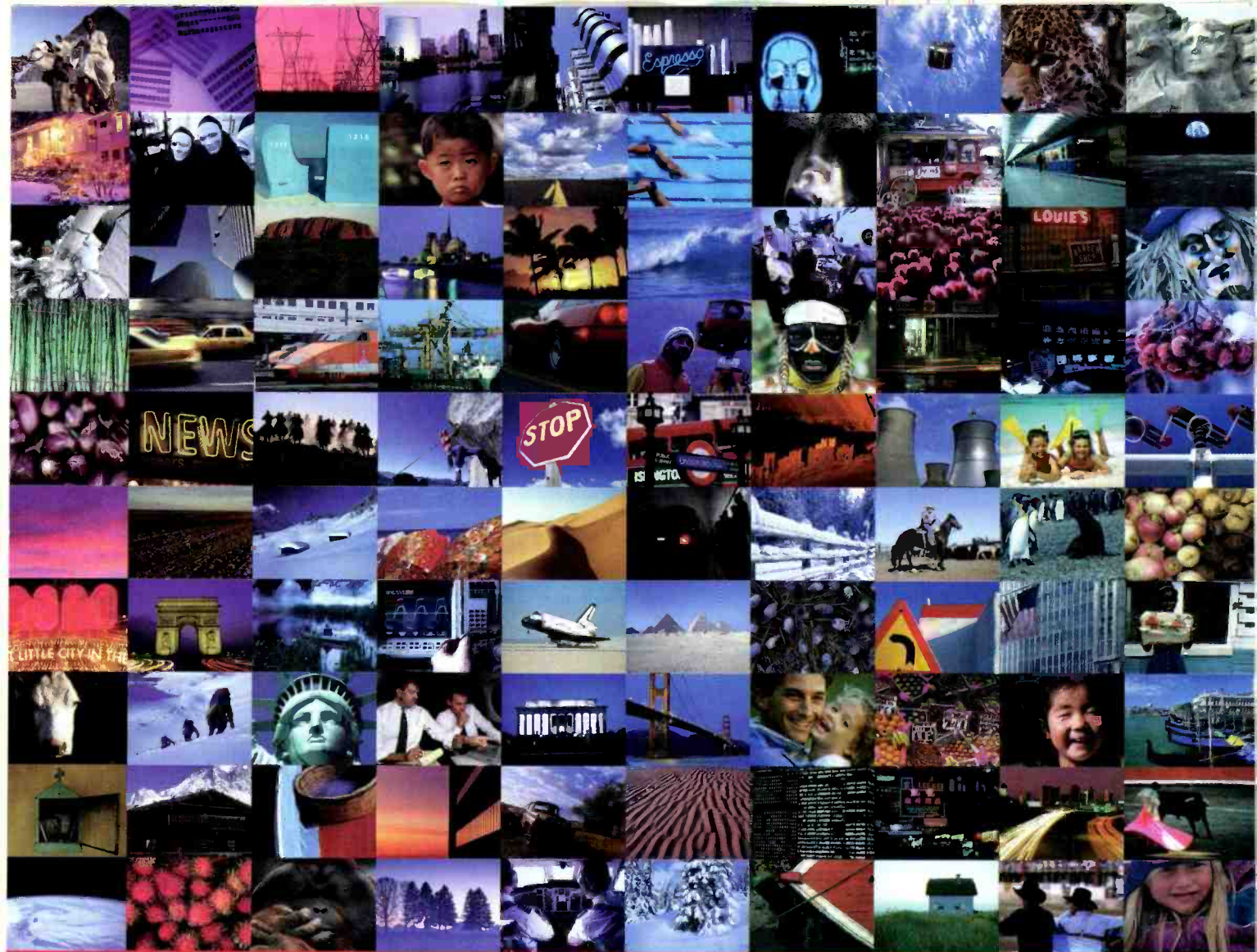


Figure 2. The dual utility feeder system of AC power loss protection. An automatic transfer switch changes the load from the main utility line to the standby line in the event of a power interruption.

Alternate sites

No matter how well you plan, something still could happen that will require you to abandon your studio or transmitter facility for some period of time. Broadcasters in some areas have instituted mutual aid agreements whereby certain facilities are made available to the affected station for a specified period of time. Some-



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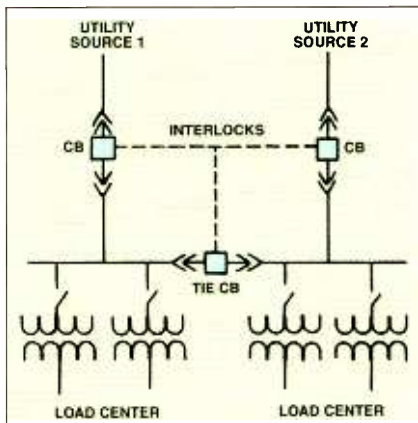


Figure 3. A dual utility feeder system with interlocked circuit breakers.

times, this is the only way to resume service to the public in the event of a major disaster. If management shows reluctance to share facilities with a competitor, respectfully ask what they would do if their own facility is rendered useless.

Standby power options

Of all the failures that a broadcast facility is likely to experience in any given year, the loss of AC power is the most common. To ensure the continuity of power, most stations depend upon some form of on-site generation.

The engine-generator shown in Figure 1 is the classic standby power system. An automatic transfer switch monitors the AC voltage coming from the utility company line for power failure conditions. Upon detection of an outage for a predetermined period of time (generally one to 10 seconds), the standby generator is started; after the generator is up to speed, the load is transferred from the utility to the local generator. Upon return of the utility feed, the load is switched back after some pre-determined "safe time-delay," and the generator is stopped. This basic type of system is widely used in

broadcasting and provides economical protection against prolonged power outages (five minutes or more).

In some areas, usually metropolitan centers, two utility company power drops can be brought into a facility as a means of providing a source of standby power. As shown in Figure 2, two separate utility service drops — from separate power-distribution systems — are brought into the facility, and an automatic transfer switch changes the load to the backup line in the event of a main-line failure. The dual feeder system provides an advantage over the auxiliary diesel arrangement in that power transfer from main to standby can be made in a fraction of a second if a static transfer switch is used. Time delays are involved in the diesel generator system that limit its usefulness to power failures lasting more than several minutes.

The dual feeder system of protection is based on the assumption that each of the service drops brought into the facil-

ity is routed via different paths. This being the case, the likelihood of a failure on both power lines simultaneously is remote. The dual feeder system will not, however, protect against area-wide power failures, which may occur from time to time.

The dual feeder system is limited primarily to urban areas. Rural or mountainous regions generally aren't equipped for dual redundant utility company operation. Even in urban areas, the cost of bringing a second power line into a facility can be high, particularly if special lines must be installed for the feed. If two separate utility services are available at or near the site, redundant feeds generally will be less expensive than engine-driven generators of equivalent capacity.

Figure 3 illustrates a dual feeder system that uses both utility inputs simultaneously at the facility. Notice that during normal operation, both AC lines feed loads, and the tie circuit breaker is open. In the event of a loss of either line,

the circuit breaker switches reconfigure the load to place the entire facility on the single remaining AC feed. Switching is performed automatically; manual control is provided in the event of a planned shutdown on one of the lines.

A more sophisticated power control system is shown in Figure 4, where a dual feeder supply is coupled with a motor-generator (m-g) set to provide clean, undisturbed AC power to the load. The m-g set will smooth over the transition from the main utility feed to the standby, often making a commercial power failure unnoticed by on-site personnel. An m-g typically will give up to half a second of power fail ride-through, more than enough to accomplish a transfer from one utility feed to the other. This standby power system is further refined in the application illustrated in Figure 5, where a diesel generator has been added to the system.

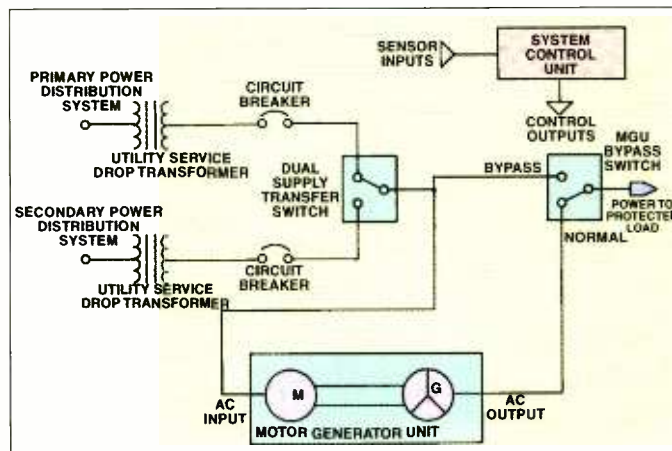


Figure 4. A dual feeder standby power system using an m-g set to provide power fail ride-through and transient-disturbance protection. Switching circuits allow the m-g set to be bypassed if necessary.

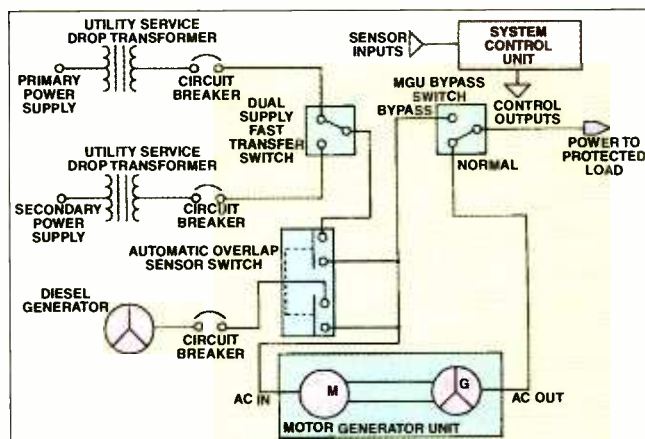


Figure 5. A premium power supply backup and conditioning system using dual utility company feeds, a diesel generator, and an m-g set.

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Preparing for disaster

With the automatic overlap transfer switch shown at the generator output, this arrangement also can be used for peak-demand power shaving.

Generators are available for power levels ranging from less than 1kVA to several thousand kVA or more. Machines also may be paralleled to provide greater capacity. Generator sets typically are divided by the type of power plant used:

- **Diesel.** *Advantages:* rugged and dependable, low fuel costs, low fire and/or explosion hazard. *Disadvantages:* somewhat more costly than other engines, heavier in smaller sizes.

- **Natural and liquefied-petroleum gas.** *Advantages:* quick starting after long shutdown periods, long life, low maintenance. *Disadvantage:* availability of natural gas during area-wide power failure subject to question.

- **Gasoline.** *Advantages:* rapid starting, low initial cost. *Disadvantages:* greater hazard associated with storing and handling gasoline, generally shorter mean time between overhaul.

- **Gas turbine.** *Advantages:* smaller and lighter than piston engines of comparable horsepower, rooftop installations practical, rapid response to load changes. *Disadvantages:* longer time required to start and reach operating speed, sensitive to high input air temperature.

The type of power plant chosen usually is determined primarily by the environment in which the system will be operated and by the cost of ownership. For example, a standby generator located in an urban area office complex may be best suited to the use of an engine powered by natural gas, because of the problems inherent in storing large amounts of fuel. State or local building codes may place expensive restrictions on fuel-storage tanks and make the use of a gasoline- or diesel-powered engine impractical. The use of propane usually is restricted to rural areas. The availability of propane during periods of bad weather (when most power failures occur) also must be considered.

The nature of most power outages requires a sophisticated monitoring system for the engine-generator set. Most power failures occur during bad

weather. Most standby generators are unattended. More often than not, the standby system will start, run and shut down without any human intervention or supervision. For reliable operation, the monitoring system must check the status of the machine continually to ensure that all parameters are within normal limits. Time-delay periods usually are provided by the controller that require an outage to last from five to 10 seconds before the generator is started and the load is transferred. This prevents false starts that needlessly exercise the system. A time delay of five to 30 minutes usually is allowed between the restoration of utility power and return of the load. This delay permits the utility AC lines to stabilize before the load is reapplied.

Batteries

Batteries are the lifeblood of most low-power portable devices. Batteries

also play a key role in the operation of uninterruptible power systems (UPS), which have become critical to the proper operation of most computers and computer-based systems. Recent research has brought about a number of different battery chemistries, each offering distinct advantages over the others, but none providing a fully satisfactory solution to all common applications. Today's most common and promising chemistries available include:

- **Nickel cadmium (NiCd)** — used for portable radios, cellular phones, video cameras, laptop computers and power tools. NiCds have good load characteristics, are economically priced and are simple to use.

- **Nickel metal hydride (NiMH)** — used for cellular phones and laptop computers where high-energy is important and cost is secondary.

- **Sealed lead acid (SLA)** — used for UPS systems and other demanding ap-

	NiCd	NiMH	SLA	Li-Ion	Li-Polymer	REUSABLE ALKALINE
ENERGY DENSITY (Wh/kg)	50	75	30	100	175	80 (initial)
CYCLE LIFE (typical)	500	500	200-300	300-500	150	10 (to 65%)
FAST-CHARGE TIME	1 1/2h	2-3h	8-15h	3-6h	8-15h	3-4h
SELF-DISCHARGE	MODERATE	HIGH	LOW	LOW	VERY LOW	VERY LOW
CELL VOLTAGE (nominal)	1.25V	1.25V	2V	3.6V	2.7V	1.5V
LOAD CURRENT	VERY HIGH	MODERATE	LOW	HIGH	LOW	VERY LOW
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COST PER CYCLE (\$)	0.04	0.16	0.10	0.25	0.60	0.50
IN COMMERCIAL USE SINCE	1950	1970	1970	1990	1997	1990

Table 1. The pros and cons of the most commonly used rechargeable batteries. (From: Isidor Buchmann, "Batteries," in The Electronics Handbook, J. C. Whitaker ed., p. 1,056, CRC Press, Boca Raton, FL, 1996.)

BATTERY TERMS DEFINED

- **Energy density** is the capacity of the battery measured in watt-hours per kilogram (Wh/kg).

- **Cycle life** indicates the typical number of charge-discharge cycles before the capacity decreases from the nominal 100% to 80% (65% for the reusable alkaline).

- **Fast-charge time** is the time required to fully charge an empty battery.

- **Self-discharge** indicates the self-discharge rate when the battery isn't in use. "Moderate" refers to 1% to 2% capacity-loss per day.

- **Cell voltage** multiplied by the number of cells provides the battery terminal voltage.

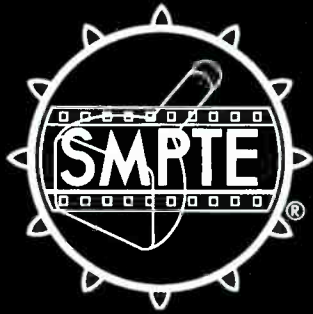
- **Load current** is the maximum recommended current the battery can provide. "High" refers to a discharge rate of 1C; "very high" is a current higher than 1C. (C-rate is a unit by which charge and discharge times are scaled. If discharged at 1C, a 1,000mAh battery provides a current of 1,000mA; if discharged at 0.5C, the current is 500mA.)

- **Exercise requirement** indicates the frequency the battery needs exercising to achieve maximum service life.

- **Battery cost** is the estimated commercial price of a commonly available battery.

- **Cost-per-cycle** indicates the operating cost derived by taking the average price of a commercial battery and dividing it by the cycle count.

- **In commercial use since** is the approximate year when the battery became commercially available.



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Preparing for disaster

plications where energy-to-weight ratio is not critical and low battery cost is desirable.

- *Lithium ion* (Li-Ion) — available only in limited supply and presently used for some video cameras. When readily available, this chemistry will replace some NiCds for high energy-density applications, but at a higher cost.

- *Lithium polymer* (Li-Polymer) — when commercially available, this battery will have the highest energy density and lowest self-discharge, but its load characteristics will only suit low-current applications.

- *Reusable alkaline* — used for light duty applications. Because of its low self-discharge, this battery is suitable for portable entertainment devices and other non-critical appliances that are used only occasionally.

No single battery offers all the answers; rather, each chemistry is based on a number of compromises. Table 1 compares the pros and cons of the six most common batteries: the sealed NiCd, NiMH, SLA, Li-Ion, Li-Polymer and reusable alkaline.

