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High-performance recording tape p. 64

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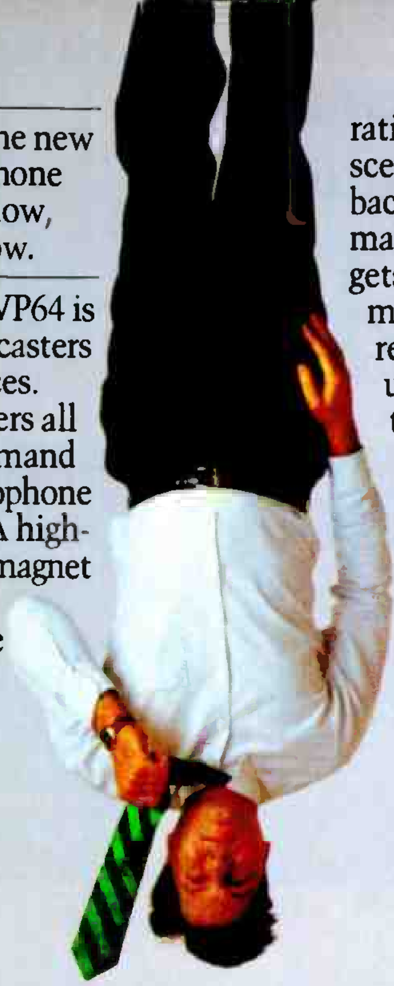

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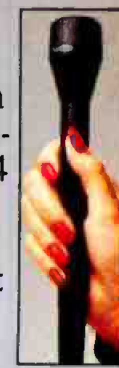

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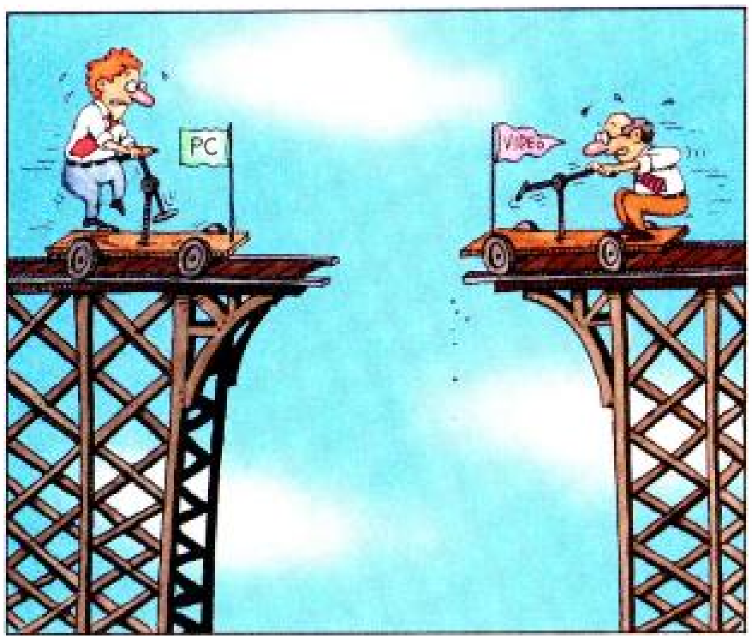
# Editorial

# Video meets computer

The recent SMPTE winter conference in San Francisco has to go down as one of the society's best efforts in addressing an important developing technology. The conference titled "Collision or Convergence: Digital Video/Audio Computers and Telecommunications" was a good effort at addressing the complex issue surrounding computers and video.

Many attended with the expectation of seeing a war develop between the two camps. Instead, the conference helped to reduce the fear and mistrust of the other's viewpoint and to increase common ground. The complex issue remains unresolved, however.




The viability of computer video continues to be a running battle between the two divergent camps. Many video professionals remain unconvinced that PC-based systems actually can produce and edit NTSC-quality video. At the same time, the computer proponents claim that their approach provides professional video capability — and does so with a tremendous price advantage. So where does the truth lie? The answer is somewhere in the middle.

The often widely divergent opinions among computer gurus and video professionals were clearly evident at the meeting. Even so, those that expected a war of words were disappointed. Instead, we saw two technological camps, each biased toward its own viewpoints but still willing to listen. Best of all, both groups seemed to be looking for solutions.

Many of the video professionals indicated that they felt personal computers are not yet up to the standards needed for broadcast and production video applications. For them, dedicated systems are still the best answer.

The computer proponents, not wanting to give any ground, had to admit that as of today, proprietary platform systems still provide the highest quality. They added, though, that computers are becoming more powerful everyday.

John Watkinson, a session chairman at the convention, summarized today's graphics systems by noting that many of the current practices in broadcasting and production are holdovers from the days of analog — one box to handle one format. According to him, the days of one box per format are gone forever.

Not wanting to leave the issue lopsided, he also noted that the computer industry tends to rely on software for solutions. The problem here, according to Watkinson, is that experience has shown that software is inherently unreliable. Based on the experts in attendance, it therefore seems that the solutions to this issue are just around the corner.

As almost an aside, the society announced the draft release of its *headers and descriptors* standard. The headers and descriptors task force is working on an interchange language that would allow the seamless digital transfer of data and images between platforms and systems.

Such a standard would be the keystone to bridging the gap not only between the computer and video worlds but also between program producer and consumer. A language that allows the video professional to transfer images to different platforms and systems *without loss of quality* could alter drastically the way video is produced. However, until that link is available, it's unlikely that those charged with producing entertainment video are going to stampede en masse to the personal computer.

Brad Dick

**Brad Dick, editor**

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# FCC Update

## IVDS to be established

By Harry C. Martin

The FCC soon will begin accepting applications for its new interactive video and data service (IVDS) and will eventually award two 500kHz channels per market through a lottery selection process. The systems will operate at 218-219MHz.

IVDS is a 2-way system through which consumers will be able to communicate directly with the providers of video programming and information or data services. Subscribers will be equipped with a "box" that will have the capability of communicating with a local IVDS base station which, in turn, would communicate by satellite or wire with a central information and transmission source. The central office then would provide to the subscriber, through a computer-coded message, the particular offering that has been ordered.

• *Typical uses.* A proposed use for IVDS would be the presentation of interactive educational programming. Instructional programming would appear on the over-the-air signal of a PBS-affiliated educational TV station. Individual students could interact with the program source by activating their in-home IVDS units. The signals transmitted to the source would have individual codes permitting the source to identify the sender and provide return information.

Another example would be a catalog service where an individual consumer could order a particular entry from a catalog using a menu provided by the IVDS source. The IVDS base station would receive the call and forward it by satellite to the catalog source. It, in turn, would provide the requested information. Computers would download and sort the interactive messages and select the first available time slot within which to provide the requested information to the subscriber.

• *Service areas.* The number of base stations needed to cover a market will depend on its size. It is expected that base stations will be able to communicate with subscribers within a 10-to-15 mile radius, except in markets with a channel 13 (210-216MHz) TV station. In such markets, the service areas of base stations would be limited to a radius of two or three miles, in order to protect the channel 13 station from interference.

• *Licensing process.* Selection of licensees will be by lottery. An abbreviated filing procedure has been adopted that will require applicants to initially file only FCC Form 155, which specifies the applicant's name, address, service area number, fee code and a filing fee of $1,400. After the lottery, selectees will be required to file, within two days, a complete license application package consisting of FCC Form 574 with all required technical showings. A public notice is to be released detailing specific instructions for lottery applications and setting the deadline for each market area. The same 734 MSA and RSAs that defined market areas for cellular filings also will be used for IVDS. To ensure that applicants who obtain a license through the lottery actually build the IVDS system, the commission has adopted regulations that include construction benchmarks and a prohibition on sale or transfer of licenses before 50% of an IVDS market is covered.

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

### FCC adopts new technical standards for cable

In February, the FCC adopted new technical standards to prescribe the quality of cable TV signals delivered on all channels provided to subscribers.

In the 1970s the commission established technical standards to govern the cable video signals, but they applied only to the retransmission of broadcast programming. No technical standards were set for channels carrying cable-originated programs and pay channels. Also in the '70s, the FCC pre-empted the authority of local and state governments to set more stringent standards. However, in a 1985 deregulatory initiative, the agency announced it would no longer enforce its signal quality standards but continued to bar local governments from regulating cable signal quality.

The standards adopted in February address the delivery of all NTSC video signals. Generally, the rules represent a reinstatement of the technical standards in effect until 1985. However, new standards were added for the delivery of color signals, as were requirements for the delivery of closed-captioned data.

Again, the commission has pre-empted local standards that differ from those the agency is implementing. There would be an exception for cable systems servicing rural communities, as well as for systems serving fewer than 1,000 subscribers, which would permit systems to negotiate for certain lower technical standards with their respective franchising authorities.

Initial enforcement of the technical standards will generally take place at the local level. However, the FCC is requiring cable systems to implement specific processes for resolving complaints about technical service.

### Spousal "attribution" presumption eliminated

The commission has eliminated the spousal attribution policy by which the media interests of one spouse are presumptively attributed to the other in applying the multiple ownership and cross-ownership rules.

Under the policy, the media interests of one spouse will not be presumptively attributed to the other solely on the basis of marital status. Rather, the commission will review the relationship between spouses, and between spouses and their respective media interests, to determine whether attribution of their media interests is necessary to preserve the objectives of economic competition and diversity. Spouses' media interests will not be attributed where the FCC is satisfied that such media interests are independently held and are not subject to common influence or control.

The presumption of spousal attribution impeded the entry of women into ownership and managerial positions, thus placing the FCC's attribution policy at odds with its equal employment opportunity policies. The commission is confident that the less-restrictive approach to husband/wife attribution, currently applied to all other family relationships, adequately safeguards the ownership rules. ■


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*Jim Schuster, Director of Operations and Engineering*
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# Strictly TV

## Serial digital video serializers and deserializers

**By Ken Ainsworth**

We create serial digital by converting parallel digital video into serial form and transmitting it one bit at a time. Because video is represented with 10-bit words, the serial clock rate is 10 times that of the parallel clock. There are three rates: 143Mb/s for NTSC composite, 177Mb/s for PAL composite and 270Mb/s for 4:2:2 component.

A typical serial system consists of five parts: a transmit co-processor, a serializer, a transmission channel, a deserializer and a receive co-processor. (See Figure 1.)

The transmit co-processor adds a line rate synchronizing signal to the incoming parallel video. This timing reference signal (TRS) synchronizes the serializer and deserializer. TRS is only added to composite video. In 4:2:2 component, the *start of active video* (SAV) and *end of active video* (EAV) signals perform this function. The serial signal also has space allocated for ancillary data, such as AES/EBU digital audio. The co-processor can insert this data.

### Scrambled serial

The serializer latches the parallel data from the co-processor and shifts it out, one bit at a time, using a phase-locked clock running at 10 times the parallel clock rate. Today's serial systems use 10-bit representations. If 8-bit video is input, then the serializer sets the two LSBs to zero.

Next, the serial data is scrambled. The scrambler alters the data spectrum to enhance clock recovery at the receiver and to reduce the signal's DC component. The scrambled signal goes to a coder that represents 1s as data transitions and 0s as no transition. This is called *non-return to zero inverted* (NRZI) coding. An output stage provides the power to drive the channel, nominally 75Ω coax.

### Receive end

At the deserializer, an equalizer compensates for the transmission channel losses. These equalizers are often automatic, based upon the signal's amplitude and the presumed loss characteristics for the channel. Next, a clock recovery circuit extracts timing information from the signal and uses it to lock up a 10 times parallel rate oscillator. This clocks the deserializer.

The signal then is converted from NRZI to NRZ coding, descrambled and fed to a shift register, which does the serial-to-parallel conversion. TRS (or EAV/SAV for component) is recovered prior to parallel conversion to frame the shift register. This ensures that the recovered parallel words consist of the proper bits, not bits from two adjacent words.

If the deserialized signal is composite, non-video data, such as TRS and ancillary data, are removed by the receive co-processor. The co-processor might decode this data or just strip it off, depending on the application. Because the 4:2:2 component standard allows ancillary data, stripping isn't required for component video.

Serial's primary use is to interconnect digital video equipment. Interfaces are already showing up on a variety of tape recorders, switchers, routers, DAs and video processors. However, because serial can be repeatedly regenerated and has good immunity to hum and other noise, it can also help with difficult analog signal-distribution problems. However, there is often a performance penalty that comes from the repeated use of A/D and D/A converters. This is usually directly related to the converter's quality. Possible performance trade-offs must be weighed against the potential advantages of serial digital distribution on a case-by-case basis.

Ainsworth is a senior engineer for Tektronix' Television Division, Beaverton, OR.

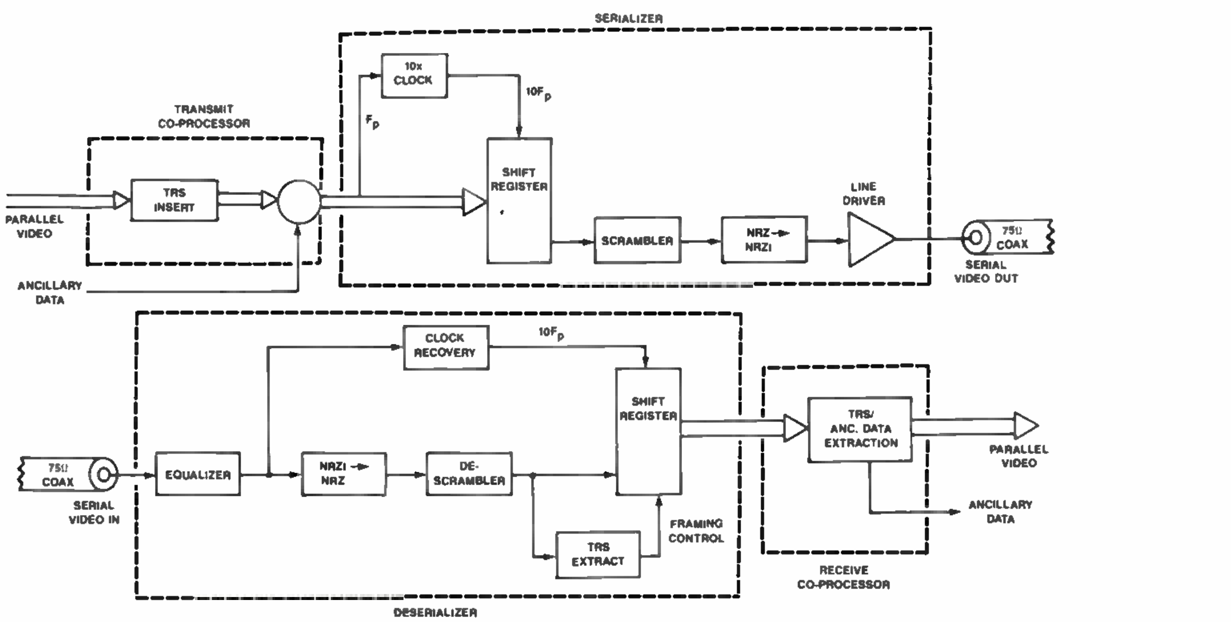
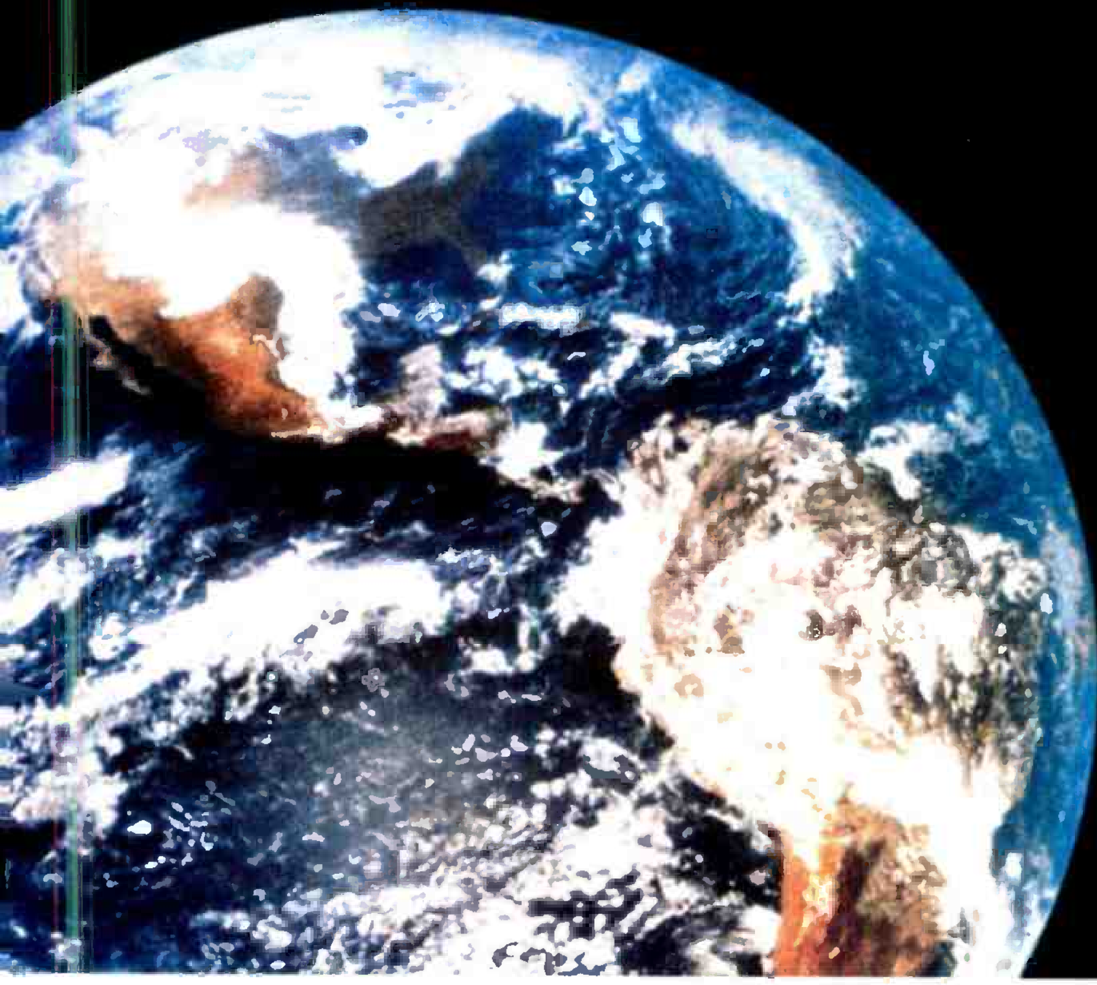



*Figure 1. A block diagram of a typical serializer and deserializer pair.*



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Circle (8) on Reply Card

# (Un)common points

By John Battison

Over the course of many years in this beautiful broadcasting business (47 to be exact), I've come across many different antenna systems. Some were exotic, some made me neurotic. Some were high power, some low power, but all of them were challenging.