It's interesting to observe that the NiCd has the shortest charge time, delivers the highest load current and offers the lowest cost-per-cycle, but is most demanding on exercise requirements. For applications where high energy density is critical, regular exercise is impractical and cost is secondary, the NiMH is considered the best choice. Not without problems, NiMH batteries have a cycle life one-third that of NiCds. Furthermore, field use has revealed that the NiMH also needs some level of exercise to maximize service life, but to a lesser extent than the NiCd. In comparison, the SLA needs little or no maintenance, but has a low energy density.

Among rechargeable batteries, the NiCd has been around the longest (since 1950). It's also one of the best understood chemistries and has become a standard against which other batteries are compared.

Plan ahead

The bottom line in dealing with a disaster is *preparation*. First, develop a realistic plan to deal with a wide range of possible occurrences. Second, gain management and staff support for the plan. Third, test the plan with practice drills and revise the procedures as necessary.

Although it may be impossible to prevent certain disasters, at least you will be able to deal with them. ■

Jerry Whitaker is a contributing editor to Broadcast Engineering magazine.

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Adding DTV to your tower: Implications and considerations

With the finalization of the Grand Alliance's DTV standard, stations will begin to look seriously at the requirements for implementing DTV. One of the most commonly overlooked links in the air chain is the tower. Before additions can be made, it must be determined what, if any, new loads the existing tower can support.

This process should begin with the station engineering staff and management agreeing on the new equipment to be installed. In many cases, there may be

multiple options, such as combining the existing NTSC UHF transmitter and new DTV transmitter into an existing antenna or perhaps, a new combined antenna will be used. In either case, the existing transmission line may be re-used or replaced or additional line or waveguide may be added. In the case of VHF stations, the question of mounting the new DTV antenna above or below the existing antenna is paramount. To further complicate the VHF stations' headaches is the option of simultaneously replacing an aging VHF antenna with a new antenna, such as a side-mounted panel array or top-

tower inspection will be required to measure all the members, guy cables, bolts, etc. Determining foundation dimensions can be difficult, and may often require a partial excavation or soil probing to outline the concrete dimensions. If the soil characteristics are unknown, a soils investigation by a geotechnical firm may be warranted. Once the tower is measured, a further complication is determining the actual grade or strength of steel used. In extreme cases, small samples of the unidentified steel, and sometimes even bolts, may be removed from the tower and sent to a lab for testing. Table 1 shows a check list of the basic information required to perform a proper structural analysis.

Often, even with a complete set of drawings, a tower inspection is strongly recommended to investigate the condition of the tower with respect to corrosion, guy cable tension and general wear and tear. Such an inspection will also accurately map the existing antennas and transmission lines.

Armed with all the information on the existing tower and antennas, the proposed antenna scenarios should be investigated, including any optional arrangements of existing NTSC and new DTV antennas. Installation considerations, including the need for any NTSC off-air periods, should be discussed with the installation crews and the structural engineers.

The sequence of antenna and transmission line change-out that is most desirable from an installation or structural engineering standpoint may not always be the best scenario to minimize off-air time. This is where using a turnkey tower company is a definite asset. A full-service tower company will be able to provide structural engineering services, tower analysis services, installation services, project management, and if necessary, fabrication of new components. If separate companies are used for field work, engineering, manufacturing and coordination rest with the station engineer.

Once the sequence of events has been decided, the tower should be analyzed for the proposed loading. If the tower is old and hasn't been recently checked, an analysis for the existing "as-is" condition may be desirable. This will provide the station engineer and management with a "benchmark" of the tower's capacity under the current code, prior to adding the new loads. The tower should be analyzed to the latest version of the EIA-222 code. The current revision "E" will soon be replaced with revision "F."



This 1,767-foot LeBlanc tower located in Homestead, FL, is believed to be the heaviest tower in the world. It is designed to withstand hurricane-force winds and replaced a tower that collapsed during Hurricane Andrew.

mounted stack. Once the various options are narrowed down, the next step is to investigate the tower's current condition and capacity.

Tower evaluation

Before any tower analysis can be undertaken, drawings or plans of the existing tower must be obtained. In many cases, stations may have little or no records or drawings of their tower. In these cases, a complete

No Matter How You Play It, You'll Have a Winning Hand.

In many parts of the United States, iceloading must be considered in the analysis, because it is a real quantity that might never have been checked under previous versions of the tower code. In some cases, towers previously designed or analyzed to the "C" revision may not pass an "E" or "F" code analysis. This is partly due to changes in the wind-loading, height factors and drag factors. Also, more accurate computer models and modern structural analysis software permit more precise analyses. Table 2 shows some combinations of wind- and iceloading that should be checked in accordance with the code.

Modifications

Based on the structural analysis results, several courses of action may be required. A proper analysis should include a detailed report outlining the conditions investigated, any assumptions used and a listing of stress levels in all members, including any overstresses.

Modifications, reinforcing design and related costs should also be presented, although some engineering firms will charge an additional fee for this work. Under ideal circumstances, little or no reinforcing will be required and the new DTV antenna installation can proceed. However, in reality, many towers will require reinforcing because of one or more of the following:

- leg members overstressed;
- bracing members overstressed;
- bolted or welded connections overstressed;
- guy cables overstressed (factor of safety is below the minimum specified value in code);
- tower base foundation overstressed (safe bearing capacity of soil/rock is exceeded); and
- tower guy anchor foundations overstressed (factor of safety against sliding or uplift is below the minimum specified value in code).

In angle member towers with bolted connections, the most economical reinforcing usually consists of bolting-in additional reinforcing angles or replacing existing members



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with stronger ones. Sometimes, drilling is required to install additional connection bolts. In towers with hollow pipe legs or solid round legs, welding additional material is an option. Unfortunately, welding is usually costly and difficult to perform on an existing tower. Welding to an existing galvanized steel tower also tends to destroy the zinc coating that protects the tower steel

Prior to performing a tower analysis, the following information is required:

- Tower member dimensions (legs, bracing, connections, guy cables, foundations, etc.)
- Tower steel grades (members, bolts, etc.)
- Ancillary attachments (platforms, antenna mounts, elevators, ladders, etc.)
- Antennas (make, model, description, mounting arrangement, elevation, location on tower, etc.)
- Transmission lines/waveguides (size, type, model, location on tower, feeding which antenna)
- Guy cables (type, diameter, elevation, termination, etc.)
- Tower layout (cross section, etc.)
- Foundations (anchor radius, drop-offs, etc.)

Table 1.

from corrosion. Reinforcing options should be discussed carefully with the structural engineer. Sometimes, the proposed reinforcing is difficult to install because there are transmission lines attached to the members that get in the way. Make sure the cost of such modifications includes relocating and reattaching any lines or antennas that may obstruct the installation of the reinforcing.

Overstressed guy cables can sometimes be corrected by adjusting the initial (at rest) tensions. An old tower

Combinations of windloading and iceloading that should be checked in accordance with the code include:

- Full wind & no ice (per EIA-E) mandatory.
- 75% of full wind and ice (per EIA-E) mandatory where icing is a factor.
- Full wind & no ice (per EIA-C). Option where tower was previously checked or designed to the "C" revision. However, must be in conjunction with an "E" analysis.
- Reduced wind and full ice (per EIA-C). Option where tower was designed to "C" for ice, but with customer-specified windloading. However, must be in conjunction with an "E" analysis. The wind level used should be discussed with the station and structural engineer so as to be realistic.

Table 2.

should have a complete plumb and guy tension adjustment performed to ensure that the tower is within the tolerances specified in the code for verticality and cable tensions. Sometimes, the guy cable capacity is limited by its termination, or end connection, at the tower or anchor end. A guy cable can easily be replaced by a larger-sized cable to increase the safety factor to an acceptable level. However, the structural engineer must then perform another analysis to verify the affects of the larger guy size on the tower members. In such cases, the foundation anchor shaft should also be investigated to make sure that there is adequate capacity to support the new guy cable loads at the anchor plate.

Tower foundations can be difficult to reinforce. Usually, the tower base is adequate, and it's the guy cable anchors that cannot withstand the new tower loads. Sometimes, additional earth material can be used to build a "berm" over the anchor block, increasing its capacity. Foundation modifications have to be reviewed on a case-by-case basis. If required, employ the services of a geotechnical firm to perform a soils analysis to ensure the maximum possible capacity of the foundations is being utilized.

In extreme cases, it may be impractical to economically perform extensive modifications. It may also be against "sound engineering practice" to perform heavy reinforcing. In such cases, investigate the cost of replacing the tower. Ensure that the quote for the new structure includes reserve capacity for leased space and future antenna requirements. It may also be worth the cost to have several antenna and transmission line combinations investigated and the related reinforcing priced out. A higher gain antenna and larger transmission line may afford savings in the cost and operation of the transmitter, but the higher windloading presented to the tower may result in excessive tower upgrade costs. The overall costs of the transmission system must be weighed against the expense of any tower reinforcing costs.

A typical example

LeBlanc recently performed a structural analysis on a typical 1,500-foot guyed tower. The tower was built by LeBlanc in the early '80s to the EIA-222-C code. Originally designed to support a top-mounted UHF TV antenna, mobile antennas and several microwave dishes, the owner now wanted to investigate the possibility of adding a second UHF TV antenna. The proposed antenna was to be side-mounted below the top of the tower. In addition, he also wanted the loading for a future DTV antenna, also side-mounted, below the tower top. Additional waveguide was to be added for the new TV station and the future DTV antenna. Because of the mountaintop location of the tower, the original design included the non-standard loading of 40 miles/hr (one-third of the design wind) with two inches of icing on all tower members and antennas. Most towers designed to the "C" version of the code would not have included iceloading.

LeBlanc proposed an up-to-date analysis of the existing and proposed conditions using EIA-E, with the same basic wind speed as the original design. In addition, an analysis for 75% of the basic wind with one inch of ice, in accordance with EIA-E requirements, was investigated. Finally, a custom analysis using the 40 miles/hr wind with two inches of radial ice was also checked using EIA-E. Based on the analysis results, the tower required some minor diagonal reinforcing in the area of the top guy level. Some of the guy cables exhibited a lower factor of safety with the new loads,

Tower registration update

By Don Markley

Although tower registration has been discussed at length previously in these pages, phone calls and mail suggest that some questions still exist. In addition, the hills seem to be alive with experts, pseudo-experts and outright charlatans who propose to perform this service.



Don Markley

First, the FCC is content to have the tower location specified to the nearest second of latitude and longitude and to have the tower height above ground and the site elevation above sea level stated to the nearest meter. The FAA would prefer that heights be to the nearest foot and coordinates to the nearest tenth of a second. For the purposes of tower registration, it's only necessary to meet the FCC requirements.

Next, the FCC will accept data obtained from a recent topographic quadrangle map. The problem comes in locating the tower(s) on

such maps. If the tower has been in existence for some time so that the map has been updated to show the tower location, the coordinates can simply be taken directly from the map. If the tower isn't shown, it must be located precisely, preferably by measurement from known markings on the map. The old calibrated eyeball simply will not do here; a survey or measurement with the proper type of GPS equipment will. If the location can be accurately determined by such means and plotted on the map, it may be

Continued on page 89

however, they were still above the minimum required values.

Fortunately, the tower foundations had originally been designed with reserve capacity. The increased foundation loads resulting from the addition of the proposed antennas were acceptable. Because of this reserve capacity in the foundations and the consideration of ice in the original tower design, no major modifications were required. Had it not been for these factors, this tower would likely have required foundation reinforcing, mast leg strengthening and replacement of several guy cables.

Before proceeding with any new DTV equipment installation on an existing tower, all aspects of the structure must be analyzed to verify their capacity to support the new loads. Towers that have been designed to previous versions of the standard should be checked using the more recent "E" or upcoming "F" revision of EIA-222.

For an accurate analysis to be performed, the structural engineer

needs to know all the details of the tower, including member sizes, foundation details and existing antenna loads. The proposed antennas and feedlines should also be finalized prior to performing a structural analysis.

A tower inspection is also recommended, even if only to verify the condition of the members and identify existing antennas. If tower reinforcing is required, the cost of the modifications should be carefully weighed against building a new tower so that the most economical solution is obtained. ■

John S. McKay, P.E., is a project/design engineer for LeBlanc & Royle Telecom, Oakville, Ontario, Canada.

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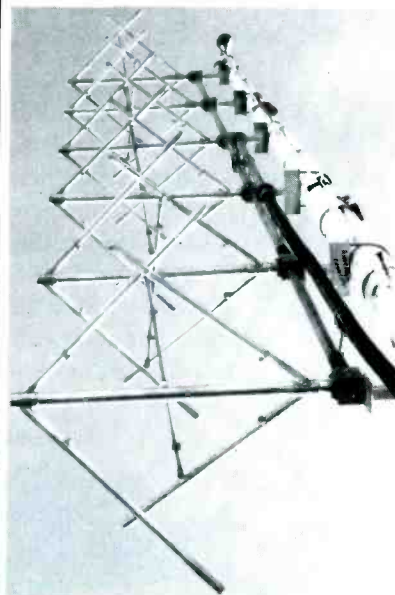
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Triax and coax camera control systems

The proliferation of broadcasting live events from such locations as stadiums, arenas, concert halls and convention centers, continues to increase the need for mobility and studio-quality video performance for field events. Today's high-quality ENG- and EFP-style cameras provide a cost-efficient alternative to placing large and expensive studio cameras in the field while providing outstanding performance. With the addition of a coax or triax camera control system, broadcasters



Telemetric's Triax TM-9250 camera control system.

can achieve the desired mobility with the ability to run extended lengths of cable between the control site and each camera location.

Cable of choice

In earlier days, standard multicore cable was used to carry all the required signals between the camera head and its base station. This severely limited the reliability and mobility of the camera due to the cable's bulky size and weight, high initial cost and the transportation expense. Multicore cable is also not easily field repairable, which presents a new spectrum of circumstances and potential problems to deal with on-location. Also, because of electrical losses, these cables cannot be run over long distances — an obvious and insurmountable disadvantage when working in large venues. The multitude of camera cables and connectors used by the different camera manufacturers also prevented the fixed installation of cables.

Because of these reasons, triax has become the standard camera cable of choice for field applications. In the field it allows users with triax adapters to interconnect cameras to base stations of any manufacturer. In

venues, such as stadiums and golf courses, the cable is permanently installed to provide substantial time and cost savings for the broadcaster. In the studio, simple patch panels are arranged to easily relocate cameras in the various set locations and provide connection to base stations in the control room.

In recognition of the importance of eliminating the multicore camera cable, a team of engineers who pioneered triax cable camera technology, at that time with Philips Broadcast, were honored with a Technical Emmy in 1992.

Recognizing the continually improving quality of ENG-style cameras and their acceptance by the broadcast industry, Telemetrics produces a full line of triax and coax camera control systems designed to adapt to these ENG-style cameras for EFP and studio camera applications. The systems provide full-featured operation over long distances using standard coax or triax cable or fiber-optic transmission systems.

Between camera and base station

In its continuing development of multiplexing systems, Telemetrics introduced the TM-9660 component triax camera control system. For broadcasters using R-Y, B-Y cameras, this system delivers operational advantages of processing component video signals, and using triax cable between the camera and its base station. Processing and transmitting component video prior to encoding results in a substantial improvement in video quality. Recording, playback, generating special effects, digitizing for transmission and video switching are also greatly enhanced with component video. In addition, component video simplifies the exchange of programming between locations using different encoding systems, such as NTSC, PAL and SECAM.

The TM-9660 provides comprehensive remote camera setup and adjustment capabilities along with video, return video, microphone audio, program audio, intercom, tally, gen-lock and power. As a result, the system outfits an ENG camera with all of the functions necessary for a live multicamera broadcast. The camera adapter is designed to directly dock to the camera body with no external jumpers.

There are several variations of the technology to choose from depending on the users specific application. For example, the TM-9250A triax camera control system accommodates cable distances up to 5,000

feet for composite signal cameras. The TM-9255A coax camera control system delivers cost-effective camera control capabilities, including power for the camera and a studio-type viewfinder for distances up to 1,500 feet. The TM-9525 dual coax/fiber system is designed to interface with fiber-optic transceivers for long-distance camera control without the use of repeaters.

Each of these systems provides the versatility to accept various transmission carriers like triax, coax, fiber and RF transmitters. This provides the user with the ability to remotely control cameras in virtually any type of field environment.

For added versatility and functionality, Telemetrics multiplex triax camera control systems are often complemented with a variety of robotic-type devices, which include pan/tilt camera mounts, linear tracks and weather-proof housings. The mating of these robotic devices to the triax system offers broadcasters the ability to capture unique video of sports and other remote events not possible with multicore-connected cameras or robotics devices.

In earlier days, standard multicore cable was used to carry all the required signals between the camera head and its base station.

Although the transmission medium often differs from user to user (triax, coax, fiber or RF), Telemetrics NTSC or PAL triax systems are widely used by broadcasters like ABC and NBC, cable stations like C-Span and independents like WJCT in Florida — as well as in stadiums, colleges, hospitals and stock exchanges all over the world.

WJCT in Jacksonville, FL, employs the TM-9250 in its studios, conference rooms and in an outdoor performing arts stage. The venues are permanently wired for multicamera shoots and are operated from a centralized location. The systems provide all camera power, control, intercom and viewfinder video through the direct-docking camera adapter. The triax systems

provide an economical means of converting high-performance CCD cameras into a triax-operated system without the expense of employing expensive high-end studio cameras. It's a perfect example of the practical, functional and cost-efficient benefits provided by triax and coax camera control technology. ■

Anthony C. Cuomo is president of Telemetrics, Inc., Mahwah, NJ.

Video compression

Continued from page 52

then the specifications for processor and co-processor architectures that meet the demands of MPEG-4 applications." If the MPEG-4 specification is ready by the 1998 deadline, according to Fellows, Emphasis expects European media companies to implement MPEG-4 as a mass market platform by "lowering the cost of MPEG-4 technology to create a critical mass of installed terminals."

At the last MPEG meeting in Chicago, held Sept. 30 to Oct. 2, the group approved work on a new standard entitled "Multimedia Content Description Interface," nicknamed MPEG-7. A working draft is expected in July 1998 with a committee draft in March 1999, followed by a draft international standard in July 1999 with specification of an international standard in November 1999. If the work stays on track, MPEG-7 would become an international standard one year after MPEG-4 attains this standing.

A point man for the MPEG-7 initiative is Fernando Pereira of the Instituto Superior Tecnico in Lisbon, who gave the keynote address at the 1996 Picture Coding Symposium in Melbourne. "Although there is still no project description for MPEG-7," Pereira says, "it may be foreseen that this project will standardize the tools for high-level indexing and description of MPEG-4-coded audio-visual information."

Compression in perspective

Name any TV delivery system — terrestrial and satellite broadcasting, microwave wireless, optical fiber, coax cable, hybrid fiber-coax, utility power line, even POT lines using twisted pairs of copper wires — and there are compression products available for video transport. Name any conventional or non-linear production house, and suitable compression products are announced and ready to ship.

Not all the bugs have been worked out, and wondrous innovations hiding behind the corner may knock current thinking for a loop, but the state of compression at the start of 1997 can be called realistically optimistic. The dream is coming true. City by city, town by town, county by county, thanks to digital compression, the United States and the rest of the world is about to have access to more information in a second than our ancestors ever had in a lifetime.

Time is money in digital transport, so investing in compression equipment increasingly makes fiscal sense. In the emerging open marketplace of digital services, the companies that can reliably compress the most content with the most quality and least signal degradation will have a competitive advantage. ■

Ken Freed is a media trade journalist specializing in cable and interactive television, and is based in Denver.

Hitachi SK2000PW camera

In 1994, the engineering staff at Maryland Public Television (MPT) decided to replace its 10-year-old tube cameras (Hitachi SK110s).

Technological considerations

Three things became clear: 1) The TV station of the future will be all-digital; 2) The 16:9 aspect ratio will replace the 4:3 aspect ratio; and 3) The camera must be upgradable to accommodate technology enhancements.



We selected Hitachi's SK2000PW digital portable production camera with switchable 16:9/4:3 capability and digital triax. Combined with digital triax and a digital camera control unit with serial digital component output, the camera provided an advantage over other manufacturers. Hitachi's

digital triax allows continuous digital transmission between the camera head and camera control unit.

Conversion

Because MPT is the fourth largest producer of programs for public television, the ability to produce, as well as broadcast, programs digitally is crucial.

With regard to TV's aspect ratio, we believe it will change from 4:3 to 16:9 within the life of our new cameras. Because today's programming will be shown for years to come, it must be available in the 16:9 format. The SK2000PW allows us to produce programming in either aspect ratio at the press of a button.

We anticipate using a 16:9 to 4:3 converter to record the same program in both aspect ratios. With the converter we will have the standard 4:3 signal to air, and at the same time, archive the same program in 16:9.

For use in the field

The cameras are being used in three production studios and will be taken into the field for production. The cameras have studio lenses, studio prompters and a studio pack with a studio viewfinder. The viewfinder can be disconnected from its cradle and a field lens and field recorder can be attached, readying the camera for the field in less than 10 minutes. This feature makes the cameras unusual because they incur no downtime.

The SK2000PW is modular, providing an easy upgrade path for technology advances. The camera head can accommodate CCDs of different densities. The design can also accommodate 12-bit A/D converters and a higher-density digital processing LSI to provide extra capability for future features.

Hitachi uses a single LSI to digitally process the RGB video. Hitachi also is the only manufacturer to offer digital triax, which offers digital transmission and an easily repairable cable.

With the Hitachi SK2000, the video stays in the digital domain after A/D conversion in the camera head through the transmission system to digital output of the camera control unit.

The SK2000PWs also provide new tools. The "flesh-tone detail" feature de-emphasizes wrinkles and blemishes. With this feature, we use detail as needed to make the set appear sharp, but natural.

The dual matrix has also eliminated subtle color reproduction differences between multiple cameras imaging the scene from different angles. This is problematic with objects that are near to yellow, magenta or cyan. The Hitachi approach allows us to use the linear matrix for optimum color reproduction and, at the same time, use the six-vector color corrector to make small changes in hue and phase of individual colors. This allows us to correct these differences for a perfect match between cameras.

Another great aid is the memory card. We store all of the set-up information and files for each studio's cameras on a removable memory card. We can then instantly restore any or all of the cameras in a studio to the exact set-up of a previous production by simply reloading the information stored on the memory card. The only adjustment we have to do to get the same look as the previous production is adjust the white balance to compensate for whatever lighting color temperature change has occurred since the previous production. ■

Tom Bohn is vice president of Maryland Public Television, Owings Mills, MD.

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

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

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

T1 over video

In late 1994, when it was decided at WHTM-TV to go stereo with SAP and PRO, decisions had to be made concerning our STL. The STL is a M/A-Com with Pac 4/5 subcarriers feeding a mono signal on 7.5MHz and ENG telemetry on 8.3MHz. Sending stereo left and right audio, SAP audio, PRO audio, ENG telemetry from the studio meant we needed from four to six subcarriers on our STL.

Intraplex multiplexing

In researching companies that make audio subcarriers for microwave, analog and digital, we discovered Intraplex. Intraplex manufactures digital T1 multiplexers and high-quality audio, voice and data modules. This T1 data signal can be applied to a microwave subcarrier, satellite, private or leased line and mobile radio. Our application is T1 over an existing microwave system. Although radio stations have been using the Intraplex idea for years, it's not widely used for television.

A TV microwave typically uses only 6 to 7MHz of the 10MHz baseband signal. Multiplexing, specifically Intraplex multiplexing, allows us to take full advantage of the microwave baseband by combining multiple audio, voice and data channels into the excess bandwidth.

The T1 signal, which has a rate of 1.544 Mb/s, is made up of 24 time slots or DSOs. Each time slot is 64kb/s long. There are also synchronization bits added to equal 1.544Mb/s. Each audio, voice and data module takes a certain amount of time slots of the T1 signal. Intraplex supplies digital audio on a T1 line, but you also need a T1 subcarrier or T1 modem to complete the system. We chose Graham-Patten Vamp DS-1 multiplex systems.

To obtain the highest-quality audio, we chose for the stereo left and right, Intraplex's PT/PR-350 program audio modules that have 16-bit coding and 64x oversampling with no digital compression. For SAP and PRO audio, we use Intraplex's PT/PR-150A program audio modules that have 16-bit coding with 4:1 digital compression using the apt-X100 coding algorithm. Both audio modules have greater than 90dB dynamic range. Each program audio module has two separate channels and performs A/D or D/A conversion on stereo or dual mono program signals of either 7.5kHz or 15kHz bandwidth. We also use the Intraplex VF-5A voice module for voice and FSK telemetry. The uncompressed program audio module takes 18 out of 24 time slots (nine per channel) of the T1 signal, whereas the

compression module takes only four time slots (two per channel). With one non-compressed and one compressed program audio module and two voice modules, we are using 24 out of 24 time slots of our T1 signal.

A T1 line is bidirectional. If you have a TSL, this T1 line can be a full-duplex circuit. Because we have a TSL, we also have 24 DSOs from transmitter to studio all on a single T1 line. In the future we would like to buy a set of compression audio modules (PT/PR-150A) to feed two channels of ENG audio back to our studio on the TSL instead of the one audio channel currently in use.

When the Intraplex system arrived at the station, we bench tested it. We couldn't hear any difference between the compressed and non-compressed signal. Using an Audio Precision portable test set, the results were impressive; they either met or exceeded the manufacturers' specifications. One of the measurements we felt was important is phase between the left and right channel — 0.4° at 15.009kHz was the worst case. We feel confident that our four audio channels at the transmitter site are transparent. Any questions we had about the setup of these modules, the engineers from Intraplex always came through with the answers. If you have a PC with a basic communications program, the multiplexer and audio modules can be set up and monitored from the RS-232 remote port. T1 is a telephone industry standard, and the technical manual, although well-written, reflects the standard. Again, the Intraplex engineers were helpful in making us T1 literate.

Because we were trying a new concept, we had some concerns about feeding all our audio signals, on one system, to the transmitter. Because of the budget of the stereo project, we couldn't buy a redundant Intraplex/Graham-Patten system. We felt we needed some type of backup audio, so we kept the original subcarrier to feed a mono signal. At least we would have audio on the air if problems arose with the digital audio system. We went on the air with the Intraplex system in May 1995 and it's been 1½ years of trouble-free operation.

We set out to get the best quality audio from studio to transmitter, with the fewest amounts of subcarriers and maintenance-free operations, with room to expand. WHTM feels that Intraplex T1 digital audio and Graham-Patten T1 modems accomplish these goals. ■

Jack Kline is assistant chief engineer for WHTM-TV, Harrisburg, PA. WHTM-TV is an Allbritton station.

new products

By Deanna Rood

News-gathering vehicle E-N-G Mobile Systems

• **OmniLink 2000:** a light-weight ENG van fully equipped for satellite and microwave transmission duties; the new turnkey system combines standard ENG functionality with high-performance SNG capabilities for analog and digital uplinks; the OmniLink is built on the Ford E-350 Super Cargo Van and does not require a special driver's license to operate.



E-N-G Mobile Systems, 2245 Via De Mercados, Concord, CA 94520;
800-662-4522 or 510-798-4060; fax 510-798-0152; eng.sales@aol.com
Circle (252) on Free Info Card

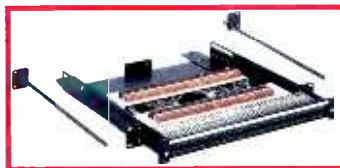
Test instrument for digital TV signal Symbionics

• **MPEG Stream Station:** an advanced test instrument for digital TV broadcasting systems; it includes conformance checks for MPEG and DVB standards and provides a powerful suite of test tools for digital TV set-top box manufacturers, multiplexer designers and digital TV broadcasters; MPEG Stream Station combines monitor, analysis, record and playback software running under Windows NT in a high-performance PC with custom hardware.

Symbionics, St. John's Innovation Park, Cowley Rd., Cambridge, CB4 4WS, UK; +44 122 342 1025; fax +44 122 342 1031
Circle (270) on Free Info Card

Audio patchbay pullout panel ADC Telecommunications Inc.

• **ProPatch pullout version:** an audio patch panel designed for truck or studio applications where front access to terminations is needed; the pull-out panel eliminates the need for rear access by sliding the jacks and terminations forward out of the rack providing access to the quick connect punchdown terminations mounted on the bottom of the tray; rear rack support bars are included to provide extra stability when the panels slide out.



ADC Telecommunications, 4900 W. 78th St., Minneapolis, MN 55435;
800-366-3891 (ext. 3475); www.adc.com
Circle (267) on Free Info Card

MPEG-2 video encoding solution Feral Industries

• **MPEGNcodR:** the first MPEG-2 product for the Feral line of digital processing and display systems; its modular design provides primary encoding solutions with the capacity to easily expand capabilities and options as user needs are identified; the MPEGNcodR delivers a video compression system that complies with MPEG-2 MP@ML standards.

Feral Industries, 9204 Bond St., Overland Park, KS 66214;
800-331-2019 or 913-492-4666; fax 913-492-5556; www.grunder.com
Circle (250) on Free Info Card

RAID-3 disk storage solution Tektronix

• **PRS200:** a storage system that is an option for the Profile professional disk recorder; developed for the "on-air" broadcast market, the PRS200 provides immunity from disk drive, power supply and fan failures while increasing the storage capacity of the Profile PDR to 96 hours of broadcast-quality video; the PRS200 system's hot swap and redundant drives, power supplies and fans virtually eliminate mechanical system failures.

Tektronix, Fourth Ave., Globe Park, Marlow, Bucks. SL7 1YD;
(01628) 403300; fax (01628) 403301
Circle (255) on Free Info Card

Punch block interfaces Leitch

• **ADC punch block interfaces:** punch block interfaces for audio routers and audio distribution amplifiers; the interfaces come prewired with umbilical cord and D25 connectors for plug-in to equipment frames offering quick interconnection for any variety of system configurations; the audio router interfaces each provide 16 I/O connections; up to eight interface modules will fit in a three-rack unit and supply as much as a 32x32 routing system; the audio DA interfaces each provide I/O for one DA and up to 10 interface modules will fit in a two-rack frame.



Leitch, 920 Corporate Lane, Chesapeake, VA 23320;
800-231-9673; fax 757-548-4088
Circle (254) on Free Info Card

Multivideo windowing system RGB Spectrum

• **SuperView 1000:** the latest product in the SuperView video windowing product line; the SuperView products display multiple live video images on a single screen; video input signals may be NTSC, PAL or S-Video, and the display screen may be any monitor or data display projector up to 1,600x1,280 pixel resolution; advanced features of the SuperView 1000 include pan and zoom, the ability to independently position and scale windows, and automatic gen-lock to a computer signal for overlaying graphics.



RGB Spectrum, 950 Marina Village Parkway, Alameda, CA 94501; 510-814-7000; fax 510-814-7026
Circle (263) on Free Info Card

Digital audio recorder ▶
Sony Electronics

• PCM-7040: a new addition to the PCM-7000 series of digital audio recorders that replaces the PCM-7030 and PCM-7050 recorders; the PCM-7040 supports a wide range of DAT recording and editing functions including a time-code reader/generator, digital I/O, memory start, RS-232C interface and edit memory; the start ID level sync function enables users to write a start ID automatically at a point where sound arises from a period of silence to above a selectable audio level, while an internal time-of-day, clock and date function allows for the automatic time-stamping of recordings (this date and time data can later be read from the tape on any PCM-7040).

Sony Electronics, 1 Sony Dr., Park Ridge, NJ 07656; 800-635-SONY or 201-930-7834; fax 201-358-4058
Circle (256) on Free Info Card



3-CCD broadcast-quality camera ▼
Thomson Broadcast Systems

• Microcam: a compact 3-CCD broadcast-quality camera; the Microcam is derived from the 1657, basically consisting of a 1657 camera modified so that the scanning block (splitter-sensor array) can be detached from the image processing section of the camera and mounted separately, resulting in a particularly small lens/scanning assembly; the Microcam provides all the features of a studio camera.