Many years ago in the southern United States, there was a 3-tower DA with a critical maximum expected operating value (MEOV). This was an accepted practice in those days (long before the dawn of standard patterns), in which antenna engineers laid a dotted line around the critical areas, based on approximately 5% of the theoretical pattern. (As time passed and the AM band became more crowded, it became standard self-protection to put an MEOV *all around the pattern*, just to be on the safe side.)

During the antenna tuneup process, if it was impossible to get the array to operate as planned in the application's pattern, it was generally possible to make its measured pattern fall within the MEOV. If there was no such "fudge factor," the only recourse was to file for a modified pattern.

### Derrick and the common woes

The antenna system in question was tuned up day and night on its operating frequency (at the top end of the band) and looked pretty good. The next day we went out to recheck the monitor points and found that a critical one in the "null" direction was way out — about 2mV/m high. Everything else was still in, and the antenna monitor ("phase monitor" in those days) was showing the desired parameters. What was causing this? Nothing in the antenna system had changed, and nothing was obviously amiss.

As it turned out, the transmitter was located near a large construction site where there had been a lot of activity during the antenna tuneup. In particular, one large derrick had been operating. It was one of those tall towers with the winch and operator's cab about 100 feet in the air.

During our tuneup, this derrick had become a "fourth tower" in our array, and its reradiation had contributed to our pattern, unbeknownst to us. But the day we finished, the construction also ended, and the derrick was dismantled. When we rechecked the monitor points the next day, the derrick no longer contributed to our pattern and this drove out our one critical point. Luckily, there were no more structural changes at the construction site, so we only had to readjust the phasor and rerun some radials in order to bring the monitor points and pattern "in" again.

### The great mouse detective

A more recent problem involved a 4-tower in-line array. The contract engineer noted that three tower parameters were in, and the monitor points were alright except for one, almost end-on to the array.

But when I arrived the array was behaving itself. All antenna parameters were in, and so were the monitor points. So the "doghouses" were inspected. These provided shelter for the antenna tuning units (ATUs), which were all about 25-year-old (at the time) Gates designs. They were strong and well-built, using open breadboard construction and laid out on metal panels with all components easily accessible.

The first three shacks were reasonable. The ATUs were covered with mouse droppings and *Decon*, but there was nothing unusual in that. On tower four, however, we found the skeletons and decaying carcasses of several mice. The scattered remains of one mouse lay under the shunt leg coil, and the edge-wound coil turns showed burn marks across several turns on the inside. I theorized that the mouse had crawled into the coil after sign-off at sunset. When power was turned on again the next morning, the mouse was barbecued.

There was no way of telling how long the mouse had been there before the monitor points were read and the discrepancy was noticed. It would have taken several weeks of RF to burn through the carcass and allow the remains to fall through to the bottom where they currently rested, explaining why everything seemed in order.

To test my hypothesis, a "scientific" experiment was devised. A dead mouse was laid across the coil as we looked at the antenna monitor and checked the monitor point in question. Sure enough, similar readings were recorded. The mystery was solved, and a non-ferrous screen was installed over each of the flat ATUs to prevent similar problems in the future.

Good inspection can prevent many of these typical problems. The commission requires documented inspection "as necessary" to ensure proper operation. But how many contract engineers really make such thorough inspections today? It seems that priorities have shifted, and money spent on "unnecessary" work is often not budgeted nowadays. Nevertheless, experience supports the argument that prevention really is better than cure.

### Go nest, young man

One day, I received an urgent call from a station with a 3-tower array. Tower three was smoking and the station was off the air. I went out to tower three and noticed a strong smoke smell, although there was no fire. After I opened the ATU box (no doghouses here), the smoke smell was much stronger and the cause was obvious.

A small animal had built a compact nest in the antenna coil. The nest was a pile of ashes, but among the ashes were some still-shiny pieces of foil. It appeared that the nest had eventually oriented itself and its conductive materials in such a way that RF arcing occurred across some turns and the sparks ignited the dry nest material. Once again, regular inspection could have prevented this fire.

Rodents can also access your transmitter and cause far worse damage. Many engineers have experienced problems in the form of chewed-through cables and dead mice across high-voltage connections that can put the station off the air. Some fires have also been caused by rodents. Regular inspection is the only sure way to prevent these annoyances from becoming catastrophes. ■

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

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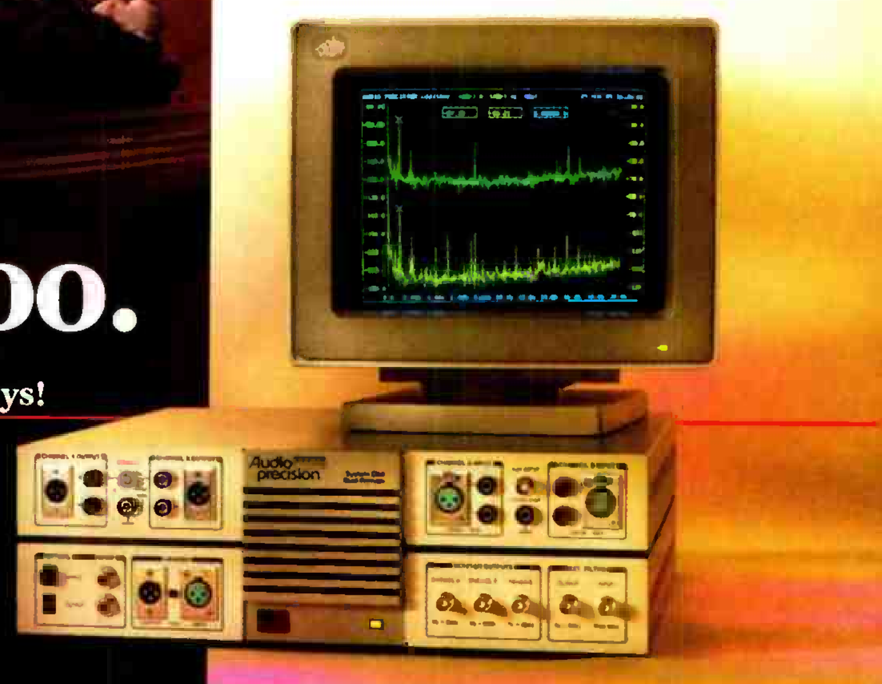

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Part 2

# Management for Engineers

## The human network: a management tool

*Building a flexible engineering network*

By Judith E.A. Perkinson

The chief engineers of eight TV stations met to examine how they might cooperate to their mutual benefit. When they examined some of their common problems relating to cost cutting, they learned that individually none of them had the buying power to negotiate any significant price break for disposable supplies.

The engineers decided to look at studio lights and see if they could combine their buying power and reduce their cost. One member of the group was assigned as purchasing agent, and each station gave him information regarding its needs. He contacted suppliers and in less than two days had found a supplier that gave them a significant break in cost and shipment to each station. In turn, the stations had to consolidate their orders and place them at one time. The end result was that each station enjoyed almost a 30% cost reduction for studio lights. The total savings that year for the eight stations was more than $18,000. These stations have replicated this approach to reduce costs in a number of other areas of their operation.

This is called a *Flexible Engineering Network* (FEN), patterned after the Flexible Manufacturing Networks found in Europe and the United States. The members of FEN need to have a purpose and direction. They also have to be committed to working together for everyone's mutual benefit.

If you completed your homework assignment from last month, you have the basis to start your own FEN. But it is not too late to start now. Contact the chief engineers at stations in your area and hold a meeting. If you are part of a broadcast group of stations and are not already operating like a FEN, get the head of engineering to consider bringing your group together to discuss the development of a FEN.

The members of a FEN normally share some characteristics, such as station type, proximity, membership in a broadcast group or size. Some common element should exist to make it easier for them to organize the network.

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

### Network organization

The establishment of a FEN begins by assembling the potential members of the network. A certain amount of trust is required for a network to be effective, so participants should get to know one another face-to-face. Once together, the group must agree upon the purpose of the network, which is to pool the knowledge, experience and resources of the members toward common problems so that participation benefits all members.

### Define common problems

Every station is different in some ways, alike in others. Once the network has agreed to work together, the next step is to identify the problems to consider. This is best done in a brainstorming session. Each network member is free to put any and all problems on the table for consideration. Listed are examples of the types of problems that networks have dealt with in the past:

- *Equipment* — lack of equipment, problems with equipment and the need to know about new equipment.
- *Personnel* — personnel problems, hiring problems, dealing with superiors, dealing with other departments, personnel cuts, training and employee evaluations.
- *Procedures* — the need for improved procedures, for training on procedures and to develop procedures.
- *Budget* — budget cuts, how to develop a budget, balancing budgets, personnel budget, capital budgets and cutting costs.
- *Technology* — access to new technology, training for new technology and money for technological improvements.
- *Laws and regulations* — compliance issues, informational needs and paperwork.

### Decide on a first step

Once the problems are out on the table, it will be evident that each member of the network has many of the same problems and needs. This can be an eye-opener for an engineer who has been struggling in isolation for years. Now it is time to select a problem for the network to address.

Two principles make a network workable: 1) there is strength in numbers, and 2) a load shared is a load lightened. Remember, using the network should prove to be an advantage, so when a problem is chosen it should be because the network can do it better, faster or cheaper than the individual. This normally happens when the strength of numbers brings savings or power or when working together benefits everyone.

Whatever project the group decides to tackle, it should be simple, fit a defined time line and show measurable results within a reasonable length of time. This way the value of participation in the network is reinforced quickly and continued involvement is easily justified to your general manager and yourself.

### Follow the rules

Network participation demands rules to follow. They are not difficult, but they need to be honored or all of the work and effort that you and your fellow members went to will be lost.

- *Decision makers.* If the network is to be effective, its decision makers must participate in the activities and meetings. Once people begin to send representatives who do not have decision-making authority, the entire ability of the group to commit, decide and act is compromised.
- *Getting and giving.* When the network is first formed, everyone must be shown how they can profit from it. Network operation involves giving and getting, and emphasis must be placed on the benefits of participation or there is no justification for the network.
- *Victimization.* The benefits must be real and everyone must share in them. If one member of the group can be hurt by the process, then anyone and everyone can be hurt. It is in the member's self-interest to protect the group from being victimized by the process.

The FEN can offer you an opportunity to expand your resources and improve your effectiveness as an engineer and a manager. Next month we will look at making a network worthwhile. ■

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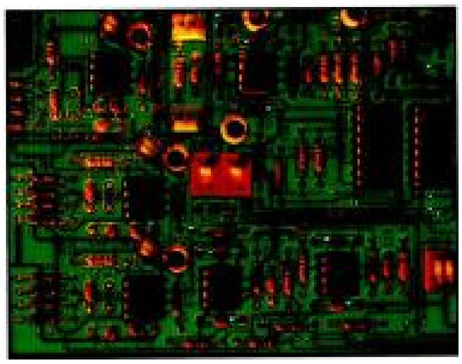
Part 2

# Circuits



## Computer-based video editing

*Multistandard decoder chip works digitally*

**By Gerry Kaufhold II**

Last month we showed how a new series of low-cost CCIR 601 (D-1) compatible chips produced an 8-bit datastream of digitized video. Now let's look at how the digital multistandard decoder (DMSD) chip pulls color out of the datastream.

Figure 1 shows the inner parts of the DMSD. The datastream comes in at the selected sampling rate. For converting NTSC video into a VGA format for a computer, the sampling rate is 12.272727MHz.

### Filtering luminance data

For luminance, the data goes to a color-stop filter. This low-pass filter is implemented using digital signal processing (DSP) techniques. The detail in Figure 1 shows that it works like a digital bucket brigade. Each byte is shifted into the input slot of an 8-byte shift register. Each time a new byte shifts into the input slot, the previous byte is multiplied by a preprogrammed coefficient and added to the contents of the next slot in the brigade.

By varying the coefficients used for multiplication and the number of slots in the daisy chain, the filter's parameters can be tightly controlled.

After filtering, the luminance signal is fed into a digital delay line. This keeps it time-aligned with the color signals, which use a separate processing path.

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

### Pulling out chrominance

The datastream also feeds a color bandpass filter. This filter eliminates luminance from above and below the color subcarrier.

The discrete time oscillator (DTO), described last month, provides highly stable timing pulses. The pulses are synchronized to an odd-numbered multiple of the input video horizontal line frequency. Because the chips produce their own clock signals based on the input video, they are compatible with multiple TV standards.

The DTO timing pulse triggers a counter circuit that provides addresses to two read-only-memories (ROMs). Each ROM contains 8-bit amplitude values for a sine wave. The waves are 90° out of phase with each other. Together, they set up the quadrature demodulation required to recover the individual color-difference channels from the signal. This is done in two multiplication blocks, one for the Y–R signal, the other for the Y–B.

At the bottom of each multiplication block is an optional input for a color saturation control. This applies a numeric multiplier that increases or decreases the gain of the two color signals.

***By varying the coefficients used for multiplication and the number of slots in the daisy chain, the filter's parameters can be tightly controlled.***

Each demodulated and amplitude-adjusted color signal passes through a digital low-pass filter. The color-difference signals and the luminance signal then pass to later stages of the DMSD, where a digital matrix decodes the YUV into RGB for display.

Because it lacks any temperature-sensitive analog components, such as capacitors, resistors or inductors, the digital demodulator may produce better results than most analog demodulators. ■

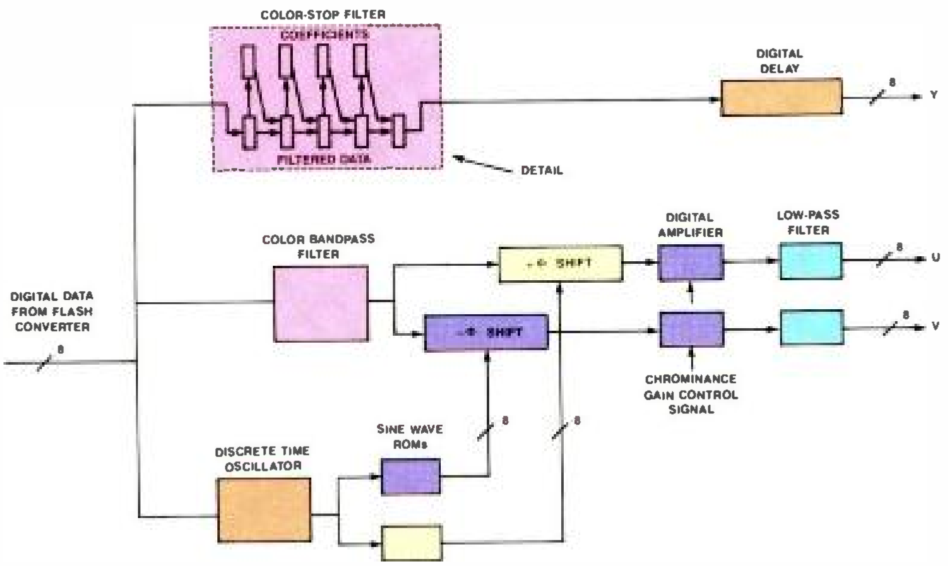



*Figure 1. Internal block diagram of a digital multistandard decoder chip. The detailed section illustrates the operation of the filters. Signals step through shift registers accompanied by successive coefficient multiplication stages.*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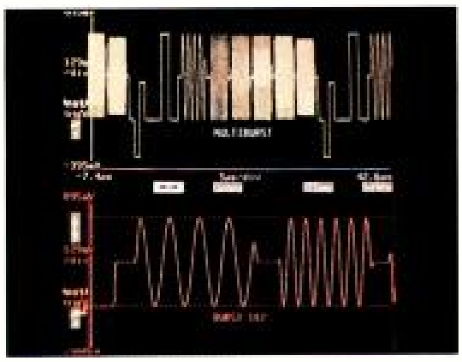
Part 2

# Troubleshooting



## Maintaining STLs

*System design calculations*

**By Chris Durso**

In any preventive maintenance program, the characteristics of a system must first be established to determine a benchmark performance level. Calculating the contribution of each component will also reveal the most effective approach to overall system maintenance.