Thomson Broadcast Systems, 17 rue de Petit Albi, BP 8244, F-95801 Cergy St. Christophe France, +33 1 3420 7000; fax +33 1 3420 7047
Circle (265) on Free Info Card

Rack systems clear legal and safety standards for power distribution

Equi=Tech ▶

• **Balanced Power AC systems:** Equi=Tech's Balanced Power AC systems have received ETL listings, meaning that the units now meet or exceed recognized standards of safety and legal liability as certified by Electrical Testing Laboratories of Cortland, NY; the Balanced Power AC systems eliminate hum and buzz in audio and video systems caused by AC power supply transients and interference.

Equi=Tech, 18258 Redwood Hwy., Selma, OR 97538; 541-597-4448; fax 541-597-4099; www.equitech.com
Circle (257) on Free Info Card

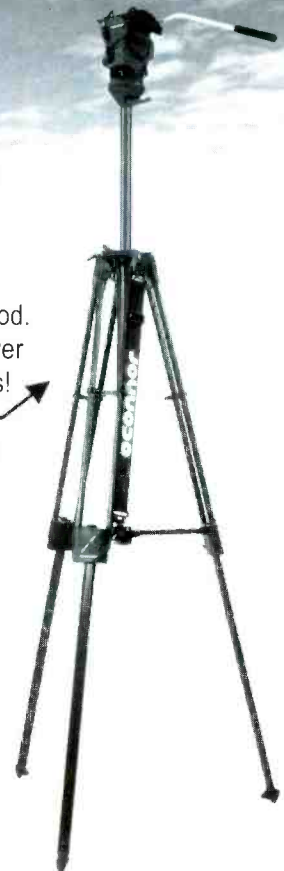


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new products

Analog mastering tape

Quantegy

• **Quantegy 408:** tape designed specifically for the Nagra portable analog field recorder; Quantegy 408 is designed to perfectly match the technical performance specifications of the Nagra portable recorder; the tape is based on the family of 406/407 tape products with additional cleaning and rewinding steps during manufacturing; the tape has significantly improved packing and tensioning characteristics and features a wide dynamic range, low distortion and high fidelity.

Quantegy, 401 Westpark Court, Suite 110, Peachtree City, GA 30269; 770-486-2800; fax 770-486-2808

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MPEG-2 4:2:2 support for Profile PDR

Tektronix

Tektronix plans to support enhancements to the Profile Professional Disk Recorder by adding MPEG-2 4:2:2 profile capability to its existing Profile PDR product line; the board set provides the flexibility to encode and decode MPEG files at data rates from 4Mb/s to 50Mb/s; the Tektronix implementation will support encoding and decoding of MPEG-2 Main Profile@Main Level for distribution quality and the 4:2:2 Profile for contribution quality.

Tektronix, P.O. Box 500, Beaverton, OR 97077; 800-547-8949; fax 503-627-7275

Circle (259) on Free Info Card

DV/DVCPRO acquisition format integrated with ASC's NLE

ASC Audio Video Corporation

The VR NLE non-linear editing systems will be configured to support DV/DVCPRO platforms; the integration of the DV/DVCPRO acquisition format will enable editors to take full advantage of high-quality digital tape that transfers 60 minutes of video in 15 minutes, and editing on a VR non-linear NT-based system can begin immediately; when further integrated with a VR server, users have simultaneous access to shared media and the ability to ship an edited story via shared drives to a VR for instant replay.

ASC, 3816 Burbank Blvd., Burbank, CA 91505; 818-843-7004; fax 818-842-8945

Circle (260) on Free Info Card

Digital sync generator

Philips TV Test Equipment

• PT 5210: an innovative digital sync generator that operates as a master or a slave sync generator not only in traditional analog setups, but also in mixed analog/digital setups and in completely digital setups; the PT5210 series consists of several standard configured sync pulse generators, as well as additional, optionally available functions; the standard configurations selected cover most basic applications and for more specialized requirements, optional units are available.

Philips, P.O. Box 80025, Bldg. TQ III-2 5600 JZ Eindhoven, The Netherlands;
+31 40 278 2099; fax +31 40 278 8256
Circle (261) on Free Info Card



Chase-lock-capable DAT recorder

Fostex

• D-15: a digital master DAT recorder with full time-code functionality, including optional chase-lock capability; the full-featured D-15 offers significantly improved functionality, including an extremely intuitive graphical user interface.

Fostex, 15431 Blackburn Ave., Norwalk, CA 90650; 310-921-1112;
fax 310-802-1964

Circle (262) on Free Info Card



Agile demodulators

Videotek

• D-145: a 154-channel, agile, cable-ready, high-performance demodulator that lends itself to the monitoring of broadcast and cable channels; some features include synchronous detection, two baseband video outputs and simultaneous SAP and stereo audio outputs.

• DM-192: a 192-channel, agile, cable-ready, high-performance demodulator that lends itself to the monitoring of broadcast and cable channels; with its synchronous or envelope detection (front-panel selectable), it is suitable for FCC proof-of-performance testing.

• DM-141A: an agile, stereo, cable-ready TV demodulator; the unit receives the "off air" or CATV signals, processes the signals and provides two buffered composite baseband video outputs; additionally, the DM-141A provides balanced stereo audio, which may be monitored via the front-panel speaker.

Videotek, 243 Shoemaker Rd., Pottstown, PA
19464-6433; 800-800-5719 or 610-327-2292;
fax 610-327-9295

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Complete systems approach for IFB via the PRO Channel

Modulation Sciences Inc.

• PRO channel equipment: the PCG-II PRO channel generator and the new PRO-II PROceiver are designed to be used as a system to allow stations to take full advantage of the new features; with the PCG-II and the PRO-II, stations can benefit from unique selective calling, main channel pushdown and shaped audio; the new features are possible through the use of time-tested, two-way industry-standard CTCSS, which provides for up to 16 unique addresses (CTCSS is also known by its Motorola Trademark, PL.); the PRO-II is a non-intercarrier TV aural receiver that ensures reliable detection of the PRO channel; it extends the coverage of the PRO channel beyond that of conventionally (intercarrier) recovered signals and extends the coverage of main channel aural, as well.

Modulation Sciences Inc., 12A World's Fair Dr., Somerset, NJ
08873; 908-302-3090; fax 908-302-0260

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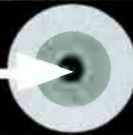
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new products

Router Works software upgrade

Leitch

• Router Works version 3.0: an improved version of the routing system control software available free to all existing Leitch Router Works customers; the Windows-based program offers an intuitive, easy-to-use set of applications for configuring, monitoring and controlling a routing system; the flexible software allows users to program complex source and destination names, as well as providing different options for controlling a single or a large multilevel routing system.

Leitch, 920 Corporate Lane, Chesapeake, VA 23320;
800-231-9673; fax 757-548-4088

Circle (253) on Free Info Card

Digital video microwave links

NUCOMM

• FT6/FR6 series: a series of dual digital/analog STL microwave transmitters and receivers; they can handle analog video signals with up to six audio subcarriers, as well as being able to separately link FSK, QAM and QPSK digital signals up to 45MB; each transmitter and receiver, together with the respective modulator and demodulator, are housed in a two-rack space, 19-inch drawer.



Nucomm, 101 Bilby Rd., Bldg. 1, Hackettstown, NJ 07840;
908-852-3700; fax 908-813-0399

Circle (266) on Free Info Card

Broadcast still-store

Spencer Technologies Inc.

• SS-2000: a broadcast still-store designed specifically for TV news that also meets the needs of production with its built-in linear keyer and a DVE; an on-air control panel makes it easy to use and it networks with paint systems, character generators, news services, etc.; the dual preview channels still searches without disrupting on-air playback.



Spencer Technologies, 4000 W. Magnolia Blvd., Unit L, Burbank, CA 91505; 818-840-0907; fax 818-840-8375;
104067.321@compuserve.com

Circle (268) on Free Info Card

DVD video encoding solution

Minerva Systems

• Compressionist 250: a commercial solution for the creation of high-quality digital video disk video assets; based on the C-Cube Microsystems' VLSI processors, the Compressionist 250 offers constant bit rate and variable bit rate MPEG-2 encoding technology combined with Minerva's unique video pre-processing and control software tools; Minerva's DVD encoding system also supports leading third-party AC-3 and MPEG-2 audio encoders and DVD authoring and disk formatting tools.

Minerva Systems, 3801 Zanker Rd., San Jose, CA 95134-1402;

800-806-9594 or 408-487-2001; fax 408-487-2013;

info@minervasys.com; www.minervasys.com

Circle (264) on Free Info Card

Continued from page 75

possible to accurately determine the elevation.

Remember, the FCC says that elevations from a 7.5-foot topographic map are acceptable as are elevations from a GPS receiver. (See the instructions for FCC Form 854.) The trick here is to use a GPS receiver that has that type of accuracy. The little hand-held unit that you use on your fishing boat probably isn't good enough. Without differential correction, a GPS receiver may be in error by +/-150 feet horizontally and 1.5 times that value vertically. Differential correction is accomplished by receiving signals from either a Coast Guard beacon or other correction source. Those signals are used to eliminate the "dither," which is purposely introduced into the satellite signals by the Department of Defense to protect us from the terrible "red menace." Another little problem exists in that the correction data is only accurate at the point where it's generated. The system accuracy then is partly a function of how far away from the location of the differential transmitter it is to the point of measurement.

It has previously been stated that the method of determining the latitude and longitude should be accurate to the nearest tenth of a second. That still seems to be a reasonable number. To round accurately to the nearest tenth of a second, the measurement method needs to be more accurate than the final result. That is, you need to know if the actual value is greater than 0.05 seconds or

less. Otherwise, you may be rounding the wrong way. It's safe to assume that USGS has accurately located your towers on a 7.5-foot topographic map and it's possible to obtain the required accuracy in measurements from the map.

With regard to those offering to provide the measurement service, use care in establishing their credentials. Some fine companies have the proper experience and equipment to provide data well within the required accuracy. Be careful when dealing with would-be experts who happen to have a GPS. Just because a device generates numbers doesn't mean that those numbers have value. In a like fashion, don't let yourself be taken advantage of by this process either. If the cost becomes more than \$1,000 for a single tower, you are being had.

Finally, don't simply copy the height and location from an old license document. The purpose of this whole exercise is to attempt to generate an accurate database. Simply resubmitting old data defeats that purpose. It also opens the station to a fine for submitting false data. This can also be a real problem when it comes time to modify or sell the station in the future. Have the numbers determined accurately and get all of the station paperwork in proper order. ■

Don Markley is president of D.L. Markley & Associates, Peoria, IL.

Frezzi Means Portable Lighting



Model: MFA-NP1HC
compact HMI light



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Frezzi
ENERGY SYSTEMS

5 Valley Street, Hawthorne NJ 07506
Tel: 201-427-1160 Fax: 201-427-0934

Circle (45) on Free Info Card

industry briefs

BUSINESS

COMARK Communications, Southwick, MA, and **NBC**, announced a strategic agreement under which NBC will purchase COMARK equipment and services for its current and future owned-and-operated stations.

Dielectric Communications, Raymond, ME, signed an agreement with **Cox Broadcasting**, Atlanta. Under terms of the agreement, Cox will purchase antennas, transmission line and RF components for DTV and NTSC from Dielectric.

Vinten TSM, Valley Cottage, NY, announced a name change to **Vinten Inc.** The change affects the company's name only. Officers, sales and service personnel continue to have the same operational and marketing responsibilities for all Vinten products in North and South America. For added customer convenience, a toll-free number, 1-800-4-VINTEN, was announced and the national sales manager, Gary Rotondelli, can be reached by E-mail at CompuServe #105223,2742.



Rees Associates, Dallas, recently completed architectural and engineering design services for KPRC-TV, Houston.

Sony Electronics, Montvale, NJ, announced a 30% reduction in the suggested list price on its entire line of MPEG-1 encoders.

Also, Sony is taking its new integrated digital video production system on the road for a tour, which will offer end-users a first look at Sony's entire DVCAM line. Dates include: 1/22-23, Houston; 1/28, Salt Lake City; 1/30, St. Louis; 2/5-6, Kansas City; 2/12-13,

Denver; 2/18, Tulsa; 2/20, New Orleans; and 2/25, Oklahoma City. For more information on specific dates and locations, call 1-800-686-SONY.

Canon USA, Lake Success, NY, received a 1996 Emmy for "Outstanding Achievement in Technical/Engineering Development," specifically for "Implementation of Lens Technology to Achieve Compatibility with CCD Sensors."

Scientific-Atlanta is offering a variety of multilevel technical training courses during the first half of 1997 on broadband systems and technologies. For more information call 1-800-722-2009 and press "3" when prompted; visit Scientific-Atlanta's web site, www.sciatl.com and click on "customer training" or circle number (201) on the Free Info Card.

PEOPLE

Kenneth Tankel joined Pro-Bel, Ltd., a subsidiary of Chyron Corporation, Melville, NY, as manager of U.S. engineering support.

Also from Chyron, **Kathy Bienz** was named product manager for Pro-Bel products.

Additionally, **Matt Allard**, was named product manager for graphics products and **Bill Reinhart** was promoted to general manager of dealer distribution and sales.

Amy Huson was promoted to vice president of marketing and customer service for Orban, San Leandro, CA.



Stephen Tullo was named Northeast area sales manager for Pesa Switching, Huntsville, AL.

Also from Pesa, **Ron Chubb** was named Northwest area sales manager.

Eric Shea was appointed national sales manager for Digitech, Sandy, UT.



Kelly Odgers joined McKibben Communications, Los Angeles, as director of operations.



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Continued from page 32

4Mb/s each; a standard definition sports channel at 6Mb/s and/or Internet pages at 4Mb/s. That range of services will occupy about 19Mb/s leaving approximately 1Mb/s for the overhead of service and network information. These examples are illustrative and error-correction and audio must be taken into consideration.

New competition

This agreement has the potential to be used as an entry by the computer industry with non-compatible broadcasting services. It opens the door for direct audience access for additional content providers and producers.

All consumers will be affected by this agreement. It will impact how the receiver manufacturers design and build the digital sets. It will affect the direction of the computer industry as they build new desktop computers and even portable laptops.

The TV receiver, even as we know it today, will change as a result of new display technology. The Plasma Display Panel (PDP) technology is now coming to the market. As opposed to today's receivers, large flat-panel displays will have a significant impact on the way TV pictures are viewed. By the time digital TV broadcast service is introduced in the United States, a 40-inch high-definition panel will be available.

Consumers who purchase the first-generation digital TV receivers will not only have access to the digital high-definition television with six channels of surround-sound digital audio, but will also have access through a modem to the information superhighway.

The estimates remain fairly solid that initial costs for the receivers will be from \$1,500 to \$2,000. These new receivers, aside from receiving TV signals, are digital receivers with powerful digital processors. They will have capabilities similar to personal computers. Modems today are

PROGRAM TYPE	MAXIMUM VIDEO RATE (Mb/s)	AVERAGE VIDEO RATE (Mb/s)	AVAILABLE FOR SERVICES
HDTV (1080 LINES) - SPORTS	18.0	14-15	4-5
HDTV (1080 LINES) - NEWS	16.0	12-13	6-7
HDTV (1080 LINES) - MOVIES	14.5	10-12	7-9
HDTV (1080 LINES) - SITCOM	15.0	10-13	6-9
EDTV (720 LINES) - SPORTS	15.5	12-14	5-7
EDTV (720 LINES) - MOVIES	6.5	4-5	14-15
SDTV (480 LINES/WIDE SCREEN) - SPORTS	8.0	5-7	12-14
SDTV (480 LINES) - NEWS	5.0	3-4	15-16
SDTV (480 LINES) - MOVIES	3.0	1.5-2.0	17-17.5
BUSINESS VIDEO (240 LINES)	1.5	0.5-1.0	18-18.5

Table 1. Use of the data space for digital television. These are estimates only based on limited samples of converted material. The maximum video rates in megabits per second do not include audio and control data requirements.

hardly more than a single semiconductor chip, probably a part of all of the digital TV receivers.


This is probably the primary reason the computer industry is so interested in being a part of this revolutionary industry. The Grand Alliance System will interface cleanly with wired NII media, particularly with a switched network environment. The DTV standard will be the broadcast part of the NII.