Performance goals for an STL system are set to satisfy a minimum demodulated carrier-to-noise or signal-to-noise figure. This figure, and the receive-signal strength required to achieve it, are specified by equipment manufacturers. An STL should also be robust enough to allow for a reasonable fade margin because propagation conditions are seldom, if ever, ideal.

### System calculations

First, list all of the components in the system (transmitter, receiver, transmission lines and antennas) and verify that each is performing as it should. If you do not have access to test equipment for microwave frequencies, you can still obtain meaningful performance data. Use front-panel meters and/or internal test points to take meter readings and compare them to those shown on the final test check-out sheet. Regular use of this procedure helps locate problems before they become serious.

### Feedline and antennas

Each element in the feedline system combines to increase the total system loss. If system loss becomes excessive, there are ways to improve it without replacing an entire line.

Ensure that all jumper cables (or "pigtails") between components are in good electrical and mechanical order. Replace any cables using RF adapter connectors with new ones having the proper connectors permanently affixed.

Consult the cable manufacturer's data sheets to calculate expected main feedline loss. (Loss will vary with frequency of operation.) For coaxial systems, assume an additional −1dB for each jumper cable and −3dB for combiners and splitters.

### Path loss

Naturally, propagation loss (*free-space loss*) over the STL path must also be considered. It can be calculated by the formula:

$$\text{Loss in dB} = 36.6 + 20 \log f_o + 20 \log d_m$$

Where $f_o$ is frequency of operation in megahertz and $d_m$ is path distance in miles.

| | |
|---|---|
| Transmitter output power | 38.45dBm |
| Transmit antenna gain | 22.00dBi |
| Receive antenna gain | 22.00dBi |
| Total system gain | +82.45dB |
| Path loss | 116.15dB |
| Total transmission loss (TX+RX) | 3.00dB |
| Total connector loss | 0.50dB |
| Other losses (splitters/combiners) | N/A dB |
| Total system loss | −119.65dB |
| Total system gain | +82.45dB |
| Total system loss | −119.65dB |
| Net received signal | −37.20dB |
| Minimum signal required | −66.00dBm |
| Net received signal | −37.20dBm |
| Fade margin | 28.80dB |
| 0.6 Fresnel zone clearance required at path midpoint | 67.51 ft |

*Table 1. Calculation summary for STL performance assessment. Example shown is a 950MHz aural STL of 10 miles, with 7W RF output, 6-foot antennas, and a total feedline (7/8") length of 200 feet. Design goals are 60dB S/N with 20dB fade margin.*

A calculation must also be made to ensure that the existing path is clear of obstructions. Microwave engineers use a figure of 0.6 Fresnel zone clearance at the path midpoint to determine if a path is clear. The Fresnel zone describes how RF energy behaves in terms of its dispersion over the path length. If an obstruction occurs within the 0.6 Fresnel zone, the system reliability may be compromised. The 0.6 Fresnel zone is largest at the path's midpoint.

To determine Fresnel zone clearance, plot a path profile on 1/3 earth-radius paper. The required accuracy dictates the use of a 7.5-minute topographical map with data points taken at every 0.1 miles. If you are aware of any man-made obstacles in the path, be sure to include them in the profile.

After the profile has been plotted, draw a straight line from the transmit site to the receive site. Use the following formula to determine required clearance:

$$\text{Clearance (ft)} = 1{,}316 \sqrt{D_1 \times (D_2 - D_1)/D_2 \times F_o}$$

Where $D_1$ is the distance to the obstruction in miles, $D_2$ is the path distance in miles and $F_o$ is the operating frequency in megahertz.

For example, over a 20-mile path, operating at 950MHz, a clearance of 95.5 feet from any obstruction is required at the midpoint (10 miles). If this condition cannot be satisfied, the transmit and/or receive antenna elevations should be increased. If this is not possible, consider a multihop system.

Once it is determined that the path is free of obstacles and all components are in good physical and electrical operating condition, add the measured and calculated losses and gains to determine the performance level of the STL system. (See Table 1.) With this information and understanding, you can quickly locate system faults and intelligently upgrade system performance. ■

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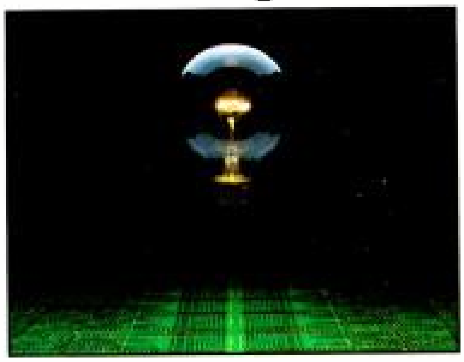
# Technology News



## Charged up, environmentally

**By Carl Bentz, special projects editor**

More than 100 years ago, Georges Leclanché, a French chemist, invented an unusual device that produced electricity from chemicals. Since that time, batteries have become a staple in our lives. In fact, our way of life would not be the same if we had to do without the myriad AA, AAA and button-type batteries that run our clocks, radios, camcorders, computers and other "must have" conveniences.

In 1990, statisticians indicated sales of 1.83 billion manganese, 480 million alkaline and 220 million lithium batteries. For 1991, a 4% increase in manganese, 9% in alkaline and 19% in lithium units were expected in Japan alone. To these *primary* battery types (primary meaning they cannot be recharged), add in nickel-cadmium units. Considering the demand for portable power worldwide, the total world sales figures would be mind-boggling. Estimates have suggested that there are more than 15 billion batteries of various types, with 90% of them being disposable types.

### Disposing of the disposables

Now, consider the problem of disposing all of these units when their useful life is concluded. If the volume of one AA type battery is only approximately 0.34 in$^3$, the volume of 10 billion AA cells is about 74 cubic yards. Spread over the world's landfills, it is not that much per year. However, each of those billions of AA cells, until recently, contained reasons for environmental concern — mercury and cadmium, among others.

Mercury in the manganese battery plays no part in power generation but protects the zinc container from corrosion. Without the trace of mercury (in 1983, 0.0035% of total weight of a manganese battery, 1.5% of alkaline batteries), consumers complained of leakage problems and the short life span they experience. (How long were the batteries on the shelf?) Meeting the demands of environmentalists to reduce contaminants, manufacturers found new ways to lengthen life, albeit with some difficulty. However, by 1991, manganese batteries were mercury-free.

The next challenge was cadmium. Sharing many of the characteristics of zinc, cadmium was found to improve the molding performance of the zinc container. When its poisonous nature as a pollutant became known, manufacturers again sought ways to remove the cadmium. The end of 1991 was targeted for freedom from cadmium.

***Disposal of batteries presents environmental concerns.***

Alkaline cells have presented problems as well. Their mercury content was even higher, causing some locales to ban the practice of throwing used alkaline cells into burning trash. Lead, indium, gallium and aluminum form anti-corrosion alloys with zinc, which brought about a hope for mercury-free alkaline cells this year. Still remaining in alkaline cells is PVC, which, when burned, releases a compound known to help cause acid rain.

The cadmium content of the NiCad rechargeables used with portable TV equipment has not escaped the environmentalists' concern. In fact, cadmium is a more prevalent component in the negative electrode of the NiCad than in alkaline units. On the plus side is the fact that larger NiCads used by ENG crews will probably be recycled. On the negative side is the problem of finding a battery chemistry with power density characteristics equivalent to or better than NiCad.

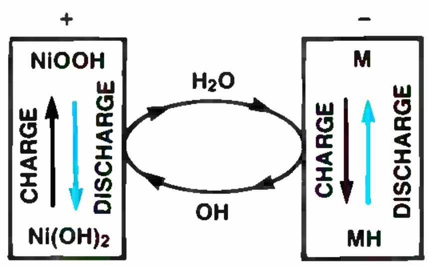



*Figure 1. The reactions involved in nickel-metal hydride battery chemistry.*

### A positive step

One solution has recently been introduced to the market. Nickel-metal hydride (N-MH) batteries are available for many applications from 2-way radios and cellular telephones to portable computers. Unlike some modern solutions to old problems, the N-MH battery appears to be a positive step in several ways. The per cell operating voltage is 1.2V, the same as NiCad. This makes the two technologies interchangeable. The discharge-recharge cycle capability of N-MH units is known to be at least 500 cycles, which projects an outstanding service life.

The best news for those using portable professional production equipment is the power capacity or power density characteristics of N-MH batteries. They offer 1.8 times greater capacity than standard NiCad systems. With proper equipment, full recharging of a battery should be accomplished in 1.5 hours.

How do N-MH batteries differ internally from NiCad? The secret is found in the replacement of the cadmium negative electrode with a metal hydride alloy that absorbs hydrogen. In fact, the alloy may extract as much as 1,000 times its own weight in hydrogen from the battery's alkaline electrolyte. The overall reactions in the charging and discharging states are exactly opposite. Voltage levels and battery temperatures provide characteristics by which the charging process can be controlled.

As you might expect, new technology means higher costs. Cost is the down side to the N-MH battery. For the time being, the initial purchase price of the new battery is greater than that of NiCad systems. However, you should consider the improved capacity (run time), the recharge cycle capability and the characteristics of environmental cleanliness. There is a good chance that the increased purchase cost will be offset significantly by the fact that the environment will not have to be rebuilt (if that's possible) when the new technology is disposed of. ■

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**1985** • AutoCam HS-110P studio camera pan/tilt head.

**1986** • Tandem operation of MultiControllers for enhancing operational flexibility.

**1987** • AutoCam HS-105P ENG/EFP camera pan/tilt head.

**1988** • AutoCam ACP-8000 touch screen, menu-driven eight camera controller. • AutoCam SP-200 Servo Pedestal for HS-110P and HS-105P. • AutoCam Newsroom Computer Interface for ACP-8000.

**1989** • AutoCam SP-200/X-Y. The world's first "free-roaming," full-motion X-Y base. • AutoCam SportsFocuser automatic focusing system. • Patent awarded for SP-200/X-Y targeting system. • Copyright for ACP-8000 touch screen software.

**1990** • AutoCam Full-Motion control editing. • ACP-8000 on-screen air tally. • Real-time CCU control. • MCB-1 local manual control box. • ROP Remote Operating Panel. • Battery Pack option for SP-200/X-Y.

**1991** • AutoCam ACP-8000S, 486/33 controller upgrade. • Real-time, collision avoidance and studio set mapping. • Enhanced VGA graphics. • Multiple screen files for quick transition for back-to-back shows. • Powerful single screen operation. • EMMY Award.

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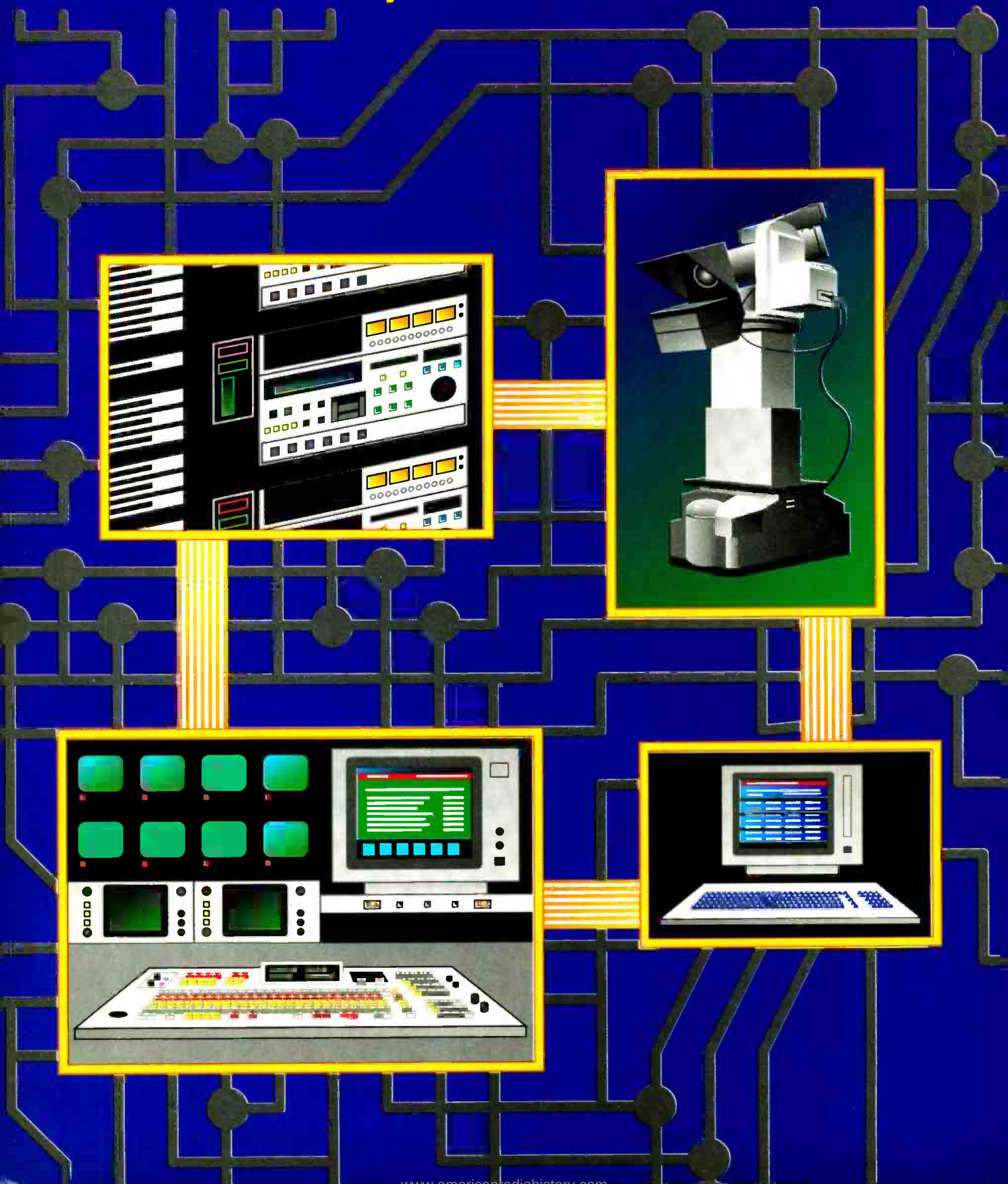
# Facility automation



## Effectively automating your station can result in big savings.

TV automation has matured greatly in the last three years. We've come a long way from the days of stand-alone automation islands to today's integrated, facility-wide systems.

The challenge for today's technical managers is to implement as much automation as possible, with an eye to production capability and the bottom line. Today's systems no longer make the decision to automate a win/lose proposition. Instead, an effectively planned system can bring tremendous benefits to many areas of the facility. Often, everyone comes out a winner.

This month's coverage begins by looking at the fast-paced area of newsroom automation. "Integrating Newsroom Automation" reveals that it isn't always necessary or prudent to replace older technology. Sometimes, renovation and modification of hardware and software can result in improvements — and do so on a cost-effective basis.

It's important that stations do not approach automation from just a piece-meal standpoint. The optimum results can be expected only when the total picture is taken into account. "Closing the Loop: Facility-Wide Automation" shows how an integrated approach to TV automation can solve problems and achieve new levels of capabilities.

Although the video cartridge machine is now taken for granted, it is only one important component in the quest for improved operations. Adding master control automation is an effective second step. "The Dollars & Sense of Master Control Automation" recounts the success one station enjoyed from the use of the technology and how you can plan to profit from it as well.

"The Human Side of Camera Robotics" explores the people side of robotic camera systems. Robotics are often perceived as a threat to some station staff. As this story explains, that needn't be the case. Those who embrace the technology often find professional growth and satisfaction by using it.

The world of the digital advantage also applies to radio. Radio stations are now finding that digital equipment affords many advantages over its analog counterparts. Often, the goal is not whether to replace analog devices with digital ones, but how soon you can do so. The author of "The Digital Radio Station" reviews some of the areas where radio stations can quickly take advantage of the digital domain.



Brad Dick

Brad Dick, editor

# Integrating newsroom automation

By Marvin Born

**Why replace your automation system when you can upgrade it?**

### *The Bottom Line*

*Today's state-of-the-art newsroom automation systems can run circles around those of just a few years ago. But today's station budgets may not be able to handle the cost of these systems. Here's how one station upgraded its existing newsroom computer, smoothly integrating it more fully into the facility. The result is a completely automated newscast system, cost effective and custom-fitted to the station's needs.*

The newsroom computer at WBNS-TV, Columbus, OH, was one of the first automated news systems ever made. It featured word processing, wire copy input and good archiving features, using a mainframe with 44 "dumb" terminals. Although long overdue for replacement, the news director did not want to give up the old archiving system, and the news staff didn't want to have to learn a new system. The cost of a new 40-terminal system was also fairly steep. In addition, none of the commercial systems available at the time provided all of the features we wanted. So it was decided to put off buying a new system and to try modifying our existing system to emulate a state-of-the-art newsroom computer.

We soon found that this wasn't going to be easy. The author of the original software had left no "hooks" in the programming for adding features, such as machine control. And with only three systems in existence, the author had no plans to write an update. After some study, it was found that the only clean way to interface with the existing mainframe was to build a stand-alone machine and pretend it was a printer on the old system.

Word processing, archiving and wire copy operations were available in the same way and terminal hardware wouldn't change. But a separate "retrofitted" system would control videotapes, teleprompting, closed-captioning, character generation, still-store graphics, and the usual "live" newscast-production features, such as back-timing, forward-timing, segment-timing and insertion or deletion of stories. For purposes of identification, the old system is referred to as the "*newsroom computer*" and the retrofit system as the "*interface computer.*" (See Figure 1.)

Born is vice president of engineering at WBNS stations, Columbus, OH.

#### The human interface

Because the software running on the main system could not be changed, the simplest method of human interface was to place control codes and key words within the scripts written by the news reporters and producers.

Code words and symbols, such as BC=N123, SS=9,800,300 and CG="John Smith" could be written into the script as the reporters entered their stories. Using the word processors on the old system, the producers and script editors simply entered the proper tape number and still-store address numbers. The character generator would use the exact spelling from the embedded text.

For example, BC=N123 is Betacart number 123, to be used on the noon news. CG="John Smith" is a lower-third super and the SS= string is address 300 on the 800Mbyte drive, which is to be output on channel 9.

#### Interface hardware and operation

The interface computer is actually a pair of 80386s running at 33MHz under OS/2, mirrored for backup purposes. Each one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holds a 150Mbyte hard drive, 8Mbyte RAM and eight separate serial ports through which all production hardware is controlled via RS-232.

Prior to the beginning of a newscast, the producer "prints" the complete show from the mainframe to the hardware-interface computer. This file contains all of the newscast's anchor and reporter scripts with embedded control commands.

Then, about five minutes before show time, the producer runs the production software on the interface computer. It searches the "printed" file that was sent to it earlier for the BC, SS and CG commands. From the BC data, a Betacart playlist is generated. The SS codes allow a stills list to be prepared in order of use, and the CG commands are used to build and store all the lower-third supers for the show. The text of the script is searched and ordered for the teleprompter and captioning displays.

### Videotape control

Videotapes for the newscasts run on a Betacart machine, which is connected to the interface computer via a serial port. Whenever a cart is loaded into a bin on the Betacart machine, the elevator sensor reads the cart's bar code information. When the news production software is run on the interface computer, a playlist is generated and sent to the Betacart. The Betacart immediately returns the tape title and duration data (obtained from bar code) to the interface computer, along with an assigned output channel. The first four tapes are assigned decks, loaded, cued and then allowed to "tape slack." If the carts are already loaded in the bins, the whole process takes about two seconds.

Although instant rolls are possible with a Betacart, our system uses a 2-second preroll. This allows rolling from tape slack, which reduces head wear and the likelihood of clogged heads. One button attached to a serial port is used to roll the decks. When it is pressed, the next-listed deck rolls and is output to its assigned channel. This takes some of the pressure off of the technical director because he doesn't have to keep track of which machine to roll. Sequencing is all automatic, including multitape rolls.

This whole system depends on bar codes, which are written by people. Errors in bar coding are the number one tape problem.

### Still-store control

The still-store program searches the newsroom computer scripts for the SS codes, finds the image's address on the proper disk pack, and places the video on the correct channel. All the news department has to know is what still-number to assign the story.

This process is fairly straightforward, but the still-store is "dumb." Although it has an RS-232 input port and will respond to commands, it does not *answer* or acknowledge the receipt of the commands. Therefore, all communication with it must be slow enough to ensure that no data is lost. Because the manufacturer no longer

*Continued on page 30*

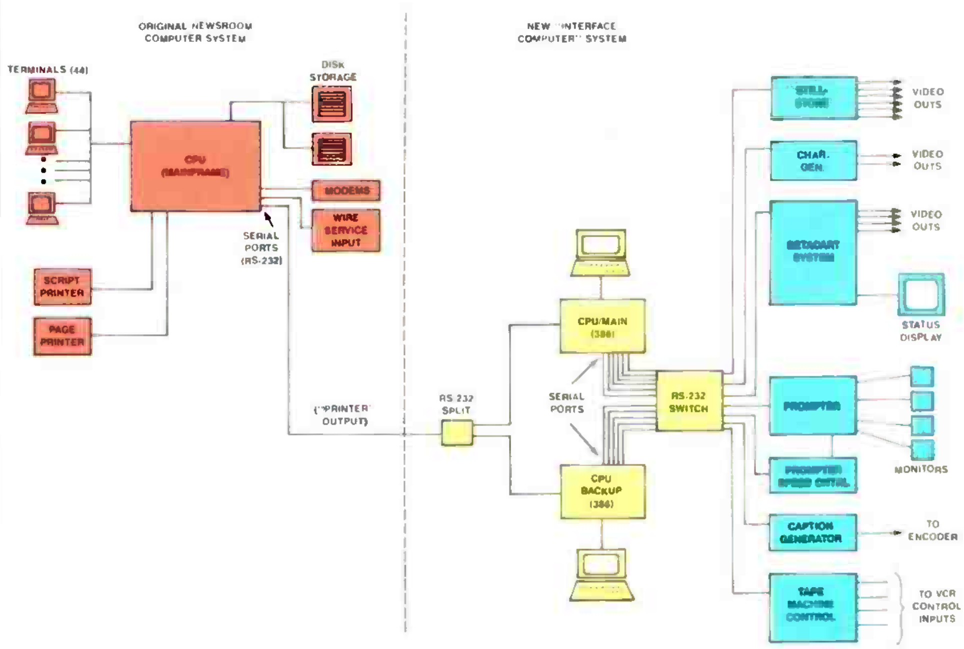
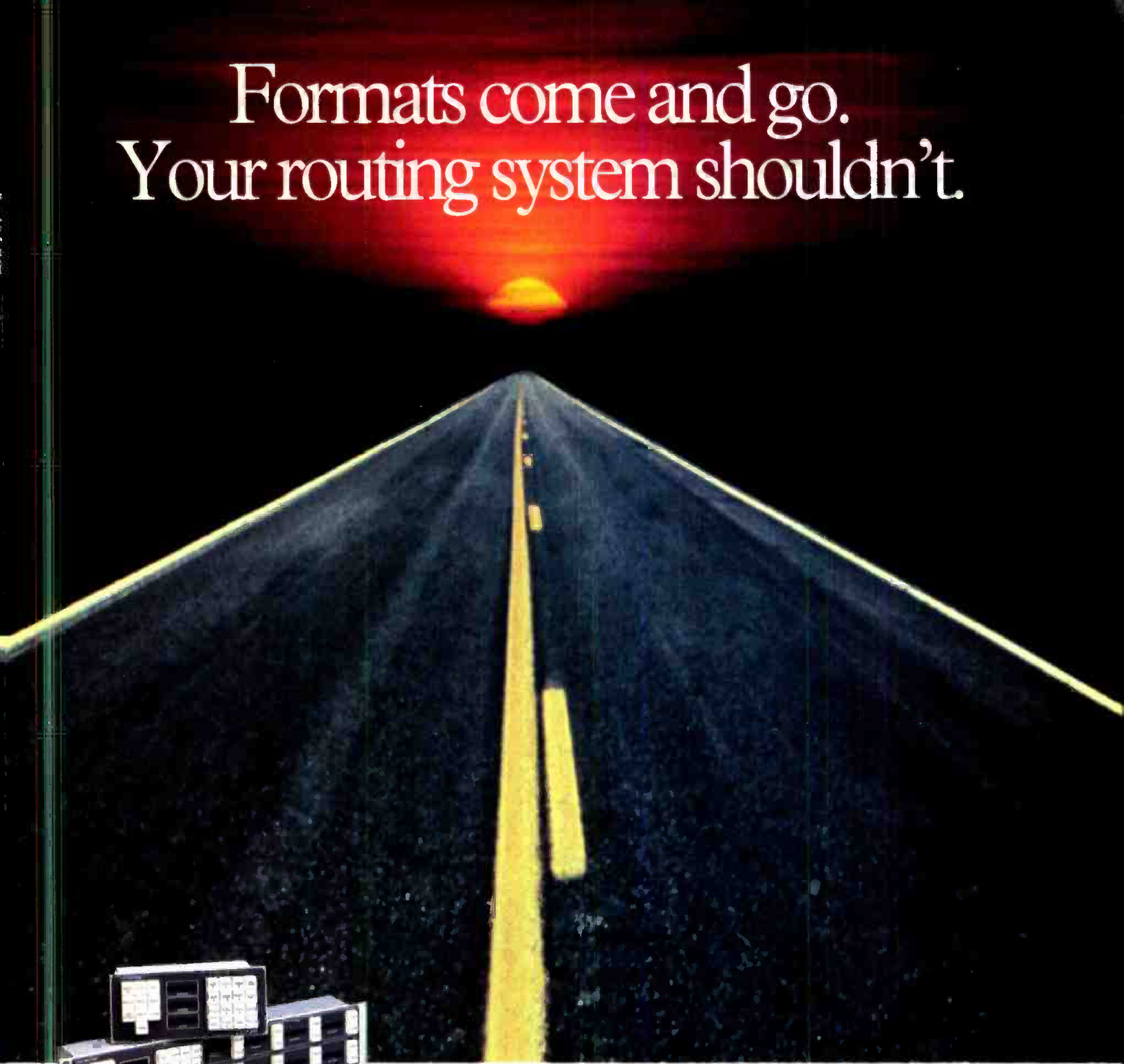
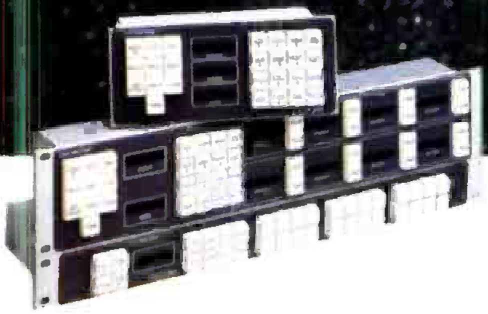



***Figure 1.** Basic block diagram of integrated newsroom computer system at WBNS-TV. Original newsroom system is at left, with retrofitted "interface computer" at right, adding automated device control. An RS-232 "printer" interface connects the two systems. Software running on 386 interface computers translates embedded control codes in news scripts to machine control data.*



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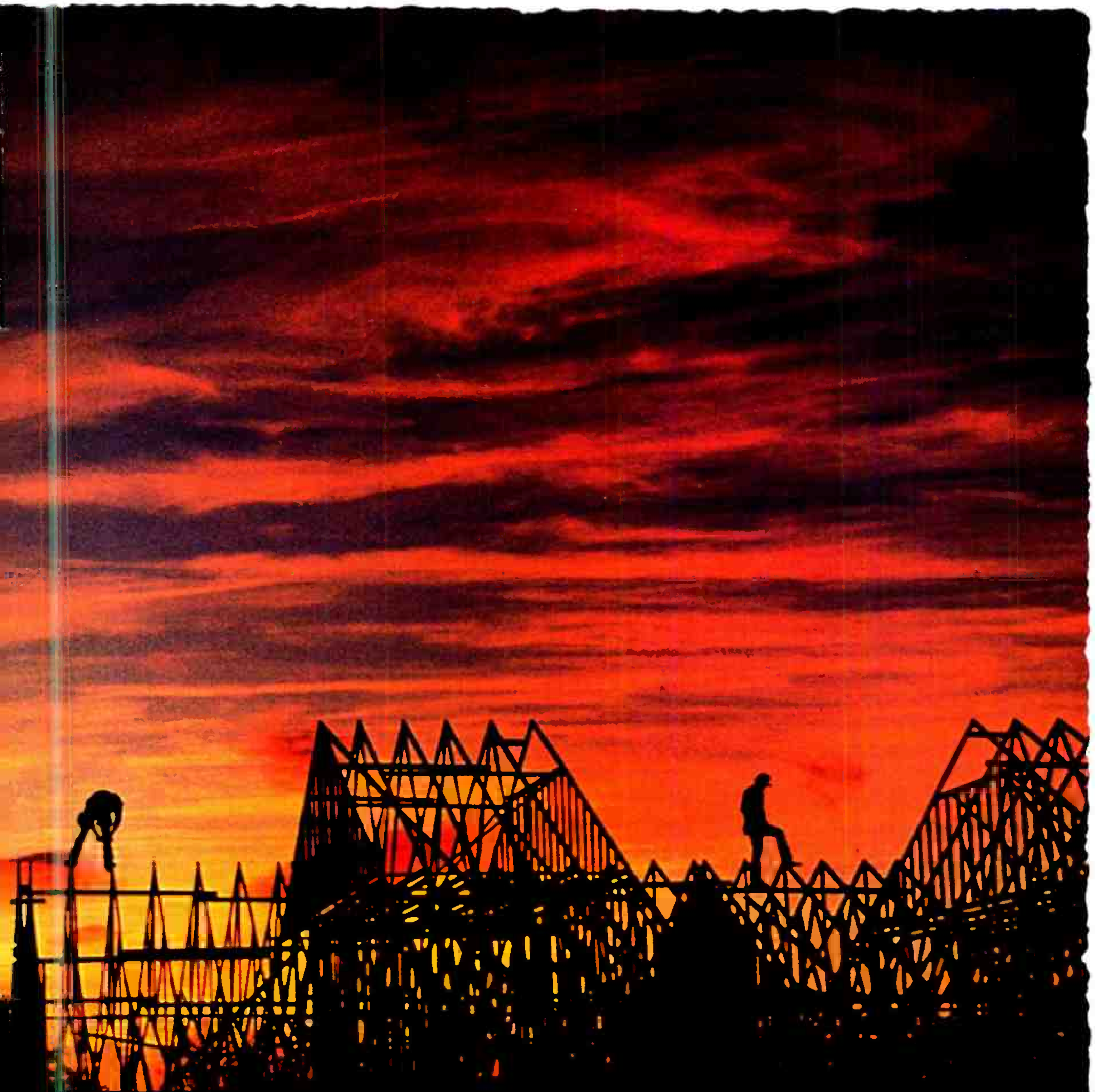

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*Continued from page 26*
supports this unit, there is no updated software to handle bidirectional data.

### Character generator control

The character generator interface was the most complicated to implement. Again, the scripts are searched for CG codes. The data enclosed between parentheses in the codes are collected, and a list is formed. That list is transmitted directly to the character generator, where the supers are built on-the-fly.

Prior to building the first super, font and position information for the complete newscast is transmitted. The first super is then built accordingly and stored on the CG's hard disk. That disk address is placed in memory in the interface computer, to be called up by the show production software when needed in the newscast.

One difficulty involved *spelling*. In the old system, the reporters gave the CG operator a list of supers. Proper spelling was the responsibility of the CG operator. If the reporter misspelled a name or a location, the CG operator generally caught the error and corrected it before it went on the air. Now, with no dedicated CG operator, the computer uses whatever is between the parentheses on the newsroom's scripts. This reassigning of responsibility took a bit of adjustment on the part of the newsroom staff.

### Teleprompter control

For prompter and captioning applications, the newscast script file contains *all* anchor and field reporter scripts (both live and tape packages). But the electronic prompting and caption equipment must deal with each type of script differently.

Although the anchors do not normally read reporters' field scripts on-air (unless tape fails), these scripts are displayed on the anchors' teleprompter monitors. To keep things straight, the anchors' scripts are displayed white on black, and the field reporter scripts are reversed black on white. The output of the prompter is also fed to the closed-caption encoder, where the control bit for reverse video is stripped so the viewers using closed-caption decoders see *all* script material in a normal display mode. The prompter operator uses a joystick to control the speed of the text as it scrolls on the screen.

Early lessons in this area learned by the staff was not to type notes in the audio section of the script and to spell *every* word correctly, not just the supers. Another difficulty came from the need to run the reporters' scripts on the system in real time for the closed-caption feed. This prevents the practice preferred by many anchors, in which the prompter is cued to the top of their next story while a tape is running (or live segment is airing). Cuing the prompter reassures the anchors that the script is ready for their next read.

We considered giving the anchors control of their own prompters. But a complicated switching system was required for each of several anchors (in dual news, sports and weather) to have control at the appropriate times. Additionally, one anchor would have to operate the system for the field tape and live field reports to keep the caption equipment in sync with the show. The problem was resolved by retaining a prompter operator and locating the control near the still-store and CG keyboards.

### Display

The producer's screen is a typical OS/2 multiwindow display. The main window contains a listing of the stories and events comprising the newscast, with a cursor and a green display bar that moves on top of the current story being aired.

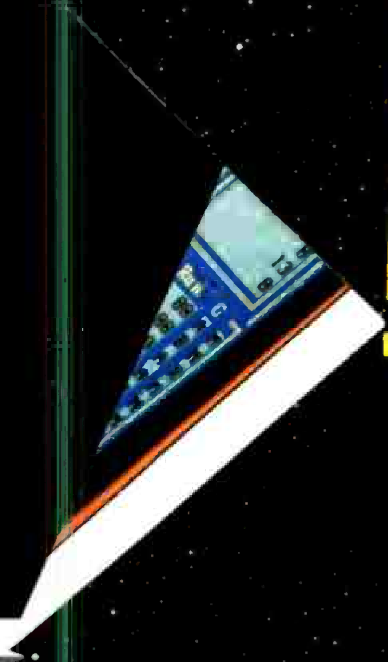
Near the top of the screen are several timers. The first is a running stopwatch that counts in seconds up from zero to 30 minutes. A reverse timer also counts down to zero. To give a reasonable time for reading the current script, an additional segment timer receives the bar code information from the tapes or data from a text algorithm. With all of the timing data available, a count is maintained for the projected running time vs. the actual running time. The timers will turn red if the show is more than five seconds long or green if the show is running short.