What next?

The race has begun. There will be a paradigm shift in the way television is viewed. Consumers will have to be won over in order for the

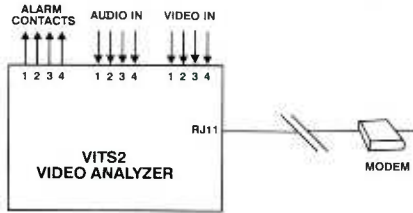
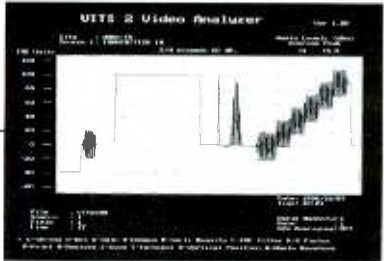
technology to be widely accepted. The change from analog to digital will be traumatic for more than just the TV industry. The chairman of the FCC, Reed E. Hundt said: "Everything will be different. The change is so extreme that many people have not grasped it." Now the tables turn and the next step in DTV implementation, and probably the future of broadcast television, is in the hands of the TV manufacturers. ■

Louis Libin is director of technology for NBC, New York.



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MILLER Fluid Heads and Tripods

The silky, smooth action of each Miller Fluid Head is the product of the finest quality cast and machined parts functioning together in a fluid environment. They are engineering masterpieces, built to operate under extreme conditions. They're engineered to exceptionally fine tolerances and their mechanisms are protected effectively against ambient moisture and dust.

Miller 20 - Series II Fluid Head

- Dynamic fluid drag control
- Sliding quick release camera platform
- Weighs 4 lbs. - handles up to 22 lbs
- Counterbalance system compensates for nose heavy or tail heavy camera configurations and permits fingertip control of the camera throughout the tilt range.
- Includes independent pan and tilt locks, bubble level, dual pan handle carriers and integrated 75mm ball levelling

Miller 25-Series II Fluid Head

- 100mm ball level fluid head
- Robust, lightweight, low profile design
- Quick release camera platform
- Weighs 7lbs - handles up to 25 lbs.
- Multi-step fluid drag system and integrated counterbalance system provide ultra-smooth, repeatable pan-and-tilt fluid control and fingertip camera balance for ENG camcorders, industrial CCD cameras or small studio cameras



#601-Lightweight Tripod

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

#649-2-Stage Tripod

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

System 20 #338—Miller 20 Head, 601 Lightweight Tripod, On Ground Spreader
System 20 ENG #339—Miller 20 Head, 649 2-Stage Aluminum, On Ground Spreader
System 25 #500—Miller 25 Head, 611 Lightweight Tripod, On Ground Spreader
System 25 ENG #502—Miller 25 Head, 641 2-Stage Aluminum, On Ground Spreader



JVC DIGITAL S BR-D80/BR-D85

Digital Editing Recorder / Digital Editing Recorder with Pre-Read

Affordable, broadcast quality digital video is here. Digital-S reproduces images that not only are superior to any analog or digital 4:1:1 format but rival even the highest priced digital systems. It combines the robustness and reliability of a 1/2-inch format with 4:2:2 component processing and very mild compression to achieve and sustain excellent quality through multi-generation dubbing.

Broadcast Quality Digital Video

- 4:2:2 digital component processing adds richness and warmth unobtainable with lesser systems. Plus, only 4:2:2 stands up to the rigors of sophisticated chroma-keying, multi-generational editing, special effects, blue-screen compositing, matting, ATV up/down conversion, and multiple transconversion between compression systems.
- Mild 3.3:1 compression reproduces the finest color details while minimizing artifacts. Digital S pumps out horizontal resolution of 540 TV lines. S/N ratio is 55dB
- Audio is recorded by 2-channel, 16-bit PCM signals with a sampling frequency of 48kHz. PCM audio channels can be edited independently.
- Standard analog inputs/outputs provide outstanding performance for most applications. When virtually perfect dubs are required, the BR-D85 offers a serial digital interface. The one true digital video standard today, SMPTE 259M permits long cable runs and is used for direct connection to digital switches, disk-based recorders and digital tape recorders. (Optional with the BR-D80).



Robust 1/2-inch Format

- They achieve super-high image quality using a robust, 1/2-inch metal particle cassette tape. The cassette housing has a dust-proof structure to increase tape life as well as your images. 1/2-inch format also offers an extra wide track-width of 20 microns for improved stability and reliability.
- Has powerful error correction circuitry that not only replaces data in the unlikely event of a tape dropout but continues to play back a picture even with a clogged head.

Digital Editing

- Equipped with variable slow motion which can be accessed by standard editing commands. Smooth and noiseless, the image quality of slow motion is equal to regular playback and is available within a range of ±1/3X.
- Longitudinal tracks include two auxiliary audio (cue) tracks and a control track for tracking purposes. Cue tracks provide easy location of edit points which can be heard at any tape speed.
- Because of its linear control track, Digital-S has a short lock-up time which eliminates long pre-rolls. This feature achieves a stable picture faster, saving precious editing time.
- Auxiliary video (sub-code) area stores two selectable uncompressed lines of video. Suitable for recording closed caption or other information located in the vertical blanking interval.

PRE-READ EDITING (BR-D85 Only) Previously an exclusive feature of very high-end digital systems, video pre-read enables the recorder to first play back the digital signal on the tape, before recording a new signal in its place. Operable with either digital or analog signals, pre-read lets you perform layering and A/B roll editing with only two VCRs, instead of three.

GY-X2B 3-CCD S-VHS Camcorder



- Newly designed three 1/2" CCD image sensors deliver 750 lines of horizontal resolution and SuperB signal-to-noise ratio of 62dB
- Micro-lets technology provides exceptional sensitivity of F8.0 at 2000 lux and LoLux mode lets you shoot with almost no light! Shoot superb footage with excellent color balance at a mere 1.5 lux
- Variable Scan allows flicker-free shooting of a computer screen
- Full Time Auto White circuit lets you move from incandescent to fluorescent to outdoor lighting without changing white balance or the filter wheel
- Quick Record Mode - when turned on the camera is set to the auto iris even if lens is set at manual. Also activates Automatic Level Control and Extended Electronic Iris which provides both variable gain and variable shutter. Shoot continuously from dark room to bright outdoors without having to adjust gain, iris or ND filter.

- Dual output system allows camera output to be connected directly to an external recorder.

KY-27C 3-CCD Color Video Camera



- New 2/3-inch broadcast-quality 380,000 pixel CCDs with advanced electronics deliver resolution of 800 horizontal lines and reduced smear
- High sensitivity of F9.0 at 2000 lux allows a truly usable minimum illumination of 1 lux with JVC's exclusive LoLux dual pixel readout sampling technique
- LoLux mode allows shooting scenes that were previously impossible due to insufficient lighting. CCDs are maximized for low light sensitivity equivalent to an electronic gain of 24dB, then the dual pixel readout system is added which provides an additional 6dB. Together they provide +30dB without the noise and picture degradation normally associated with this much gain.
- Signal-to-Noise ratio of 63dB assures virtually "noise free" images
- Auto knee circuitry extends a scene's light to dark dynamic range reproduction by up to five times without overexposure.
- Has large 1.5-inch viewfinder with 600 lines of resolution and SMPTE color bars. Status system provides audio levels, accumulated or remaining recording time, VTR operation, battery voltage and camera setup. Zebra pattern indication and safety zones with a center marker are also provided.
- Variable scan function enables a precise shutter speed from 1/60 to 1/196.7 of a second in 256 increments to be set, matching a computer's scan rate. Almost any computer display can be clearly recorded.
- Camera head allows direct input of genlock signal and timing adjustment. A wide range optional remote controls, RS-232 interface, multicore and triax CCD's are available.
- Docks directly to the JVC BR-S422U, BR-S411UB and BR-S420CU professional S-VHS recorders. Optional adapters for docking to Hi-8 and Betacam SP are also available.



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

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. All heavy-duty two-stage tripods have a folding tripod handle.

NEW! Sachtler CADDY Systems

Now Sachtler quality is available to low budget users. The price of a CADDY system includes the new 7-step dampened CADDY fluid head, ultralight but rugged carbon fiber tripod, lightweight spreader and either a soft bag or cover. The CADDY fluid head features an adjustable pan arm, 7 step adjustment for quick counter balance and the self-locking Sachtler Touch and Go System.

CAD 01

- Single-Stage ENG Carbon Fiber System:
- CADDY Fluid Head
- ENG Single-Stage Carbon Fiber Tripod
- SP 100 Lightweight Spreader
- Transport Cover 100

CAD 2A

- 2-Stage ENG Carbon Fiber System:
- CADDY Fluid Head
- ENG 2-Stage Carbon Fiber Tripod
- SP 100 Lightweight Spreader
- Soft padded ENG Bag

Vinten

Vision SD 12 and SD 22 Pan and Tilt Heads with Serial Drag

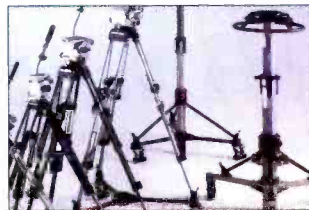
The Vision SD 12 and SD 22 are the first heads with the "Serial Drag" pan and tilt system. The system consists of a unique, permanently-sealed fluid drag and an advanced lubricated friction drag. Now you can achieve the smoothest pans and tilts regardless of speed, drag setting and ambient temperature.

- 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 excellence" whip pans
- Consistent drag levels in both pan and tilt axis
- Flick on, flick off pan and tilt caliper disc brakes
- Greater control, precision, flexibility and "touch"
- Touch activated, time delayed illuminated level bubble
- Working conditions from as low as -40° up to +60°C
- SD 12 weighs 6.6 lbs and supports up to 35 lbs
- SD 22 weighs 12.7 lbs and supports up to 55 lbs

Vision Two Stage ENG and LT Carbon Fibre ENG Tripods

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

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



Vision 12 Systems

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

SD-12A System

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

SD-12D System

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

Vision 22 Systems

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

SD-22E System

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

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Panasonic Broadcast & Television Systems



AG-DP800H UPERCAM S-VHS 3-CCD Digital Signal Processing Camcorder



- Three high-density 380,000 pixel CCDs with half-pitch pixel offset achieves over 750 lines of horizontal resolution, a S/N ratio of 60dB and remarkable sensitivity of f8 at 2000 lux. Additionally the Frame Interline Transfer (FIT) CCDs minimize vertical smear, so you maintain impressive picture quality even in very bright illumination.
- Digital Signal Processing circuitry provides four valuable benefits:
 - 1) Consistently reliable up-to-spec performance
 - 2) Fine adjustment of a wide range of parameters
 - 3) Memory storage and instant recall of specific settings
 - 4) More flexible and higher quality image processing, as well as easier maintenance
- In addition to regular AGC (Automatic Gain Control), Supercam has a Super High Gain Mode. At F1.4 this enables shooting under illumination as low as 2 lux while retaining detail and color balance.
- Synchro Scan function allows flicker-free shooting of computer monitors. Electronic shutter increments can be set variably from 1/61 seconds to 1/253 of a second.
- Built-in internal time code generator lets you record with SMPTE LTC/VITC (Longitudinal/Vertical Interval) time code
- Two hi-fi stereo audio channels with a dynamic range of 80 dB, as well as two linear audio channels with Dolby NR. Normal/Hi-Fi recording is selectable. Uses XLR connectors to further ensure high-quality sound.
- Has a 26-pin connector on the back that outputs a composite or component video signal. This enables convenient backup recordings using an additional VCR equipped with a 26 or 14-pin connector
- Phantom power can be supplied to an optional microphone. Power can be switched off to prevent battery drain when not in use.

**Purchase a Panasonic AG-DP800H UPERCAM
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NRG POWER VEST SYSTEM

The Power Vest combines the comfort and convenience of a photo-journalist style vest with the power of NRG's highest capacity power belt. Available in two styles, the **Field** model is designed for use in a field production environment, while the **Event** model is for shooting events where style is everything. The Field model is ruggedly constructed from black high density weatherized ballistic nylon and has an open-cut style that makes it comfortable to wear in a variety of climates. Also has a highly adjustable design to fit almost any physical proportion.

- Internal and external pockets for blank tapes and accessories. A clear insert window for a press pass or business card, D-rings for cables and microphones, and an integral padded camera rest on the right shoulder.
- Cleverly concealed inside the vest is your choice of 12-volt 96 watt hour or 13.2-volt 95 watt hour nicad cell packs.
- A control box on the front features dual power outputs (dual cigarette, dual XLR or mixed).
- 7-stage "fuel-gauge", charge status indication and auto reset short-circuit protection.



The **Event** model is very similar to the **Field** except in place of rugged fabric and pockets it features shoulder to sternum black satin lux fabric. Worn under a suit coat, the **Event** model is indistinguishable from a formal dress vest and it still retains interior and low exterior pockets. Both vests include 300-series charger (12 hrs.) and can be used with the optional Inteliquick Fast Charger (2 hrs.).

POWER CAN SERIES

For powering single or multiple pieces of 12V DC equipment for extended periods of time, nothing beats the power and convenience of NRG's Power-Can Series. It integrates an ultra-high capacity, high-discharge-capable UPS type lead acid power cell, a world-wide fast charger, and a computer-controlled monitoring system with display—in a single, rugged package. Connect up to four pieces of equipment simultaneously. From a midnight emergency scene to a wedding reception in the park, the Power-Can delivers ample power for extended running time.

- Recharge in 8-10 hours by simply plugging the Power-Can into any source of AC power (90-250V AC).
- LCD display shows discharge/charge status, voltage etc.
- An optional "Power Dolly" allows the Power-Can to be rolled for easy transport.

Available in 18, 28 and 40 amp versions, each Power-Can has either four cigarette lighter connectors, four 4-pin XLR connectors or two of each.



HORITA BSG-50 Blackburst/Sync/Tone Generator

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

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

*269

CSG-50 Color Bar/Sync/Tone Generator

Generates full/SMPTE color bars, blackburst and composite sync signals.

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

*349

- WE STOCK THE FULL LINE OF HORITA PRODUCTS INCLUDING:
- WG-50 Window Dub Inserter
 - TRG-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
 - RCT-50 RGB Test Signal Generator
 - FG-50 Serial Control Timer "Industrial" CG
 - SCT-50 Time-Date Stamp, Time Code Captioning Safe Area, Convergence Pattern and Oscilloscope Line Trigger and Generator



Canon

IF+ Series 1/2-inch and 2/3-inch Zoom Lenses

Canon's IF+ family of lenses are engineered to meet the needs of the next generation of broadcasting while meeting the standards of today. Besides having the widest wide angle lens available, the IF+ lens series have wider angles at shorter M.O.D. (Minimum Object Distance), provide higher MTF performance and incorporate Hi-UD glass for reduced chromatic aberration. In addition to superb optics they're all designed with Canon's "Ergonomic Grip" for fatigue-free shooting over an extended time. IF+ lenses are your assurance of unsurpassed quality and performance for today and tomorrow.



J15ax8B

A next generation internal focusing lens with the shortest MOD and widest angle of any standard lens, the J15ax8B IRS/IAS is a standard ENG lens that lets you shoot in tight or restricted areas at the closest minimum object distance ever possible and capture more of the subject. It incorporates all the great features of IF-lenses including a built-in 2X extender, high MTF performance, Hi-UD glass, square lens hood and Canon's "Ergonomic Grip".