*Producer's station, with interface computer terminal at center (countersunk monitor). Two video monitors on overbridge behind the terminal show teleprompter and Betacart status displays, respectively. Terminal at far right is part of original newsroom computer system.*

Windows display the on-air and next-to-air still-image titles and CG supers. A separate monitor displays Betacart information, so there is no full-time window for cart information. However, a "cart fix window" can be opened on the interface computer for changing tape numbers and titles or making additions and deletions.

### Late changes

Not only must *tape* changes be accommodated, but *whole stories* may need to be replaced. In this case, the old story data is deleted on the interface computer and a new story is written on the newsroom computer and "printed" to the interface



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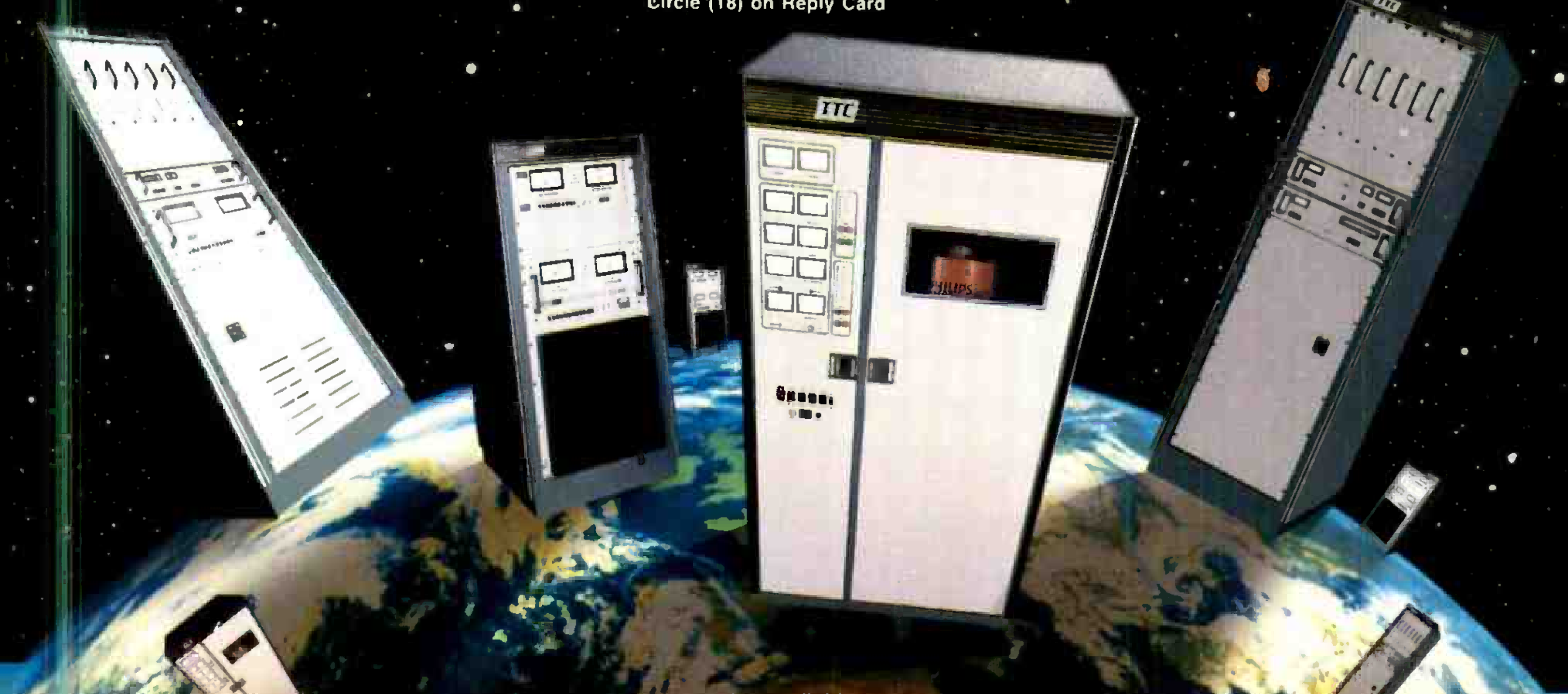




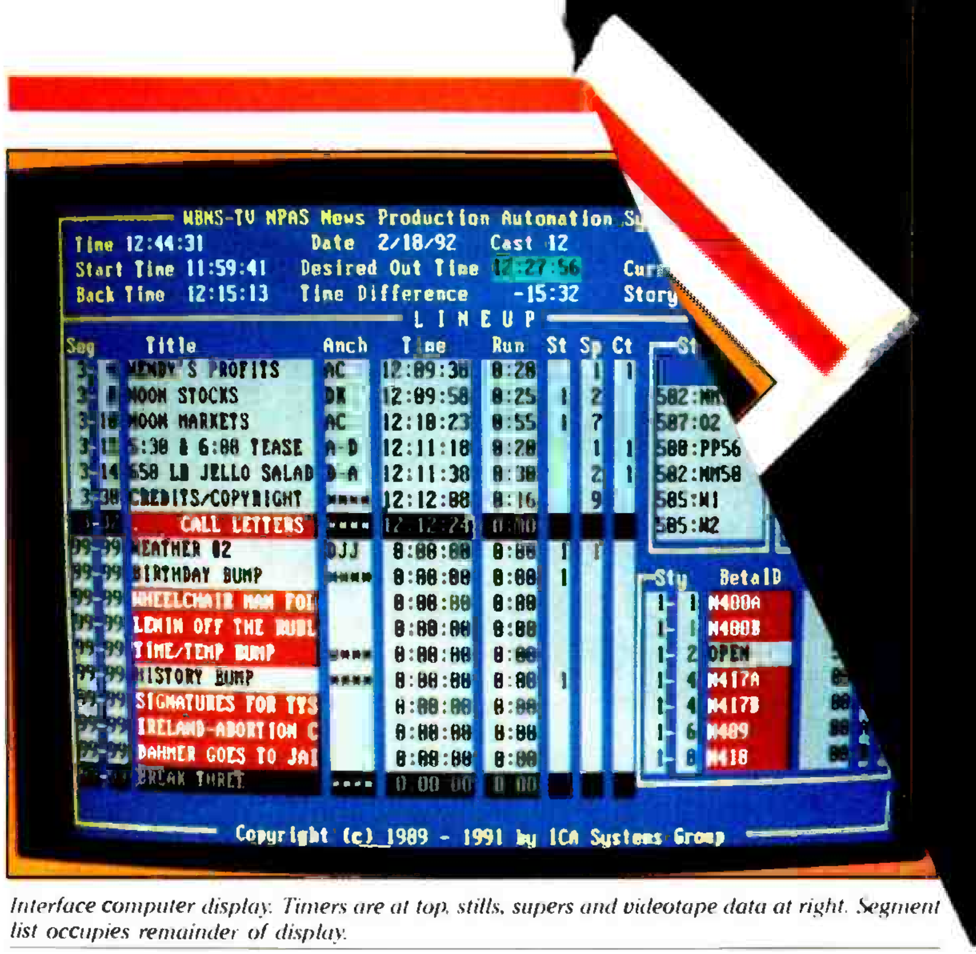


*Interface computer display. Timers are at top, stills, supers and videotape data at right. Segment list occupies remainder of display.*

computer, just as the original story data was. The producer then will designate the replacement story's place in the show's running order at the interface computer. Such insertions can take place right up to airing. But because the Betacart may have to unload and reload tapes, a more realistic limit to insertion time is about 10 seconds to air.

For live segments that are not quite ready but expected anytime, automation data can be placed in "story location 99" on the interface computer. This information can then be added anywhere in the rundown during the show, like any other insert. This is preferred over moving the story down the list several times when multiple delays occur. Once the shot is ready, 99 can be inserted "next-to-air" within seconds. This feature is helpful because all tapes, scripts, stills and supers follow the move to and from location 99.

This feature also allows the newsroom to prepare two stories for the same event when the outcome is unknown at show time but a conclusion is expected during the newscast. In the next software revision, perhaps more than one of these "standby" locations will be added. Sometimes two or more stories have been held.

### Lessons learned

One of the advantages of using an electronic news system is personnel reduction. Although some reduction may indeed be possible, actual experience shows that the computer will occasionally fail, and when it does, someone must be available to keep things afloat. An electronic newsroom system should be installed primarily for the flexibility it provides, not the personnel reduction it may offer.

One problem with prompter-driven captioning equipment is the lack of captions on ad-lib show segments, such as weather and breaking news stories. With current state-of-the-art equipment, it's possible to use a voice-recognition system to supply basic captioning for such events, using a library database of about 2,000 words for each reporter or weathercaster and larger libraries for anchors.

Blue-sky projections also call for live video displays on the newsroom computer terminal — a sort of "one-screen-does-it-all" system. For example, if the computer can call up a still for airing, it could call the still up to the reporter or producer's terminal as well, reducing the guesswork when composing the story and eliminating the need for the reporter/producer to walk to another part of the facility to see the stills prior to air.

The reporter could also view a full-motion videotape segment on screen while writing the script. Going a step or two further, editing commands could be written into the script to produce an edit list at the same time. That list could be used to drive an editing station, allowing the final edit of the tape to be produced from a newsroom computer terminal. Will things go this far? With current technology and the pace of its progress, the answer is a resounding YES, and then some.

*➡ For more information on newsroom automation circle Reader Service Number 543.* ■

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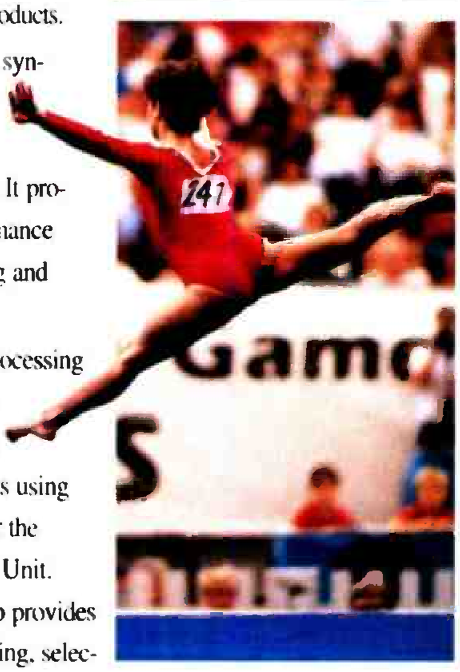

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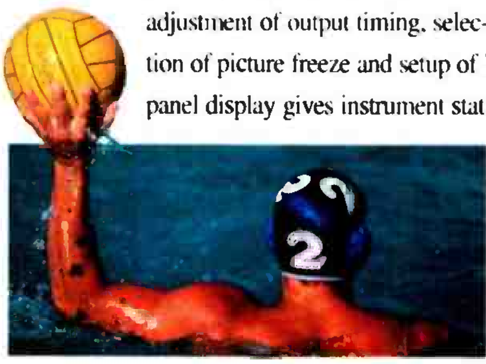

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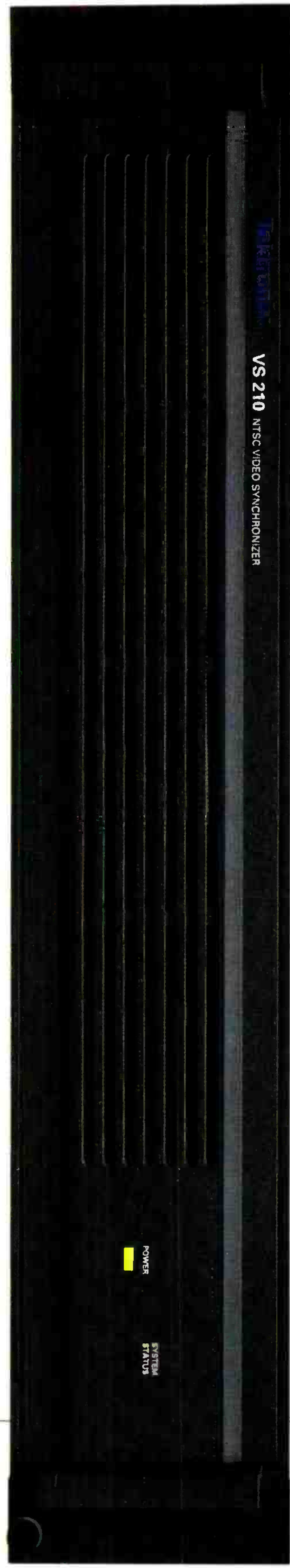


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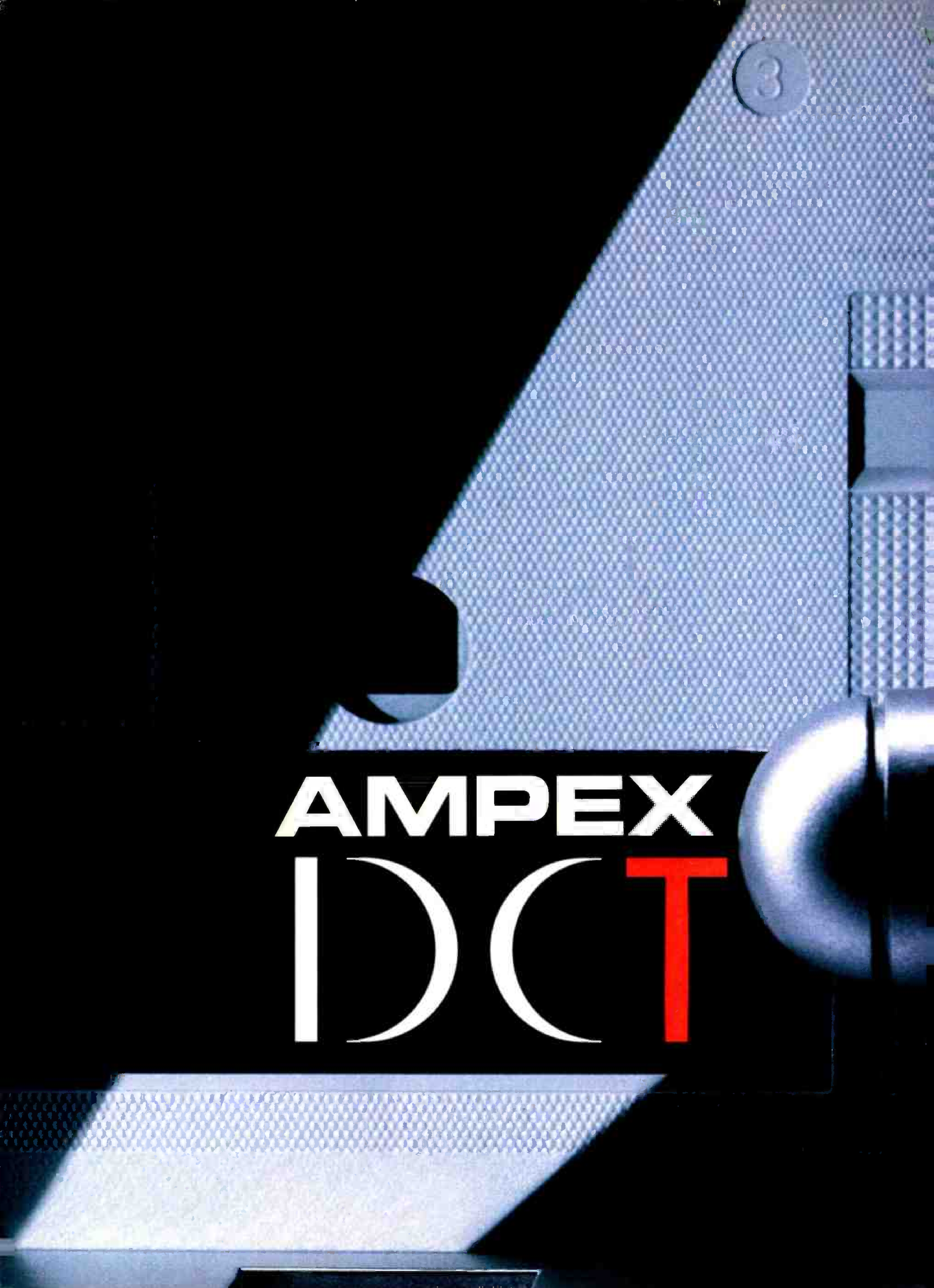
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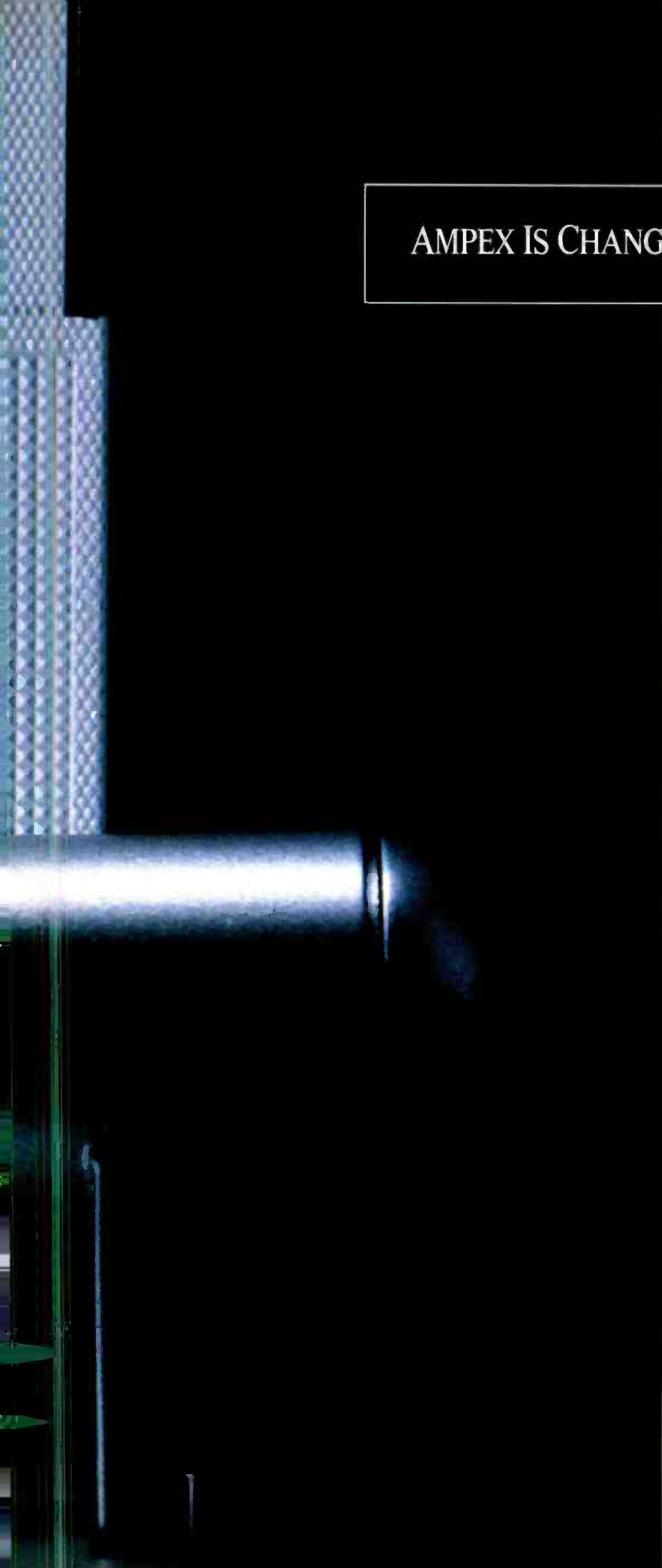

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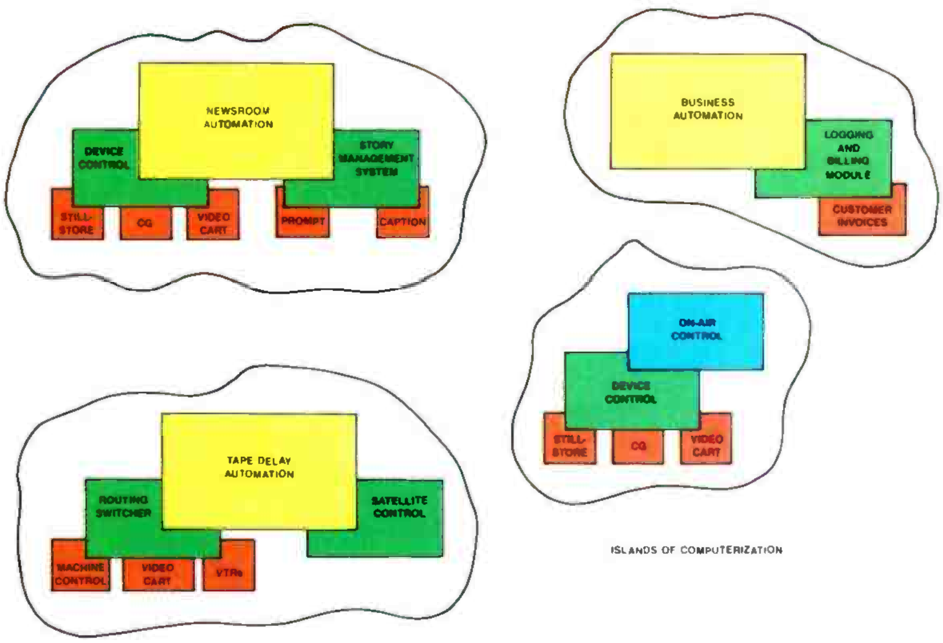


***Figure 1.*** *Many facilities have developed islands of automation. These do a good job of their specific functions, but they have a hard time sharing resources with the other islands. This reduces efficiency and increases costs.*

(LAN). A LAN allows different systems to talk to each other because on the network, all systems speak the same language. Translation occurs using software drivers within each system. This allows data to be shared without manual intervention.

One of the most common LANs is *ethernet*. The system is named for the medium through which radio waves were once thought to propagate. Ethernet uses a single coaxial cable as its medium. Any device with a message to send does so the moment it senses the cable is clear. All devices monitor the net and copy those messages that bear their address (call sign). If somehow two devices transmit simultaneously, messages may be corrupted. In this case, a jamming signal instructs all receivers to disregard both messages. Both transmitters then back off for a random interval before trying again. The chances are high that one or the other will capture the bus on the second attempt.

The free-for-all nature of ethernet sets

*Continued on page 42*

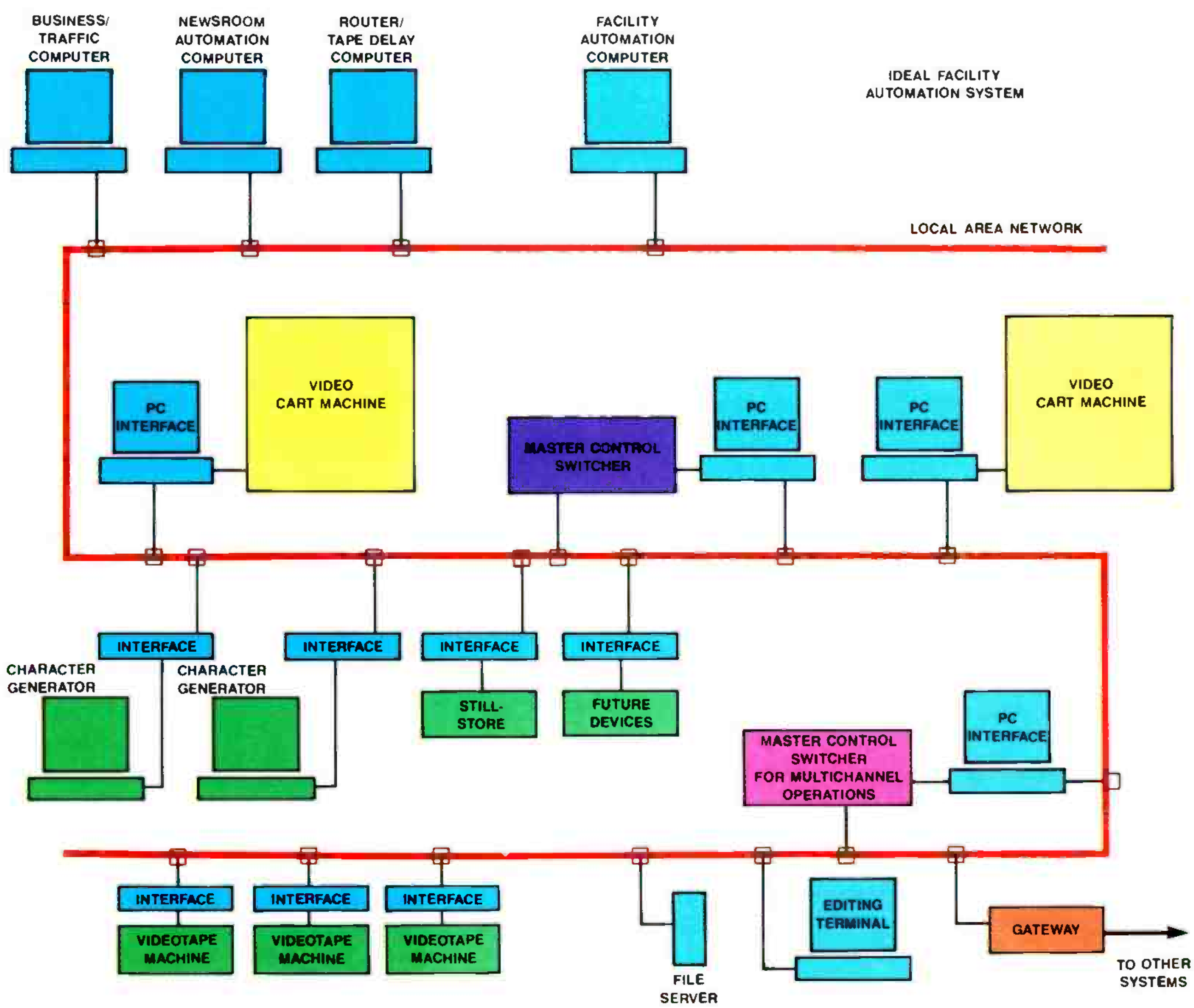


***Figure 2.*** *In a facility-wide automation system, all the automation islands become subsystems that share the station's production resources. The LAN enables the assigning and reassigning of devices.*

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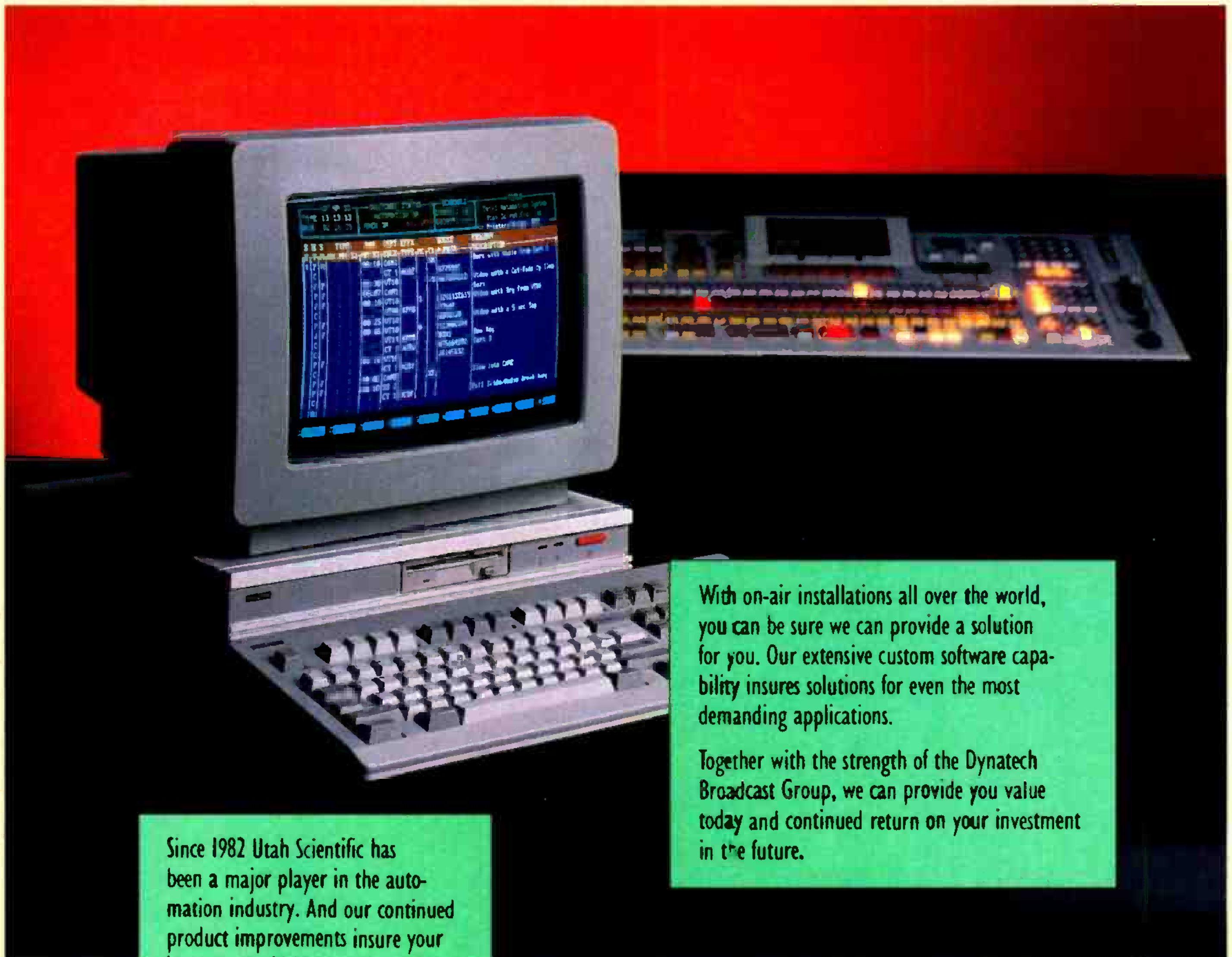

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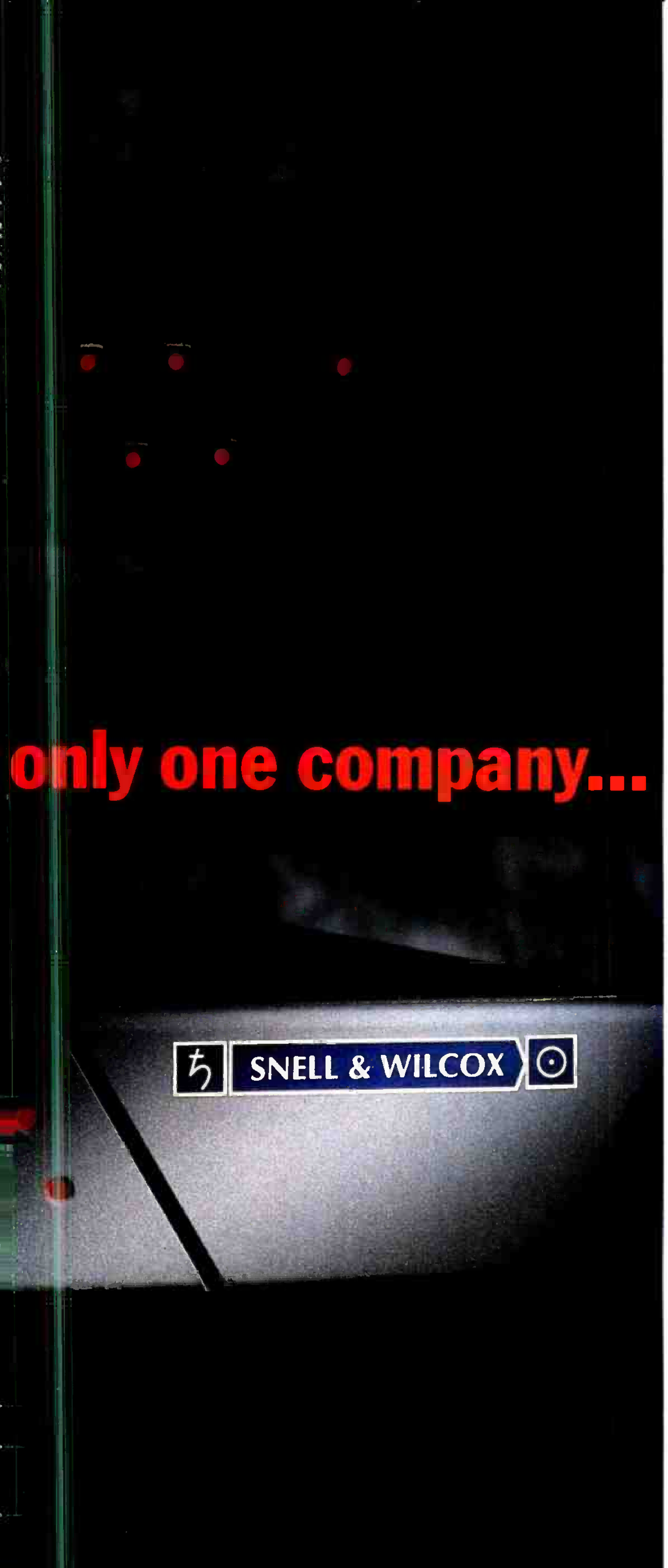


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# The dollars & sense of master control automation

By Olin P. Morris

**From rags to riches — automatically.**

### *The Bottom Line*

*Decreasing costs and increasing productivity are top priorities with today's station managers and engineers. Although automation is not a panacea, it can make good sense if implemented properly and in the right areas. When one TV station automated its master control operations, it saw an increase in productivity, a decrease in errors and a reduction in costs. If automation is planned and implemented carefully, it could change the color of your bottom line from red to black.* **$**

Increased productivity has become a focal point for business in the 1990s, and TV stations are no exception. Hard times have emphasized that efficiency is an important ingredient in the recipe for profitability. Therefore, the issue isn't whether to improve efficiency and thus productivity, but how to best accomplish it. This article recounts how WREG-TV — a top 40-market station near Memphis, TN — improved its operation through the implementation of a master control automation system.

**Identify problem areas**

In television, automation can be used in several areas. Any area automated will likely gain in productivity and lower operating costs. Typical operations often targeted for automation include the newsroom, camera operation and the on-air or master control area. Each of these areas can be individually automated, operating basically as a self-contained system. However, the best solution is not "islands" of automation that operate independently, but an integrated system where each of these systems work in conjunction with the others.

Each station has its own unique areas of operation where automation technology can provide solutions. If a station doesn't yet rely on cart machines, this may be the best first step toward automation. Although cart machines are quite effective in improving on-air playback of commercials, they are only part of the solution. More improved operation comes through the ability to integrate the as-run log, developed by the cart machine, with the station's business and accounting computer system. A station without this ability may have to manually reconcile 300 or 400 commercials each day. Electronic reconciliation compares the original program log against the automation system's as-run log. This means only the spots that ran outside of the allowed time windows must be manually reconciled. The new automation system reduced the time required to perform this manual task by 50 minutes per day. Although this may not seem like much, each small savings goes directly to the bottom line.