J20ax8B IRS/IAS

Excellent for ENG, sports and production, the J20ax8B IRS/IAS lets you squeeze in shots from 8mm and still take you all the way out to 320mm with its built-in extender. Incorporates all IF+ features, plus is the only lens (besides the J9ax5.2B IRS/IAS) with aVari-Polar lens hood, enabling rotation of attached filters

Anton/Bauer

Logic Series DIGITAL Gold Mount Batteries



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

DIGITAL PRO PACS

The Digital Pro Pac is the ultimate professional video battery and is recommended for all applications. The premium heavy duty 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

GOLD MOUNT BATTERIES

Logic Series Gold Mount batteries are identical to the respective DIGITAL versions with respect to size, weight, capacity, IMPAC case construction, and application. They are similarly equipped with micro-code logic circuits and complementary ACS sensors. They do not 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)
- TRIMPAC 14 NICAD BATTERY (14.4v 40 Watt Hours)
- TRIMPAC 13 NICAD BATTERY (13.2v 36 Watt Hours)
- TRIMPAC 14 NICAD BATTERY (14.4v 40 Watt Hours)
- COMPAC 13 NICAD BATTERY (13.2v 36 Watt Hours)

InterActive 2000 Power/Chargers

A new generation of portable power systems, the InterActive 2000 Power/Charger series was designed from the ground up to offer unprecedented flexibility and economic expansion capabilities. Fully compatible with all current and future Gold Mount batteries, the InterActive 2000 Power/Chargers deliver all the advancements and proven reliability of interactive charging plus the ability to power a camera from AC mains. They also offer a unique, totally modular design that allows economical expansion to meet future needs. Starting with a base model, upgrades can be easily added at any time. With an unparalleled combination of value and features, the InterActive 2000 Power/Charger system redefines the standard of power for video applications.

Standard Features on all InterActive 2000 Power/Chargers

- Two or four position models each with the full complement of InterActive technologies (see previous page) including: Automatic balance and rejuvenation, Lifesaver Maintenance, Cold battery safety and Power Loss Memory modes
- They have a slim, lightweight design for easy portability. The 2702 and 2401 Quad Power/Chargers fit easily in a notebook computer carrying case and the 2701 and 2401 Dual Power/Chargers weigh just 2.3 pounds. Plus, they include power supplies, so you can leave your AC supply behind!
- Built in regulated DC power supply output powers cameras from AC mains worldwide. Wide range (90-260 volts AC, 50/60 Hz) input automatically adapts to any worldwide source
- Standard serial output for printer and PC interface.
- Two power choices for optimized performance and economy.
- LCD automatically displays critical battery and charger data.
- Expanded communications with Digital Batteries and new charging protocols improve charge times and performance.
- Modular design allows addition or upgrades after purchase.
- A charge position expansion port allows the addition of expansion charge modules to increase charge capability to four, six or eight batteries, including NP and BP-90 types.
- Optional Diagnostic/Discharge module featuring automatic calibration of digital batteries is available for each model. (standard on Quad 2702)
- Power supply upgrade allows 40 Watt (2400 series) to be upgraded to 70 Watt (2700 series) capability

QUAD 2702/2401

Four-Position Power/Chargers

The 2401 and 2702 are the lightest (and slimmest) full featured four position chargers ever available. Designed for the rigors of professional use, they can fast charge four Gold Mount batteries and can be expanded to charge up to eight. They also power any camera/camcorders from an AC main all in a package the size of a notebook computer and weighing a mere 4 lbs (1.8 kg)! The 40 watt (upgradeable to 70 watt) 2401 will charge ProPac batteries in two hours and TrimPac batteries in one hour. Add the Diagnostic/Discharge module and the QUAD 2401 becomes an all purpose power and test system with its standard LCD providing instant access to battery status. The 70 watt QUAD 2702 bundles the complete package of all the Power/Charger features in the ultimate professional power system.



Dual 2702/2401 Two-Position Power/Chargers

The DUAL 2701 (70 watt) and 2401 (40 watt) are sleek, rugged and economical two position Power/Chargers that have all the features of Anton/Bauer InterActive 2000 technology including DC camera output and an LCD display that shows the status of each battery as well as the internal battery data communicated from Digital Batteries. The high performance DUAL 2701 will charge any Gold Mount battery in one hour; the DUAL 2401 charges ProPac batteries in two hours and TrimPacs in one hour. Their compact, lightweight package design makes them the ultimate travel Power/Chargers. They can also be upgraded with the Diagnostic/Discharge Module and/or with the Expansion Charge Modules to charge up to six batteries of any type.



PROFESSIONAL VIDEO TAPE



Professional Grade VHS		
PG-30	2.29	PG-60 2.49 PG-120 2.69
Superior Grade Double Coated VHS		
SG-30	3.39	SG-60 3.99 SG-120 4.49
H471S S-VHS Double Coated		
ST-30	6.99	ST-60 7.49 ST-120 7.99
M221 Hi 8 Double Coated		
Metal Particles		Metal Evaporated
P630HMP	4.99	E630HME 8.39
P660HMP	6.49	E660HME 10.49
P6120HMP	8.49	E6120HME 13.99
M321SP Metal Betacam (Box)		
05S	17.95	10S 18.49
20S	19.95	30S 22.95
60L	31.95	90L 49.95

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P/I PLUS Expitaxial VHS		
T-30 Plus	1.69	T-60 Plus 1.99 T-90 Plus 2.09
T-120 Plus		2.19 T-160 Plus 2.69
HGXT-PLUS Expitaxial VHS (Box)		
HGXT-60 Plus	2.69	HGXT-120 Plus 2.99
HGXT-160 Plus		3.99
BQ Broadcast Quality Expitaxial VHS (Box)		
T-30 BQ	5.49	T-60 BQ 6.19 T-120 BQ 7.39
BQ Certified Professional S-VHS (In Box)		
ST-31 BQ	7.19	ST-62 BQ 8.09
ST-126 BQ	8.39	ST-182 BQ 14.99
Betacam SP		
B5MSP	15.75	B10MSP 17.75 B20MSP 19.75
B30MSP	20.50	B60MLSP 29.75 B90MLSP 46.49

SONY

Hi-8 Professional Metal Video Cassettes		
P6-30 HMPX	4.59	P6-30 HMEAX 7.99
P6-60 HMPX	6.59	P6-60 HMEAX 11.49
P6-120HMPX	8.89	P6-120HMEAX 15.49
Hi-8 Metal Evaporated Editor (HMEAD)		
E6-30 HMEAD	10.49	E6-60 HMEAD 14.89
E6-120 HMEAD		20.19
PR Series Professional Grade VHS		
T-30PR	2.39	T-60PR 2.59 T-120PR 2.79
PM Series Premier Grade Professional VHS		
T-30PM	3.49	T-60PM 3.99 T-120PM 4.79
BA Series Premier Hi-Grade Broadcast VHS (In Box)		
T-30BA	3.59	T-60BA 3.99 T-120BA 4.79
MQ Master Quality S-VHS (In Box)		
MOST-60	7.99	MOST-120 8.39
BRS 3/4" U-matic Broadcast Standard (In Box)		
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KCA-30 BRS	9.69	KCA-60 BRS 13.39
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BCT Metal Betacam SP Broadcast Master (Box)		
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BCT-20M (small)	17.99	BCT-30M (small) 18.99
BCT-30ML	21.49	BCT-60ML 27.99
BCT-90ML		41.99
BCT Metal Professional Series		
UVW-30MLA	18.95	UVW-60MLA 24.95
UVW-90MLA		39.99



Quick-Draw Professional FOR CAMCORDERS OR STAND ALONE CAMERAS

Designed for working from the back of a van or the trunk of your car. The top loading case has a wide open fold back top that stays neatly out of the way. It's lighter and more compact than shipping cases, thus saving valuable storage space. With other equipment crowded around it the sturdy built-in frame provides added protection.

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



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DIGITAL PROCESSING SYSTEMS INC.

PVR-2500 'Perception' Digital Video Recorder

The Heart of an Advanced Digital Audio/Video Workstation

The PVR-2500 offers powerful features for awesome animation, morphing and rotoscoping capabilities. With features like 720 x 480 resolution, 10-bit 2x oversampled video encoding, better than D1 scaling, component and S-Video outputs, multi-processor support and integrated FAST SCSI-2 controller, it empowers your computer to rival the finest professional production studios.

- The PVR-2500 is a full-length PCI card with a FAST SCSI-2 controller which connects to one or up to seven dedicated hard drives. Because the SCSI controller is integrated with the PVR-2500, video data never has to go over the PCI bus during playback. This avoids the bottlenecks found in systems which use the computer's hard drive for video storage.
- Perception gives animations out of your computer fast and easy. Its exclusive multi-format virtual file system ensures complete integration with your Windows NT applications. Any acquired video or computer generated Perception video clips appear simultaneously in many different file formats including TARGA, SGI, BMP and IFF. Perception is compatible with Lightwave 3D, Autodesk 3D Studio Max, Crystal Graphics TOPAS 5.1 PRO, Microsoft Softimage, Elastic Reality and others.
- Runs under Windows NT 3.5 on computers with Pentium, DEC Alpha or MIPS processors. Perception's software utilizes NT's native support for multitasking and multiple processors, allowing use with the most powerful computers.
- Perception performs real-time interpolation of 30 fps video to 24 fps film rates or vice versa. This means that it is also at home on the Hollywood movie set as well.



- Video output section utilizes 10-bit 2x oversampled encoding and provides broadcast quality CCIR-601 (720 x 480) resolution. Dynamic range is in excess of D1 scaling so images are brighter, have more color and greater spatial resolution than ever before. Component, composite and S-Video outputs are provided via the included breakout cables.
- Also control BVU protocol VCRs for video acquisition. VCR-like controls on the Perception's GUI simplifies the task of batch digitizing and recording. In this mode, the PVR-2500 can read SMPTE time code from the source deck.
- Can be used with any Windows NT compatible sound card while synchronization of audio and video is maintained by the PVR software. Captured audio is stored on the computer's system hard drive, not on the dedicated drives. This approach provides maximum flexibility for manipulating audio and video during editing.
- Can be used with third party editing software such as Adobe Premier or in sync Speed Razor MACH III. In fact, a system equipped with the PVR-2500, AD-2500 capture card, a sound card, editing software & one or more SCSI drives becomes a non-linear editor of unparalleled performance — at an unbeatable price.

AD-2500 Component Video Capture Card

Couples with the AD-2500 live video capture daughter card, the PVR-2500 becomes a broadcast-quality digital disk recorder. It delivers unsurpassed picture quality and storage capacity is limited only by the size/number of attached SCSI hard drives.

- Has component, composite and S-Video inputs for real-time recording. Captured video can also be exported as sequential RGB files for rotoscoping and other compositing applications.
- Incorporates a sophisticated automatic entropy prediction circuit that analyzes the content of incoming video and dynamically calculates the optimum amount of compression on a field-by-field basis—even during real-time recording. You also have complete manual control over compression level/quality settings.

FX-2500 Perception Effects Accelerator

The FX-2500 significantly reduces the time required to render complex non-linear transitions. Although it doesn't deliver real-time transitions, it significantly improves the productivity of non-linear editing systems by dramatically speeding up the rendering time for many effects and transitions.

- A stand-alone PVR-2500 provides real-time cuts between video clips, but other transitions such as dissolves and wipes, substantial delay can occur. A 30 frame dissolve can take minutes to render, even with the fastest PC, because the host CPU processes source frames on a pixel-by-pixel basis. The Perception FX reduces the waiting time to under 10 seconds.

DAR-2500 Digital A4V Recorder

Featuring comprehensive audio post-production capabilities, the AV4 (Audio for Video) board provides perfect video/audio synchronization when used with the PVR-2500. A full-length PCI card, the AV4's input and output connections are made via the supplied breakout cables while digital audio is stored on the system hard drive. And to ensure compatibility with third-party audio editing software, it plays and records standard uncompressed WAV files. It can be controlled directly by video editing software like in sync's Speed Razor Mach III.

- Non-linear, non-destructive audio editing. No waiting for edits to compile.
- True audio scrub.
- Simultaneous record/playback. Play up to three stereo tracks while recording one stereo track.
- Mix four stereo source tracks down to two output channels in real-time.
- Four-band Parametric EQ for each channel (assignable by stereo pair).
- Real-time reverb and compressor/limiter. Additional effects can be easily added via software upgrades.
- Built-in LTC/VITC time code generator/reader/inserter lets you create window dubs with time code information superimposed over composite or S-Video signals.
- Unlimited audio editing capabilities with third party software.



FAST The Art of Digital Video Video Machine

Video Machine is an edit controller for A/B roll, A/X roll and audio/video split editing. It controls any VCR with Control-L or Panasonic 9-pin edit protocol. With optional interface it provides RS-232/RS-422 machine control as well. Controls 3 VCRs with no other hardware. Also features EDL export, alpha wipes, test pattern generator, Editing Panel, and more than 400 digital effects.

- Bundled VM-Studio software uses a graphical timeline interface for editing. You can work with all available material at the same time, and all objects in the timeline can be edited and moved to any position, any time.
- During previews and recording uses time code (VITC, RC, Control Track) to accurately cue the VCRs to the in/out points of individual clips. Graphics, titles, and effects are automatically inserted at the point specified.
- Over 400 digital video effects (dissolves, wipes, tumblers, flips, picture-in-picture, fly-ins, fly-outs, zoom etc). With the DVE Editor, create an unlimited number of 2D effects. All effects are performed in real time.
- Supports composite and S-Video signals in PAL and NTSC. Up to six video inputs (two of which are controllable) can be connected, and any two can be assigned to the two video channels. Video standards can be mixed in real time.
- Two integrated frame synchronizers eliminate the need for TBCs (Time Base Correctors). Also provides two 32-bit framestores and a built-in background color generator.



- VM-Titlet lets you create titles, logos and graphics in Windows application such as Corel DRAW or Photoshop. Use any font, size and color. Graphics produced in standard word processing or graphics applications are imported via the VM-Titlet software module. Scanned pictures or images can even be imported from Photo CDs. Titles and graphics can be manipulated with any of the effects available. Functions such as scroll and crawl titling are off and running within a matter of seconds. Has complex filters for anti-flickering, scaling etc. Produces text without "stair-stepped" effects.

VIDEO MACHINE + DPR = HYBRID EDITING

Linear and Non-Linear Editing in a Single System for Maximum Flexibility

Video Machine with DPR (Digital Player/Recorder) is the only system which offers real-time mixing of analog and digital sources. Video Machine with DPR integrates two complete editing systems under one interface, thus ensuring the optimum balance of cost, performance, training, and maintenance. It executes both tape- and hard disk-based edits effortlessly, and it's simply a matter of preference whether you work in analog or digital, or both — all on the same system! Only the FAST hybrid system gives you the best of both worlds. Instead of being stuck with an inflexible system, you can select your method to suit your circumstances. For example, viewing and logging your tape footage can be tedious enough without having to face the next step. But imagine instructing the system to copy selected scenes onto the hard disk, while you take a coffee break. When you come back, you're ready to enjoy the creative freedom of non-linear. And once the creative decisions are made, you can either have the system perform the on-line edit for you, from tape or hard disk, or you can choose to go with an EDL export. No other system gives you this much flexibility.

DPR (Digital Player/Recorder):

- With DPR Video Machine becomes a state-of-the-art digital editing system. In addition DPR executes effects and transitions in real time. True M-JPEG compression enables every frame or field to be accessed individually.
- Compresses and decompresses video (software-selectable) from 200:1 to 2:1. At 2:1 DPR delivers broadcast, on-line quality allowing for mastering directly from the hard disk.
- Video Machine system treats the DPR just like any other "normal" video source. The DPR is enabled by a single mouse-click in the VM-Studio software. The edit suite instantly converts to nonlinear and allows you for example, to execute an offline edit in real time. A second click changes the editing suite back to analog. You can now edit the project using tape source material from your VCRs. Whether working on- or off-line, linear or non-linear—all four editing modes are available on one complete system.
- Integrated digital eight-channel mixer allows audio to be edited in real time in standard WAVE format. The audio is synced to video and recorded in full 16-bit, 48 kHz sampling. It is easy to split the digital audio and video signals, and the waveform display helps to precisely position edits. All eight online tracks can be monitored simultaneously.
- DPR is an ideal solution for animation. It offers broadcast quality while reducing recording time to a fraction of what is required with single-frame capable VCRs. Scene logging and batch digitizing are also automatically integrated via the connection of the edit control functions of Video Machine.
- Video Machine is based on an open architecture design and is almost infinitely expandable as far as storage. Up to 29 hard disks can be daisy-chained directly to the DPR. Using 9 GB drives, up to 260 GB is available on the system—enough for 15 hours of 5:1 or 300 hours of 100:1 video.

OPTIONAL ACCESSORIES:

Video Machine is designed to interface perfectly with traditional broadcast equipment. These rack-mountable accessories integrate Video Machine into a professional video studio environment.