In addition to billing adjustments, the number of make-goods can be kept to a minimum. Because a computer handles most on-air playback tasks, the number of make-goods has been reduced to almost zero.

One of the most common problems stations face when considering automation is how to integrate the equipment already owned. No one can afford to replace everything, so the new automation system must be capable of working with whatever

Morris is president and general manager of WREG-TV, Memphis, TN.

hardware is being used.

Typically, a station's cart machines, log and traffic systems and other on-air equipment come from a variety of vendors. Each vendor's equipment will probably have different protocols. Getting the machines to talk to each other can be a challenge. Be sure they can handle this task when considering any vendor of master control equipment.

Two other areas that are prime candidates for control by automation include spot playback and satellite feed recording. An integrated master control automation system can help a station shift as much as two-thirds of its personnel running breaks to more productive and interesting tasks, such as production.

### Develop a plan

As soon as you have identified your station's particular problems, you can begin looking for answers. WREG-TV formed a high-technology task force to explore the options for station automation. The task force included representatives from the New York Times Broadcast Group, the station controller, the station's director of engineering and the president and general manager. By having a committee composed of experts in different areas you are more likely to identify a system that meets the overall needs of the facility.

Once the committee is formed, first identify in broad terms exactly what you expect the system to do. Is it to reduce make-goods, have fewer black holes, decrease overtime costs or obtain greater staff productivity and improve morale? Be sure you don't limit your initial thinking to an oversimplified goal such as "cutting costs." Make your goals more specific.

Use the goals developed earlier to create a decision grid for selecting the system. The horizontal axis of the chart should list each potential vendor. The vertical axis should list the features needed. Next, cross-check the features against the vendors. Now all you have to do is see which vendors have most or all of the features you need. You may want to begin your interview phase with the vendor who has the most check marks.

Furthermore, you should ask yourself several questions, such as "What equipment should automation control?" and "Can the vendor's system integrate our existing equipment?" It is also important to identify which method will be used to benchmark the system's performance (fewer make-goods or black holes in a day). Is the system compatible with your traffic system?

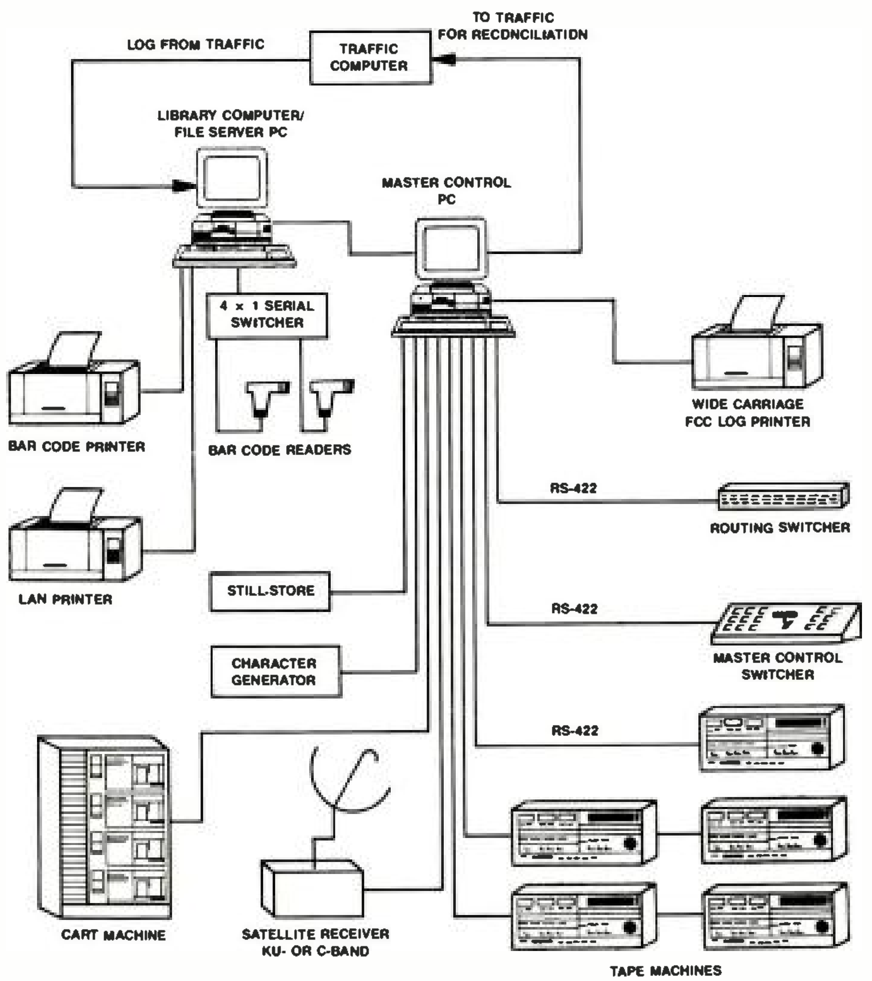


*Figure 1. In this PC-based automation system the master control computer controls the on-air and recording tasks while following the electronic log provided by the traffic computer, and reporting back the as-run log for reconciliation. (Courtesy of Columbine Systems.)*

### Using the system

An automation system doesn't have to take over an entire wing of your station. The system WREG-TV selected operates on PCs connected through a local area network (LAN). (See Figure 1.) The master control PC connects to all the station's equipment, including the master control switcher, cart machine via the host port, tape machines via their RS-422 serial ports, routing switcher, character generator, satellite receiver and traffic system. This configuration affords the station great flexibility and almost total freedom to adapt to changing needs.

The system you select should be easy to use. Your personnel aren't computer operators, and they shouldn't have to be to run the automation system. The system's commands should be in a language that is easy to understand and operate. Screens should be easy to follow, and the reports the system generates should be modeled after the paper report the station used before the system's installation. Training time, even for staff with no computer experience, shouldn't cause productivity to lag.

The system should also streamline station operations by taking the daily schedule from the traffic system, fully automating the airing of all scheduled events — commercial spots, news and feature programs and public service announcements — and returning the as-run schedule to the accounting department for reconciliation.

The ability to record automatic satellite feeds is important from a time and cost standpoint. For example, if a particular program is scheduled to be transmitted via satellite at 4 a.m. and then run three hours later, the automation system should be able to handle the entire process.

Although WREG-TV can play multisegment tapes within its video cart machine, it prefers to play programs on VTRs that are under the direct control of the automation system.

Stations with cart machines that do not have multisegment program capability may find that an automation system can provide the advantages of this feature without having to upgrade the cart machine.

### Complete the loop

In today's competitive markets, technical managers and station owners often find that automation is an effective tool in the battle to remain profitable. Although there are many areas within a TV station that can be automated, the approach that interconnects each of the various subsystems may prove to be the most

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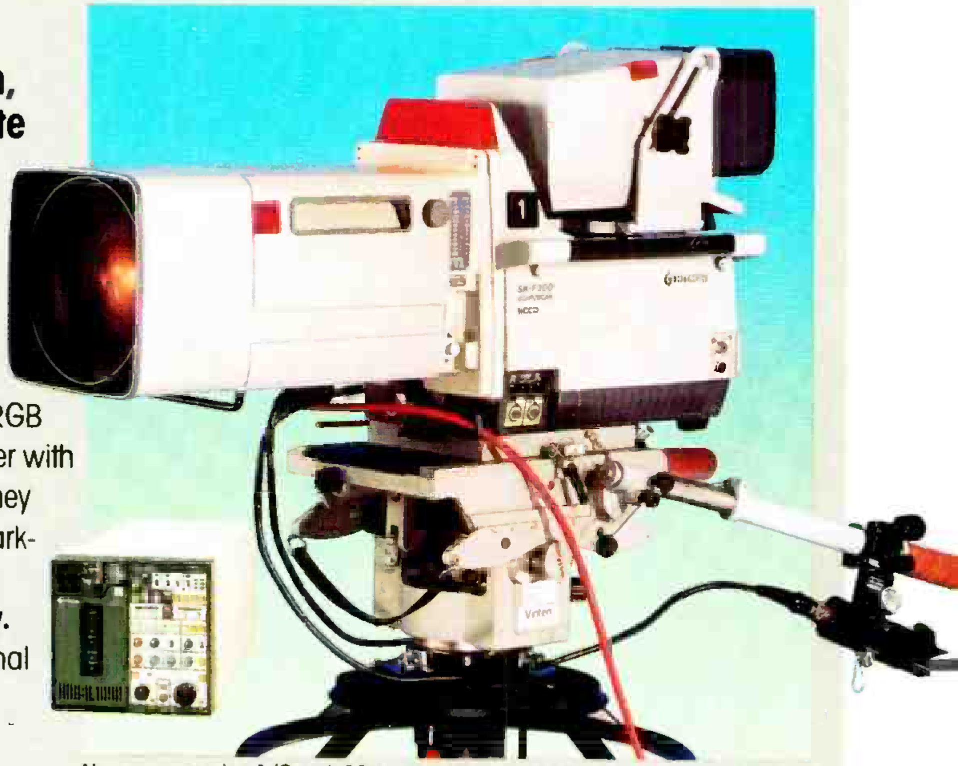

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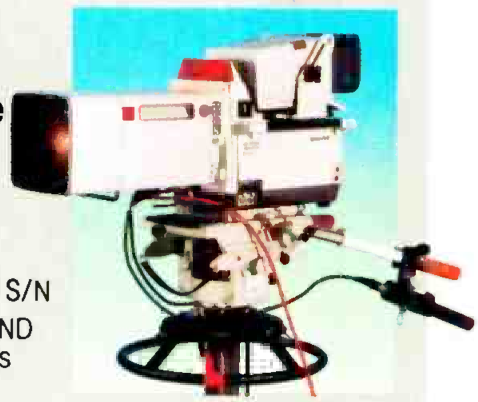

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Master control automation systems offer affordable ways to increase productivity. Through the large reduction of billing adjustments, make-goods and black holes, they can also boost ad revenues and enhance a station's on-air look.

Because these systems can literally pay for themselves in less than a year, the question shouldn't be "Can we afford to automate?" but "Can we afford *not* to automate?".

**Acknowledgment:** Thanks to Joni Steffen, senior marketing analyst, Columbine Systems, for her assistance with this article.

# Automation quiz

**By Steve O'Hara**

A master control automation system is a small expense compared to the price of a cart machine. However, certain considerations should be kept in mind before you make any automation purchase. Many types of automation systems are available, each with their own advantages. The task for technical and station management is to first determine the needs of the station. Only then can you begin evaluating potential vendors' hardware.

*1. Why are you considering an automation system?*

What do you want the system to do that it cannot already do? Do you want to reduce personnel overtime costs? Do you want to reduce tape-playing errors or eliminate black holes in your broadcast day? You must be able to define exactly what you hope to accomplish with the system before selecting any package.

*2. What do you want automation to control?*

Not all master control automation systems control everything. Do you want automation of your cart machines only to play commercials, PSAs and promotional material? Or, in addition to the cart machines, do you want to control stand-alone tape machines? What about the character generator or taping and replaying of satellite feeds? Each level of automation has a different cost associated with it. Some systems can even be implemented in phases to accommodate budget constraints.

*3. Will all of your existing equipment be supported by the automation system?*

A compatibility question for master control automation systems is much like the compatibility issue with computers. The vendor should be able to integrate its system with your existing equipment, no matter what communications protocols your equipment uses.

*4. How will you benchmark the automation system?*

Establish some baseline performance criteria for your system. The criteria developed will allow you to fairly evaluate the different vendors' equipment. Be sure the benchmarks apply to your station, not just one that the vendor suggests you use. Reduction in personnel costs is a benchmark criterion to consider.

*5. How many hours a week does traffic spend manually reconciling the log?*

This is a good benchmarking measurement, as well as a business advantage, an automation system should provide. Your traffic department probably spends quite a bit of time doing make-goods on commercials that aired incorrectly. A master control automation system will electronically transfer an as-run information log into the traffic system, then automatically compare the two and print out a list of discrepancies.

*6. How flexible is the automation system in regard to the computer platform it runs on?*

Many automation systems run on standard PC platforms, which makes it easier to replace equipment. Be sure you know what type of computers and terminals will be used. Proprietary platforms may offer special advantages, but they may do so at the penalty of a higher cost and limited second sourcing of replacements.

*7. How easy is it to make last-minute changes?*

Nobody likes surprises, but your automation control system should be able to handle them if it becomes necessary to make a change five minutes or less before airtime.

*8. Is the automation system compatible with your traffic system?*

Can it receive log information downloaded from your traffic department via a local area network (LAN)?

*9. Does the system feature bar code readers?*

Bar code readers allow your staff to easily track inventory into a stand-alone tape machine. Bar code operation can help eliminate the unnecessary retyping of information into the system, and the likelihood of mistakes.

*10. What media base capabilties does the automation system have?*

Combined with the bar code reading capability, an automation control system should be able to tell a cart machine when to stop playing a program tape to run commercials or other promotional material. It should then be able to tell the cart player to resume playing the program tape at the exact spot where it left off.

*11. Can you switch back and forth between automation and manual operation?*

Ask yourself if you can do it and how easy is it to do. Ideally, you should be able to push one button for manual and another for automatic.

*12. Are you thinking about replacing any existing equipment?*

Buying new equipment is an ideal time to consider an automation control system. If you're going to spend $300,000 on a new cart machine, why not spend a fraction of that amount to further enhance your on-air operation.

*13. Does the system feature a significant fault monitoring and recovery capability?*

How can you easily and quickly determine if a problem is due to hardware, software or user error? The automation control system should provide easy-to-understand error messages.

*14. What kind of support is available?*

What kind of support will the vendor be able to provide? Is there an 800 telephone number? What about 24-hour telephone assistance?

*15. How difficult is the system to learn?*

Although this may not be the most important consideration, it shouldn't be ignored. Moving from paper to computers is easier for some operators than others. Consider how easy the vendor's system will be to learn. Also, will your staff need specialized training for maintenance and troubleshooting? Will it be provided free, or will there be an additional charge?

Spend plenty of time asking questions. Ask for a customer list and call as many as possible. Don't stop with one or two calls. After you've talked to 10 or more customers, you'll have a good idea of how effective the equipment is and how well the company supports its product. Learn from other's mistakes — it's a lot cheaper.

Automation is not the cure-all for every station operational problem. It does, however, provide practical and cost-effective solutions. The time spent researching your purchase will reward you many times over, so don't short-change yourself by moving too fast.

O'Hara is segment manager for IBM Media Industry, White Plains, NY.

*For more information on master control automation circle Reader Service Number 545.*

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# The human side of camera robotics

By Robert Gardner

**Staff involvement eases the fear of impending automation.**

### *The Bottom Line*

*The decision to automate studio cameras is becoming increasingly popular. Benefits of camera robotics include greater consistency in production and increased production values through more complicated shots. In these lean times, however, the economic advantage of automating cameras is most likely the deciding factor.*

*This article will look at the human side of automation. It will explore ways for managers to make automation more palatable to the camera operators, directors and on-air talent whom it will most affect. A compilation of three case studies will show that if approached properly, automation can be financially rewarding and humane.*

As camera robotic systems have matured, it has become easier to imagine them as part of your own facility. The technologies are proven, and the cost-cutting potential is attractive. The decision to automate typically requires making a few a priori assumptions:

- Installing a robotic system always results in job losses.
- The youngest staff members will be the first to learn and master the system.
- The push to automate will originate in the accounting department.
- Robotics will save money, but it will negatively affect production quality.
- Directors will have to change the way they direct.
- Talent will not be able to adapt.

Interestingly, the experiences of the facilities cited in this article proved most of these assumptions wrong.

This article will discuss the human side of the camera automation experience as it occurred at three facilities — KMOV-TV, St. Louis; WJBK-TV, Detroit; and New York's CBS Broadcast Center and WCBS-TV. Study of these facilities' experiences will pinpoint common factors of a successful robotics transition.