Studio Control (SC):

Connects video, audio, sync, machine control and TC cables from VCRs to Video Machine. With built-in LTC reader/generator, additional preview outputs, balanced XLR audio and reference in/out, the SC Box offers a simple way to interface with studio equipment.

YUV Interface:

19-inch terminal box connects to the internal YUV board. Enhanced analog bandwidth, 2X oversampling and a balanced signal filter guarantee excellent quality. Included calibration software lets you adjust volume and timing. Digital signal passes directly without generation loss.

GPI Box:

The GPI box provides control of external DAT recorders, CD players, video mixers and effect generators. As a master, Video Machine can sync control to up to four devices with pulse signals and has tally support for live cameras. In slave mode, Video Machine serves as the player for titles, graphics and digital video effects.

Jog/Shuttle Wheel:

An alternative to the mouse and keyboard, the physical Jog/Shuttle wheel offers a better "feel" for the edit and during preview.

TRUEVISION

TARGA2000 DTX/RTX

The **TARGA 2000 DTX** (data throughput enhanced) is a next generation digital video solution that delivers unmatched price/performance on the desktop, as well as offering a secure, flexible upgrade path to real-time digital video effects. The 2000 DTX offers an open systems architecture and an industry best data rate of up to 12 MB/second to deliver the most pristine video quality available on the desktop today — at any price. A single codec configuration of the award-winning TARGA 2000 RTX, the 2000 DTX is a perfect match for professional non-linear editing, compositing, animation, and 3D applications.



- Motion-JPEG codec. DVR architecture delivers near lossless quality video. Supports data rates up to 12MB/second (400 KB/frame NTSC).
- CCIR 601 720 x 486 NTSC and 720 x 576 PAL resolution support. Square pixel 840 x 480, 648 x 486 NTSC or 768 x 576 PAL resolution support.
- Synchronized audio and video in hardware.
- Balanced CD and DAT quality audio via XLR connectors with optional Breakout Box. The box can be utilized as a desktop device or rack mounted in a standard 19" rack.

- Drives both RGB and NTSC/PAL monitors simultaneously.
- On-board acceleration up to 600% of 19 popular Adobe Premiere transitions.
- Cross platform support for Mac OS and Windows NT.
- Video-for-Windows native file formats.
- Supports component YUV, RGB, S-Video and composite input and output.
- For those that will come to need non-linear A/B roll editing capability, there is also an upgrade path to the real-time effects processing of the TARGA 2000 RTX.

The **TARGA 2000 RTX** brings real-time processing and the highest I/O throughput to the desktop. It delivers real-time DVE, broadcast quality video, and professional I/O connections with support for industry standard video file formats under Mac/Windows NT operating systems. The system is designed to meet the needs of video professionals who are looking for an open-system solution for non-linear editing and desktop multimedia production.

- Processes digital video effects such as wipes, fades and dissolves in real-time. These common transition effects now require long render times using the host CPU for many computer-intensive tasks. On the RTX, these frames are created in real-time at full quality. Once frames are created by the RTX, they can be instantly output to tape at the high quality level demanded in professional broadcast applications—full motion 60 field NTSC and 50 field PAL broadcast quality video (300 KB/frame). Supports CCIR 601 as well as square pixel resolutions.

- Fully video-for-windows and QuickTime native, so all your current authoring applications supporting these standards will fly with TARGA.
- Drives both the video monitor and the RGB screen up to 21 inches at 24-bit color and supports full-motion previewing on both RGB and video displays for optimal video editing.
- Designed for easy integration into broadcast and post-production facilities, the 2000 RTX includes a breakout box which can be rack mounted or used as a stand alone device on the desktop. The box allows easy connection to Composite S-Video or Component input/outputs as well as XLR balanced audio, genlock and alpha channel connections.

ANTEX ELECTRONICS StudioCard

4-Channel Digital Audio Card for Windows

The next generation in digital audio for the desktop, StudioCard is a premium-quality digital audio adapter with advanced features, studio-quality specs and professional connections. Unmatched in quality, flexibility and expandability, it features 4 tracks of audio sound and real-time digital mixing capability, making it the ideal board for musicians who want digital multitracking and mixing on their PC, or producers looking for a versatile board for post-production digital audio editing and uncompromised audio quality. StudioCard is Windows 95' plug and play compatible plus includes drivers for Windows NT as well.

- Key to StudioCard's amazing sound is the marriage of a low noise analog I/O section and high quality A/D and D/A converters. A PCI-based 32-bit memory mapped board, it delivers less than 0.003% total harmonic distortion and 92dB dynamic range. Plus, a PLL-based sample clock generator that can be locked to an assortment of clock sources.
- Incorporates a programmable 32-bit 40 MHz DSP and pro connections like 4 independent balanced analog I/Os (+4dBu or -10 dBV) and AES/EBU or S/PDIF digital I/O. It also offers a MIDI port with deep buffers and time stamping. No matter which type of equipment you have StudioCard will integrate into standard studio environments.

- Compatible with film, video or MIDI. StudioCard offers synchronization via SMPTE, MTC, word and pixel clocks, and composite video. Plus, the StudioCard not only reads SMPTE timecode, but generates it as well.

- Unique to the Antex design is StudioCard's multiple adapter capability. This means you can install multiple StudioCards in a single computer for up to 16-track recording. Start with one StudioCard today - add more StudioCards tomorrow. Also included is an on-board SPX expansion connector for plugging in optional daughtercards for compression or enhanced DSP operations.

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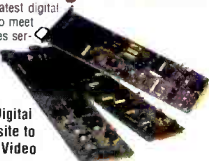
StudioFrame Modular Video Processing System

The Nova StudioFrame Series is a modular, flexible, digital/analog signal processing system. It is designed to efficiently and effectively combine a wide variety of individual function (or processor) boards such as A-D and D-A converters, video signal encoders and decoders, audio and video distribution amplifiers and frame synchronizers into more complex function groups, all in one equipment mainframe. The scalable nature of the StudioFrame design allows it to be easily reconfigured and/or upgraded as today's video standards and requirements continue to evolve. The system is based on two rackmount frame models (the SF-3 and SF-1) allowing up to thirteen front loading processor boards and thirteen rear mounted passive interface cards to be accommodated in a single chassis. Both the StudioFrame SF-1 and SF-3 chassis are designed to meet the most stringent broadcast requirements. The SF-3 is a thirteen slot, 3RU chassis while the SF-1 is a 4 slot, 1RU chassis. All studio cards as well as the two chassis are backed by a two year warranty on parts and labor with guaranteed 24-hour turnaround service. The units are ruggedly constructed to endure studio rackmount, production van and OB (Outside Broadcast) mobile applications. A universal power supply operates at either 110 or 240 VAC, 50/60 cycle. DC operation is optionally available as is a redundant supply with automatic switchover. Dual exhaust fans maintain proper airflow and cooling. "Hot swappable" front card loading allows power-on removal/installation of individual processing modules without disturbing others in the system. All cabling can remain in place while you service any module. An intelligent "centerplane" provides power, sync, timing and data distribution facilitating expansion to more complex, more cost-effective signal processing functions.



NovaASD/NovaSDA Analog to Serial Digital & Serial Digital to Analog Converters

Components of the Nova StudioFrame series, the NovaASD and the NovaSDA incorporate the latest digital video processing techniques for high speed A-D and D-A signal conversion. They are designed to meet the most stringent broadcast requirements and their "hot swappable" front card loading facilitates servicing without disturbing other cards in the system. The NovaASD is ideal for interfacing analog signals with digital video formats and the NovaSDA for interfacing serial digital signals with existing analog video systems as well as for signal monitoring applications.



SDA-1 Serial Digital Component to Analog Converter

- SMPTE 259M 4:2:2 Serial Digital Component (D1) input,
- Equalized and relocked serial digital component output
- Analog component video (Y, R-Y, B-Y) (YUV), RGB or RGB/S outputs
- 10-bit D/A converters
- Output level control
- NTSC and PAL compatible

SDA-2 Serial Digital Component to Composite and S-Video Converter

- SMPTE 259M 4:2:2 Serial Digital Component (D1) input,
- Equalized and relocked serial digital component output
- Dual composite & dual S-Video outputs
- Color bar output selectable
- 10-bit D/A converters
- Output level control
- NTSC and PAL compatible

SDA-3 Serial Digital Component to Analog Video Converter

- SMPTE 259M Serial Digital Composite (D2,D3) input,
- Equalized and relocked serial digital component output
- Four analog composite video outputs
- Color bar output selectable • 10-bit D/A converters

ASD-1 Analog Component to Serial Digital Component Converter

- Analog component video (Y, R-Y, B-Y) (YUV), RGB or RGB/S inputs
- Dual SMPTE 259M 4:2:2 Serial Digital Component (D1) outputs
- 10-bit D/A converters
- Picture positioning control
- NTSC and PAL compatible

ASD-2 Analog Composite and S-Video to Serial Digital Component Converter

- Analog composite and S-Video input
- Dual SMPTE 259M 4:2:2 Serial Digital Component (D1) outputs
- 10-bit D/A converters
- NTSC and PAL compatible

ASD-3 Analog Composite to Serial Digital Component Converter

- Analog composite video input
- Dual SMPTE 259M 4:2:2 Serial Digital Component (D2/D3) outputs
- 10-bit D/A converters
- Input gain adjustment

NovAMNR Median Noise Reducer

The NovAMNR is a StudioFrame card that eliminates impulse and transmission noise, cleans up satellite, microwave and fiber feeds and fills in CDDCEC and time-based corrected videotape drop-outs. It features full bandwidth, uncompressed 10-bit digital processing for ultimate video transparency as well as analog composite inputs and outputs.

- Eliminates "sparklies", those black and white dots that sometimes appear on remote video feeds. The NovAMNR incorporates a proprietary adaptive three-dimensional median filter that analyzes pixels from several fields of video and replaces the impulse noise with uncorrupted, clean video.
- Universal drop-out compensation replaces missing video information, whether it is from a time-base-corrected VCR source or the decoded output of a CDDCEC feed. The NovAMNR effectively fills in drop-outs with replacement video from the surrounding pixels and previous video field.

- Control's are accessible locally or remotely. A three position threshold switch (off/low/high) adjusts system noise sensitivity while a bypass/operate switch is also included. Both switches are remotable via RJ-11 jack.
- Also available in PAL and PAL-M versions.

NC-8 RGB/Component to Composite/S-Video Encoder

The NC-8 processor module is a 10-bit digital encoder that converts analog RGB or component video input sources into Y/C and composite video. Designed to facilitate multi-format interleave requirements, the module incorporates the latest digital video processing techniques along with luminance and chrominance pre-comb filtering to assure the highest quality encoding. A frame of memory is utilized to provide an effective zero insertion delay.

- 10-bit processing, 8-bit D/A conversion
- Zero insertion delay, frame of memory
- Two composite and one S-video output.
- Analog RGB (Sync on Green or all three), RGB/Sync and YUV (Beta) inputs. Also available with looping inputs.
- Variable luminance notch filter
- Y and C pre-comb filtering for maximum encoding performance

- Remote serial control
- Output level control
- Color bar output selectable
- Designed to meet the most stringent broadcast requirements
- "Hot swappable" front card loading facilitates servicing without disturbing other cards
- Available in PAL and PAL-M versions

NovaRouter Intelligent Matrix Routers

NovaRouter is a series of serially controlled audio and video matrix routing switches. These intelligent routers are available in 8x8, 16x16 and 32x32 matrices. They are capable of up to five switching levels to support unlimited combinations of Stereo Audio, Composite Video, Y/C Video, Component Video (Beta or MII), RGB/S and VGA Graphics. Audio follow video or breakaway routing is controlled by very intuitive computer software or optional XY control panels.

The computer software and VGA display provides quick visualization of all crosspoints and facilitates routing operations. An unlimited number of switching configurations may be stored and recalled at the click of a mouse. User defined labels for all sources and destinations provide positive identification of the matrix status. One computer can control several NovaRouter Systems for multiple studio or large presentation system applications. The optional, easy to use, XY control panels provide routing functions for basic systems without the use of a computer interface. All video, audio and audio follow video switching functions are controlled by source select and destination select switches. Clearing and verifying the matrix configuration is simple and clear. The XY controls may be front panel mounted or are available as a remote control unit.

Broadcast quality audio and video processing and microprocessor control ensure superior quality and performance. Yet, the simplicity and modular configurations of NovaRouters™ make them economical for broadcast, production, cable TV, graphics, presentation, teleconference and educational applications.



- 8x8, 16x16 and 32x32 switching matrices
- Stereo audio, composite video, Y/C, component video, RGB/S and VGA
- Up to five (5) levels of switching
- Audio follow video and audio break-away
- Serial control via intuitive computer software or optional XY control units
- Computer VGA monitor display provides quick visualization of all crosspoints
- Easy single "click" mouse switching control
- User labeling of sources and destinations
- Store system configurations in memories
- Multiple locations can be controlled from one computer
- Push-button XY control options, front panel mount or remote control units
- Audio and video modules provide easy system upgrade

VIDEONICS POWERScript™

Animated Postscript Character and Graphics Generator

The most advanced character generator ever designed for video production, multimedia and industrial applications, PowerScript delivers the huge range of titles and graphics supported by PostScript display technology, plus animation, effects, transparency and color keying. It features two GPI inputs, anti-aliased, 17.5 ns (nanosecond) pixel resolution and 4:2:2 broadcast-quality video. It also offers high-speed RISC processing to provide real-time Level 2 PostScript imaging and fast rendering—even with the most complex images. The PowerScript works stand-alone or with a computer, has a built-in TBC, offers a powerful and intuitive interface, and is suitable for the desktop or can be rackmounted.



Powerful Character Generator

- Choose from 35 built-in fonts or download PostScript fonts from your PC. PowerScript's high-speed RISC processor provides real-time PostScript imaging.
- Characters can be rotated at any angle, scaled to any size, stretched horizontally or vertically.
- Styles include variable bold and italic, underline and shadow (drop shadow, variable displacement and opacity). Each character can be adjusted separately.
- Text can be positioned anywhere on the screen or automatically centered, vertically or horizontally. Left, right, top, bottom and center justification is also provided.
- Characters are automatically kerned, using the font's standard kerning information. Spacing is highly flexible with variable word and letter spacing and line spacing (leading).

Intuitive User Interface

- Built-in real-time object-based drawing tool and text editor—no computer or software required. Design can be done ahead of time and displayed later, or can be done on the fly.
- Supplied keyboard and mouse are used with easy on-screen menus to place and modify graphics and text.
- Change fonts, colors, and other characters instantly.

Transparency and Colors

- Characters can be made transparent (0-100%) over video, other characters and graphics with 64 levels of transparency.
- Opaque characters can be used over 4,000,000 colors, transparent characters can use over 8,000.
- Different colors can be used for fill and outline (variable width) as well as each letter and each graphic.

Roll, Scrawl, Animation, Effects

- Variable speed roll, crawl and push (slide) in all directions
- Every text object, graphic and logo can be animated. Complex animations include changing elements follow paths, bounce, etc.
- Elements can change outline and/or fill color, transparency, position as they move and results are displayed in real time.
- Move individual characters in different directions; make colors change, flash words; make letters and words bounce; spin a letter across the screen. Use fades and wipes to transition between titles and video or between two pages of titles.

Backgrounds and Graphics

- Titles can be placed on solid color, patterned or graduated backgrounds, or they can be locked to incoming video.
- Lines, squares, rectangles, ovals and circles can be created and placed anywhere on the screen. Each graphic object can use a different color, transparency, rotation, size, fill and outline.

Imported Logos and Graphics

- Accepts most PostScript or PCX format graphics without modification. Imported images can be any size and can be scaled, skewed, and rotated when placed on screen. Transparency and anti-aliasing can be defined when graphics is generated.

Expansion Capabilities

- Although PowerScript operates on its own, you can still add peripherals and connect to a computer or network. Two PC-card slots allow the addition of non-volatile flash-RAM and Ethernet cards. RS-232 port allows connection to desktop computers for added storage and downloading of fonts or graphics from a PC.



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Manufacturing test and measurement equipment for over 40 years, Leader Instruments is the standard which others are measured against for reliability, performance, and most important—cost effectiveness. Before a product is brought to market, an exceptional degree of energy and effort go into its design. Prototypes are built and tested to withstand environmental and other factors far exceeding actual operating conditions. These include high humidity, extremes of heat, cold, shock and vibration. Manufacturing quality is built in every step of the way and only the finest parts are used. At each production run, subassemblies are separately tested before they are integrated into the finished product, then each product is tested again. This is why less than half of 1% of all Leader products are ever returned for warranty repair or adjustment.



5860C WAVEFORM MONITOR

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

5850C VECTORSCOPE

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

5100 4-Channel Component / Composite WAVEFORM

The 5100 handles three channels of component signals, plus a fourth channel for composite signals, in mixed component / composite facilities. Features are overlaid and parade waveform displays, component vector displays, and automatic bow-tie or "shark fin" displays for timing checks. Menu-driven options select format (525/60, 625/50, and 1125/60 HDTV), full line-select, vector calibration, preset front-panel setups and more. On-screen readout of scan rates, line-select, preset numbers, trigger source, cursor time and volts.

5870 Waveform/Vectorscope w/SCH and Line Select

A two-channel Waveform/Vectorscope, the microprocessor-run 5870 permits overlaid waveform and vector displays, as well as overlaid A and B inputs for precision amplitude and timing/phase matching. Use of decoded R-Y allows relatively high-resolution DG and DP measurements. The 5870 adds a precision SCH measurement with on-screen numerical readout of error with an analog display of SCH error over field and line times. Full-raster line select is also featured with on-screen readout of selected lines, a strobe on the PIX MON output signal to highlight the selected line, and presets for up to nine lines for routine checks.

5872A Combination Waveform/Vectorscope

Models 5872A offers all the operating advantages of the 5870, except for the following: SCH is deleted from the 5872A (line select retained), making it ideal for satellite work.

5864A Waveform Monitor

A two-input waveform monitor that offers full monitoring facilities for cameras, VCRs and video transmission links. The 5864A offers front panel selection of A or B inputs, the choice of 2H or 2V display with sweep magnification, and flat frequency response or the insertion of an IRE filter. In addition, a switchable gain boost of X4 magnifies setup to 30 IRE units, and a dashed graticule line at 30 units on screen facilitates easy setting of master pedestal. Intensity and focus are fixed and automatic for optimum display. Supplied with an instruction manual and DC power cable.

5854 Vectorscope

A dual channel component vectorscope, the 5854 provides precision checkout of camera encoders and camera balance, as well as the means for precise genlock adjustments for two or more video sources. Front panel controls choose between A and B inputs for display and between A and B for decoder reference. Gain is fixed or variable, with front panel controls for gain and phase adjustments. A gain boost of 5X facilitates precise camera balance adjustments in the field. Supplied with a DC power cable.

Designed for FFP and ENG (electronic field production and electronic news gathering) operations, they feature compact size, light weight and 12V DC power operation. Thus full monitoring facilities can be carried into the field and powered from NP-1 batteries, battery belts and vehicle power. Careful thought has been given to the reduction of operating controls to facilitate the maximum in monitoring options with the operating simplicity demanded in field work.

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CHIEF ENGINEER WTVY-TV, a Benedek Broadcasting station and CBS affiliate for Dothan and Panama City, has an immediate opening for a Chief Engineer. Candidates should have experience with Harris transmitters, ENG operations, microwave systems, equipment maintenance and computer systems. SBE certification, FCC General Class license, management experience and five years in broadcast engineering is preferred. Send resume to: Human Resource, WTVY-TV, P.O. Box 1089, Dothan, AL 36302. Fax #334-793-3947. EOE.

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CHIEF ENGINEER UHF CBS Affiliate with AM/FM seeks candidate who has extensive experience in transmitter and microwave systems maintenance, including at least five years of experience in broadcast television station engineering management. AM directional experience a plus. Strong interpersonal skills are needed to manage the station's engineering staff. This individual will prepare and administer capital and operating budgets, and plan equipment purchases and installation. Send resume and application to: Kendra Cooper, WMBD, 3131 N. University St., Peoria, IL 61604. EOE/M/F

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CHIEF ENGINEER & SERVICE TECHNICIAN New York Post Production Facility seeking Chief Engineer and Service Technician. Must be experienced with component level troubleshooting, repair and maintenance. Please FAX resume to: Peter Yahr, 212-398-9660.

MAINTENANCE ENGINEER - Full-time position for individual with experience in broadcast television including trouble-shooting and repair of studio audio/video equipment, transmitters and computer systems. FCC license/SBE certification preferred. Resumes to: Chief Engineer, UPN20/WDC, P.O. Box 9662, Washington, DC 20016. Equal Opportunity Employer.

FOLLOW THE LEADER

Sony's Business and Professional Group is seeking the following broadcast professionals:

Senior Video Systems Design Engineers

We are looking for seasoned engineers to design large-scale digital audio/video facilities, including floor plans, equipment rack layouts and detailed signal flow diagrams. Candidates must have 5+ years' experience with state-of-the-art analog and digital A/V, production and broadcast facilities and be especially strong in system level engineering design and technical problem-solving. Fluency in MS Excel for Windows is required; AutoCAD, Word and Access knowledge is a plus. Team building, communication skills and the ability to work with minimal supervision are also key. We have both regular and contract positions available, but all require full-time presence at our San Jose facility. Some travel during installation/testing will be required. (Job # CY-BE1)

Software Project Support Engineer

Work closely with software designers and interface with domestic and international support groups to provide guidance in their support plan development. Your focus will be providing technical and management support for new software products from design through deployment. Position requires a BS or equivalent with 6+ years of industry experience. Must have strong troubleshooting capabilities relating to software-based systems. Programming experience in C/C++ and knowledge of Windows/NT are highly desirable. (Job # LG-BE1)

Software Systems Engineers

Perform system engineering design for complex video system control software product. You will work with a software development team to implement the next generation of Sony professional broadcast systems consisting of both hardware and software components. Position requires 5+ years of systems engineering, with experience in design and development of complex hardware and software systems. Solid disciplined systems design and architecture background required. A background in video hardware is preferred, as is an understanding of object-oriented programming. (Job # LG-BE2)

Software Product Support Engineer

Manage all technical support for products such as Sony's Integrated Duplication Operation, Video Store and Edit Station. You will review all technical documentation, actively problem-solve and act as a liaison between factory design and support, and marketing, field service and product sales. Position requires a BS in EE or CS with 7+ years of experience developing and supporting software-based products and 2+ years with servicing or designing Sony products. (Job # CY-BE2)

Project Managers

Responsible for the management of resources to execute fully-integrated broadcast systems. Must be able to complete projects on time and within budget. The ideal candidate will bring 5+ years of project management in broadcast or production systems. (Job # CY-BE3)

Senior Instructor

Present training courses focusing on the television industry's standard production techniques and technologies. This involves developing and implementing courses associated with the introduction of new technologies, products and services intended for the video industry. Position requires a BA/BS or MFA in TV production, broadcast journalism or communications with 5+ years' experience in broadcast or industrial production. (Job # CY-BE4)

Senior Marketing Manager

Develop and direct marketing strategy for the broadcast industry. This includes video file server-based automation systems, master control routing switches and related products. Position requires 10+ years of extensive marketing experience in broadcast or other closely related industry. (Job # CY-BE5)

Please send your resume, INDICATING CODE OF INTEREST, to: Sony Electronics Inc., Attn: Professional Staffing, MS SJ-2C2, 3300 Zanker Road, San Jose, CA 95134-1901. FAX: (408) 955-5166. E-mail (in ASCII text): sj_jobs@mail.sel.sony.com. For more information, visit our Web site at: <http://www.sel.sony.com/HR/> EOE.

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Just-noticeable differences

January is the start of a new year, and we're supposed to reflect on the last year and swear to resolutions for our future behavior. These are things that should be avoided by engineers. If there are changes to be made, we'd be doing them now rather than waiting for an artificial odometer to clack across to a new number.

It's increasingly painful to enter a new year, not because of aging or the hangover from another Scottish Hogmanay, but because of the little changes. Recognizing that it really doesn't matter if you put the right year on checks because nobody at the bank looks at them or the budget year you used to look forward to now starts in September or on average, 50 to 75 new laws became effective — at least half of them involving us motorist-career-criminals.

I become more morbid at the end of the year; 1996 saw the death of a number of friends, including four ex-colleagues in a single accident. But it's wrong to turn this quasi-technical

forum into a techie obituary, however tempting it is.

The new year should be about foretelling the future. Of course, if I could be sure of the channels I'm using, I would already have bought the first major winning California lottery ticket of 1997; but I haven't, so we'll stick with video predictions.

A look down the road

With hundreds of thousands of DVD players in warehouses, it doesn't take a genius to recognize that the November agreement on copy protection was a little too late to get the product moving for Christmas; but the players will be out by March, and maybe some really good disks will be out by summer. And? Well, knowing the next generation of lasers is already in the offing, with a tripling of disk capacity, I'll just sit back and wait for awhile.

This will be the year of the "just-noticeable difference" (JND). Actually, it probably will be *another* year for JNDs, because although they may be revised, they sure aren't new. Every past attempt at JNDs has been incredibly logical — and mostly unsuccessful. Perhaps the most common JND is the decibel (dB), which is supposedly the JND for the average ear's ability to detect level changes.

Other JNDs are in the "k" rating system in the British

version of video measurements and in the creation of standard chromaticity triangles. Neither is exactly an everyday interpretation of quality. But in the measurements arena, the problems of finding out what's happening with digital signals seem to defy any other logical approach. You can't test a digital processing path with current test signals; they're not even a vague challenge to a codec. You could set up bouncing, breathing, rotating zone patterns and you can certainly invent such a pattern that will "break" every codec made. But what does that tell you? And if you use standard moving test patterns, like zone plates, how do you agree on the measurements?

The set of Sarnoff test signals (real-world types of pictures) will be the standard for JNDs this year. In a test path, the standard signals will be generated, allowed to go through all the processing and paths and then, at the receive point, will be compared to a locally generated set of the same patterns. The differences will be viewed and measured in JNDs.

Predictions were the order of business at COMDEX. In the semiconductor industry, there are many recipients of confidential Intel documents relating to the power needs of the next X86 microprocessors. These companies are all under non-disclosure agreements, but the demands of the future processors are so incredible that few can keep from, at best guffawing, at worst crying, about Intel's vision of the future and the weekly changes in the specifications. It's so easy in the digital world to reduce voltages on ICs that it's easy to overlook possible consequences.

The talk is now of PC supplies being at 3V with currents of more than 40A. This creates mind-boggling design problems for the power-conditioning products and printed-circuit boards. But wait, there's more: Andy Grove made some predictions. In the year 2011, the number of devices in a microprocessor will have increased from 5.5 million up to 1 billion and clock frequencies will have increased from 200MHz up to 10GHz.

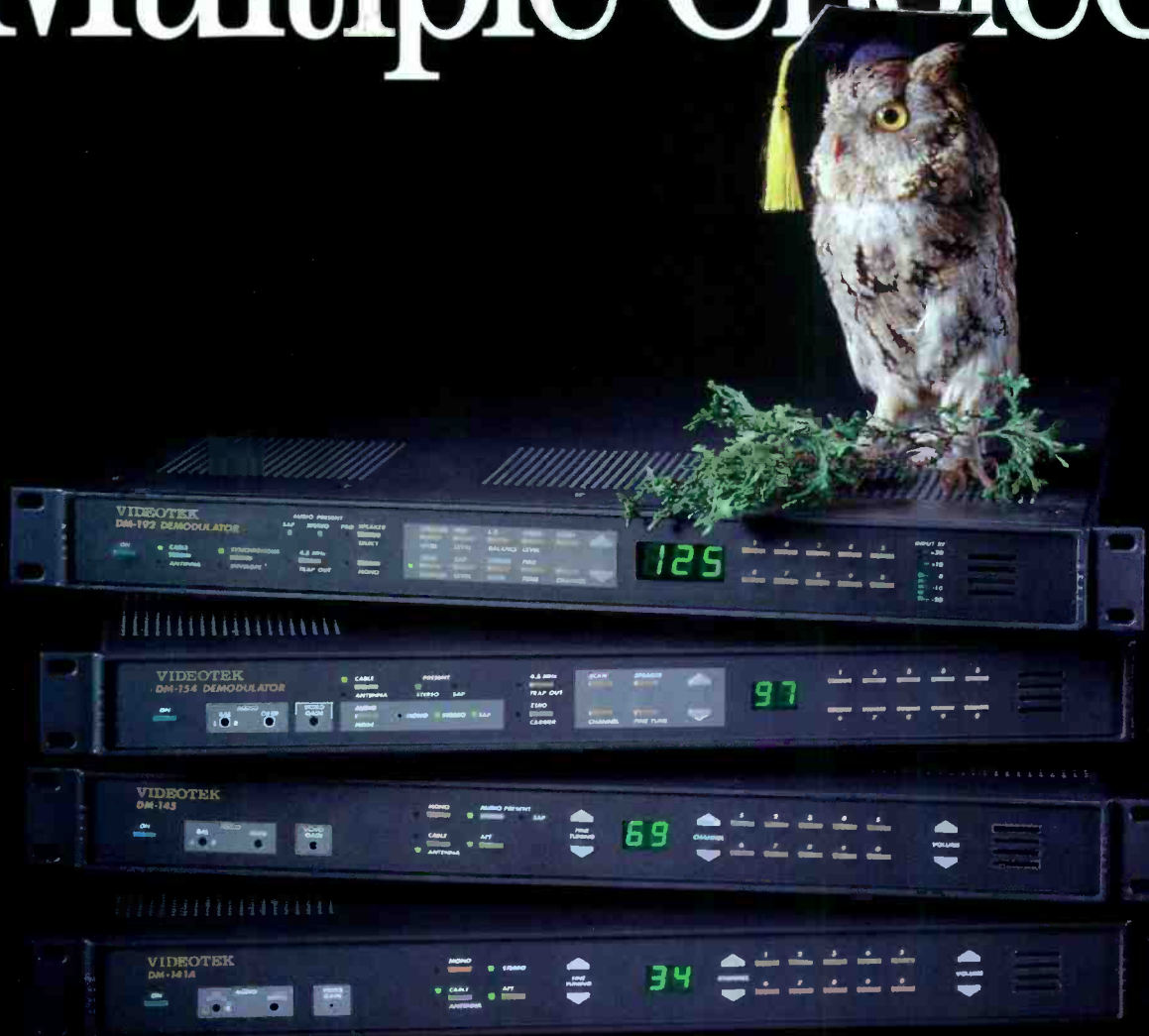
The combination of power supplies of 3V/40A and RF frequencies of 10GHz just doesn't make any layout sense on what we think of today as motherboards; does anyone have any idea how this can be done? And what semiconductor process can be used for the microprocessor? I guess we'll find out when we get there. ■

Paul McGoldrick is a free-lance writer and consultant based on the West Coast.



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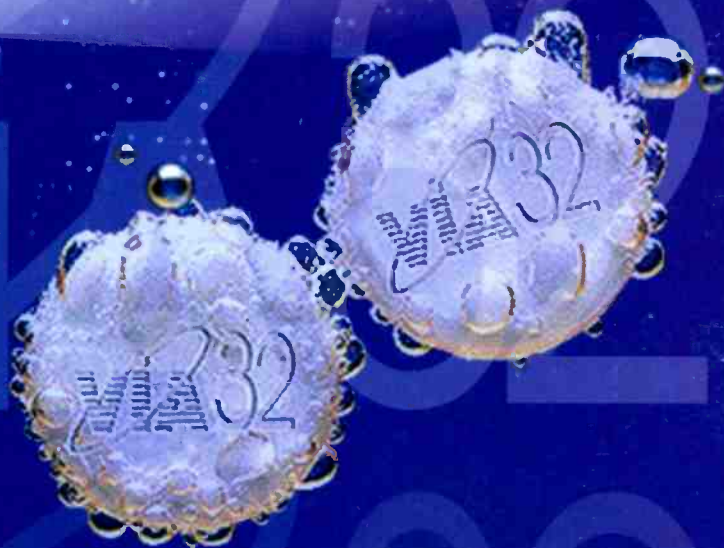
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