**KMOV: automation for production**

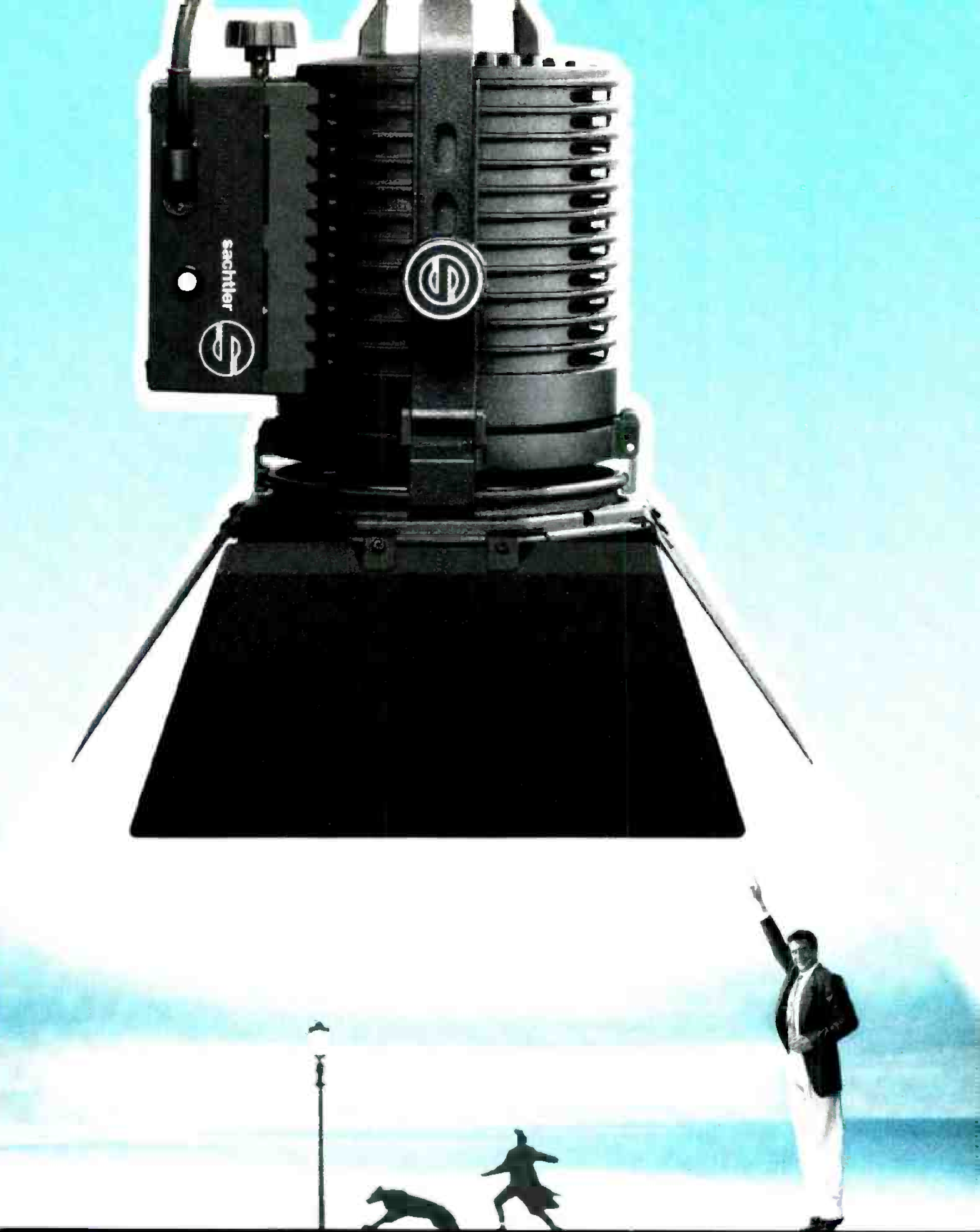
Although camera automation may reduce studio head count, this is not the objective. At the time KMOV-TV was considering automation, it had only one full-time camera operator. Other technical employees were asked to operate the three cameras during newscasts. On weekends, the newscast used only two of the cameras. In this case, robotics obviously would not result in massive work force savings.

Cost reductions and higher productivity were considerations. However, the station's most dramatic benefit was improved production performance. Camera automation produces greater shot repeatability. The robotic system also produced higher production values because it made feasible difficult shots combining dolly moves with pan, tilt and zoom changes. It also enabled the station to use all three cameras for weekend news programming.

**Detroit's WJBK: the case for economics**

The drive to automate studio cameras at WJBK-TV started in 1989 when corporate management encouraged the station to seek new technologies to maximize productivity and control costs. The camera automation push occurred around the same time as the renewal date for the station's union contract. Because robotic camera installation was anticipated during the period covered by the contract, station management worked hard to protect the employees from any threat to their job security. They made it clear that there

Gardner is president of Gardner & Company, an advertising and public relations agency in Weston, CT.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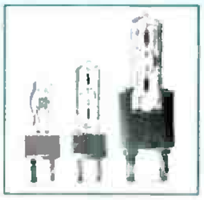


would be no dismissals and that any staff reductions would take place strictly through attrition. This simple effort went a long way toward getting the staff to accept the technology.

***It was made clear there would be no dismissals. Any staff reductions would take place strictly through attrition. This simple effort went a long way toward getting the staff to accept the technology.***

In addition to making the automation announcement to operators and engineers, the news directors and talent were also informed. To further help meet the needs of concerned individuals, the station sent several staff members to KMOV-TV so they could observe a robotic system in operation. After seeing the system in action, they returned as enthusiastic converts.

**CBS News and WCBS-TV, New York: speedy transition**

Early in 1991, CBS engineering management was directed to automate the cameras in two news studios at the CBS Broadcast Center in New York. This included Studio 47, where CBS News network broadcasts originate, and Studio 46, the news and public affairs studio of WCBS-TV. Less than six months later, the transition was complete.

Although cost control or reduced head count may have been an underlying goal, not a single staff job was lost. Before automating, each studio had four cameras. Each still does, but instead of four camera operators, two robotic operators handle each system. The key news at CBS was no loss of staff jobs.

**Fact-finding**

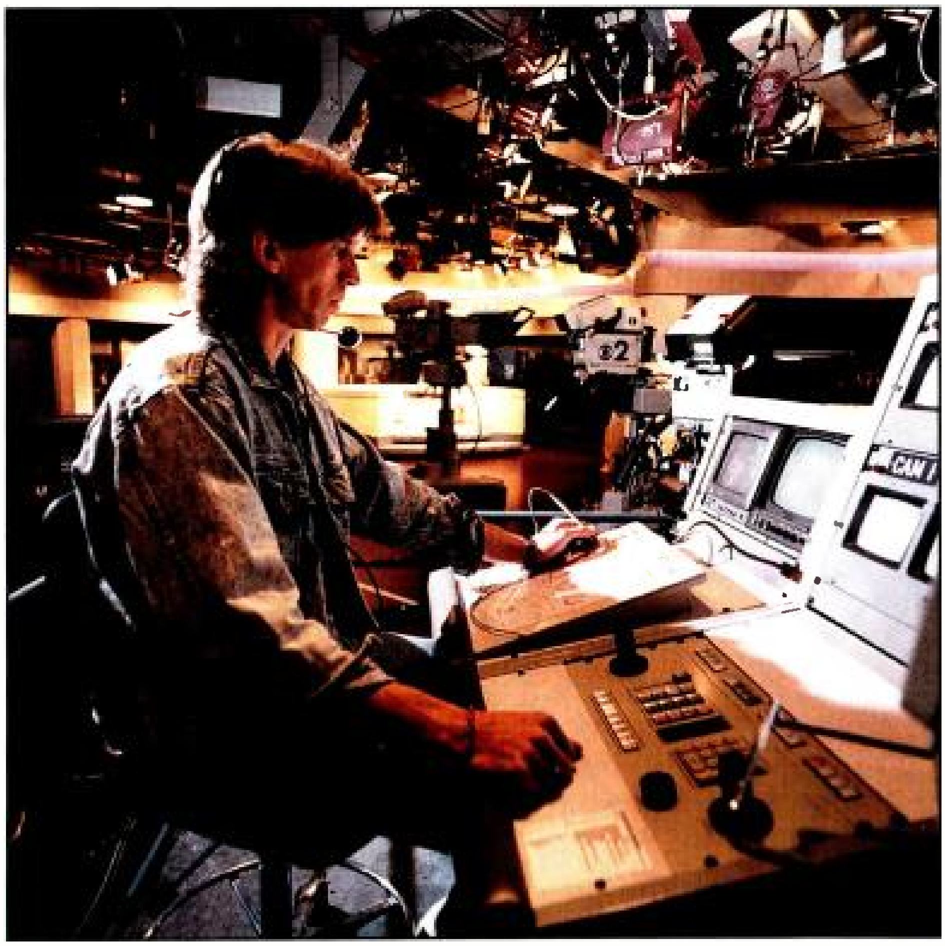
From the outset, the aim was to replicate all the actions and moves of the existing cameras. Extensive meetings were held with producers, directors, news management, creative people and technicians. The goal was to involve them in the process and gain their input.

The engineer assigned to select the system vendor and oversee the installation began by carefully observing the network's and station's newscasts. The needed shots were defined as well as how the directors called for them. The camera operators, producers and directors were encouraged to participate early in the planning process. Not surprisingly, individuals remarked several times that robotic cameras would never work and there was still time to stop the project. An evaluation team of local and network camera operators was then assembled to visit each robotics vendor. Other automated broadcast installations were also visited.

Each competing robotic pedestal was then taken into the lab, one at a time, over a 6-week period. The demonstrations provided the opportunity to compare features as well as allow the staff a chance to provide feedback. This kept them involved in the selection process. The final decision concerned camera operators, representatives of the engineering department and news directors.

The final installation consisted of one system of four robotic pedestals in Studio 47 and a second 4-pedestal system for the WCBS-TV Studio 46. These systems were augmented by a pair of existing manual pedestals, which were converted to provide automated pan, tilt and elevation control. A final touch involved the installation of a remote-controlled pan/tilt head in the network's London news bureau.

The entire installation uses six control panels, two each for Studio 47, Studio 46 and control room No. 34. The control room has optional remote control over the Studio 47 system, with direct control of the flash studio and, via a modem, the London studio.



*The robotic camera control position in Studio 46 (used for WCBS-TV News), at the CBS Broadcast Center in New York.*

***Staff training was an important part of the conversion process.***

**Training time**

Staff training was an important part of the conversion process. Camera operators, directors and studio managers all attended training sessions. Every camera operator was offered the opportunity to learn the robotic system, but it was clear that although some of them enjoyed the experience and challenge, others rebelled. Some operators felt that automation eliminated the art and creativity of camera operation. Some also felt that using a joystick, push-buttons and a graphics tablet were too far removed from pan bars,

*Continued on page 54*

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*Continued from page 50*

steering rings and hand controls.

Other camera operators saw robotics as the wave of the future and from the beginning wanted to be involved. Among those who made the transition, many now border on being zealots. One cameraman with 15 years' experience describes his new position as the most exciting he has had.

To this operator, the old way of doing the news meant trudging back and forth between the same five shots. He now commands four cameras in a studio with four different sets, all of which are used for each news program. Driving four robotic cameras through multiple moves, while responding to the director's calls, setting up the next shot and trimming, while keeping an eye out for the unexpected, requires his total concentration. Once privately concerned about being able to grasp the new system, he now feels his value has been enhanced by the greater responsibility.

***One cameraman with 15 years experience describes his new position as the most exciting he has had.***

So what happened to all the camera operators at CBS who used to work on the news? Those who chose not to get involved with robotics are still practicing their skills behind the cameras at CBS. Assigned to sports, soap operas and outside productions, they are still on the job.

**General lessons—get the word out**

No one dives into robotics on a whim. Take your time. About a year prior to taking any action, announce your intentions. You might even consider routing articles about robotic systems from trade publications to all of those who will be involved. This may stimulate discussion that could reveal useful information for your facility and how robotics can be used.

***No one dives into robotics on a whim. Take your time.***

KMOV-TV gave the staff members a chance to play with the robotics before they went on-line. One robotic camera was set up in the production studio for a month so the staff could get some "hands-on" time. Station management used this period to look for potential system operators. Those who showed the greatest interest and involvement were selected.

**Significant others**

Although the camera operators may be the first to perceive robots as being an immediate financial threat, directors and talent are also often skeptical.

- *Directors.*

Directors are often concerned about robotics' ability to match a human operator's speed, flexibility, spontaneity and reflexes. Will converting to robotics entail a loss of quality? Will having fewer hands in the studio hurt production? What about safety? These concerns are natural and they need to be addressed so you can get the director's support.

Many directors have found it advantageous to continue to call each shot as though they still had four camera operators — *Camera one, 2-shot left, Camera two, 3-shot right.* Robotic systems do re-

*The robotic camera control position in the news studio at Detroit's WJBK-TV controls three fully automated pedestals.*

quire directors to be more precise as they call for each shot, most of which are preprogrammed into the system. Even so, they can still "talk" to each camera as if it was manually controlled.

One advantage of human camera operators is that they can follow the talent. If the talent shifts in the chair, or leans, a human can follow and still frame the shot. Robotic systems that automatically provide similar capabilities are still in prototype form. For now, it is often easier to control the talent's position. Some facilities ask anchors to move their chairs to the spot they find most comfortable. The chairs are then attached to the floor with rails.

• *Talent.*

Expect some of the on-air talent to feel some initial uneasiness as free-navigating, camera-bearing pedestals move across their field of vision while they try to concentrate on the prompters.

One newsman reported that he missed the human contact, the give-and-take with the camera operators. A little time with the system will overcome these problems. Perhaps because of too many science fiction movies about robots gone amuck, some have expressed concern about safety. After all, a self-propelled pedestal equipped with a studio camera, viewfinder and prompter weighs approximately half a ton. However, with a maximum floor speed of about 10 inches per second plus several layers of safety systems, the hardware will soon prove non-threatening.

### Eye in the sky

Not all facilities locate the robotic controls in all the studios where the cameras are in use. The WJBK-TV robotic system had to be used for multiple productions including news, public affairs regionally syndicated shows and a weekly religious program. If that wasn't tough enough, the shows took place in three different studios. This meant that the operator had to use the robotic cameras to look at each other and the set in order to know where everything and everyone was. The solution was the addition of fixed over-head-mounted CCTV cameras.

***Experienced operators suggest that robotic operators can't be intimidated by gadgets and buttons. They also should be able to put everything out of their minds except the task at hand.***

Operating much like a security system, these cameras give the system operator a bird's-eye view of the set. This makes it easier to keep track of where the pedestals are, where the talent is and to observe changes as they are made. The overhead cameras also eliminated the need and expense of adding extra control systems.

### Stunt flying

What kind of camera operator makes the best robotic operator? Experienced operators suggest that robotic operators can't be intimidated by gadgets and buttons. They also should be able to put everything out of their minds except the task at hand. They may find that while the director is calling for the next shot or asking to modify the current on-air shot, a script person is walking where a pedestal is going to move, and that the talent has wiggled out of the shot. The operator's concentration has to be complete and constant.

Good robotic operators will learn to stretch their operating envelope to do everything the directors demand. This translates into taking advantage of the system to perform moving dolly shots with simultaneous pans, tilts and zoom on the air — live. Not everything is possible, even with robotics. Sometimes a director may call for a shot that will take longer to get than the robots allow. This makes advance planning essential.

### Exciting conclusion

The decision to install camera robotics must take into account the people who will be affected. The decision to use robotics should be shared by the station's management, chief engineer and production manager. To work, camera automation needs everyone's support and use. Once the management team decides to use the technology, it's time to get the users involved. This means bringing the camera operators, directors and talent into the process. Leaving those who must use the equipment out of the loop only creates fear, uncertainty and lengthens the time required to get the system up and operating at the quality levels that are possible.

Selecting the right system is not as complex as you might imagine. There are only three vendors, and each company's approach to camera robotics has its own advantages. Start by understanding thoroughly your own production requirements. Then list the essential, nice-if-you-can-get-it, and not-needed features.

Because the technology is so new, it's worthwhile to visit other automated studios. Study how the equipment works with the staff. Ask them how they feel about the system. Does it perform as needed? Is it reliable? Are there things the system can't do? You may find that those who work with modern robotic systems are the technology's best proponents.

➡ *For more information on camera robotic systems circle Reader Service Number 544.* ■


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# The digital radio station

By Ken Tankel

**Is the age of the "thoroughbred" digital facility upon us?**

## *The Bottom Line*

*The word "digital" has an alluring quality in audio circles today. But its value beyond that of pure buzzword is subject to debate. In the creation of today's "hybridized" analog/digital broadcast facilities, some have discovered that integrating digital audio can be a "1-step-forward, 2-steps-back" process. Conversely, others have experienced astounding improvements in their station's quality, productivity and flexibility by making more appropriate choices. Clearly, the path from analog to digital warrants carefully guided steps.*

Can a true digital radio station be built today? What equipment would be necessary? What benefits would it provide? Given the economy, would such investment be prudent?

These are a few of the questions that may occur to you in your quest for the total digital radio station. You can find some answers by looking at digital audio's past, present and future.

### The past

For the last several years, some parts of the broadcast environment have routinely used digital audio equipment. (See Figure 1.) Digital reverb and effects systems, recorders, samplers, time-compressor/expanders, broadcast delay systems and even telephone hybrids deliver features and performance previously unattainable by analog devices.

One important factor in making some products (and not others) so successful and welcome in the broadcast facility is a good user-interface. New technology should be accessible and practical. It should not make us change the way we work but rather should fit easily into our habits, making it simpler to achieve our creative goals. Many digital systems help us work faster and with greater economy.

### The present

Today, some digital audio products (effects units, CD players) are so widely used that they are barely perceived as new technology. These products are reasonably priced, user-friendly and taken for granted.

But other devices have been introduced that are not yet used with this level of comfort at the typical radio station. Some have just not had the time. Others have required the hefty (and risky) investment in a wholesale system replacement, as opposed to the piecemeal component upgrades previously encountered. And many new devices simply haven't gone through the maturation process necessary to make them useful professional tools. A close look at some of these product areas can offer some perspective on the current state of digital audio arts for broadcast.

### Digital audiotape (DAT)

DAT, like the CD before it, is still in transition from a consumer product to a truly professional one. Excellent audio quality along with truly impressive value for archiving, field recording, time shifting and playback for air are among the attributes that make DAT a viable consideration when outfitting a facility with digital technology.

But DAT's present limitations in editing and post-production must be reckoned with. Only now are the first truly flexible DAT production systems becoming available, and they are still somewhat expensive. Difficulties in direct digital transfer cannot be ignored, either. Consumer ma-

Tankel is director of technical operations, East Coast region, for CBS Radio, Philadelphia.

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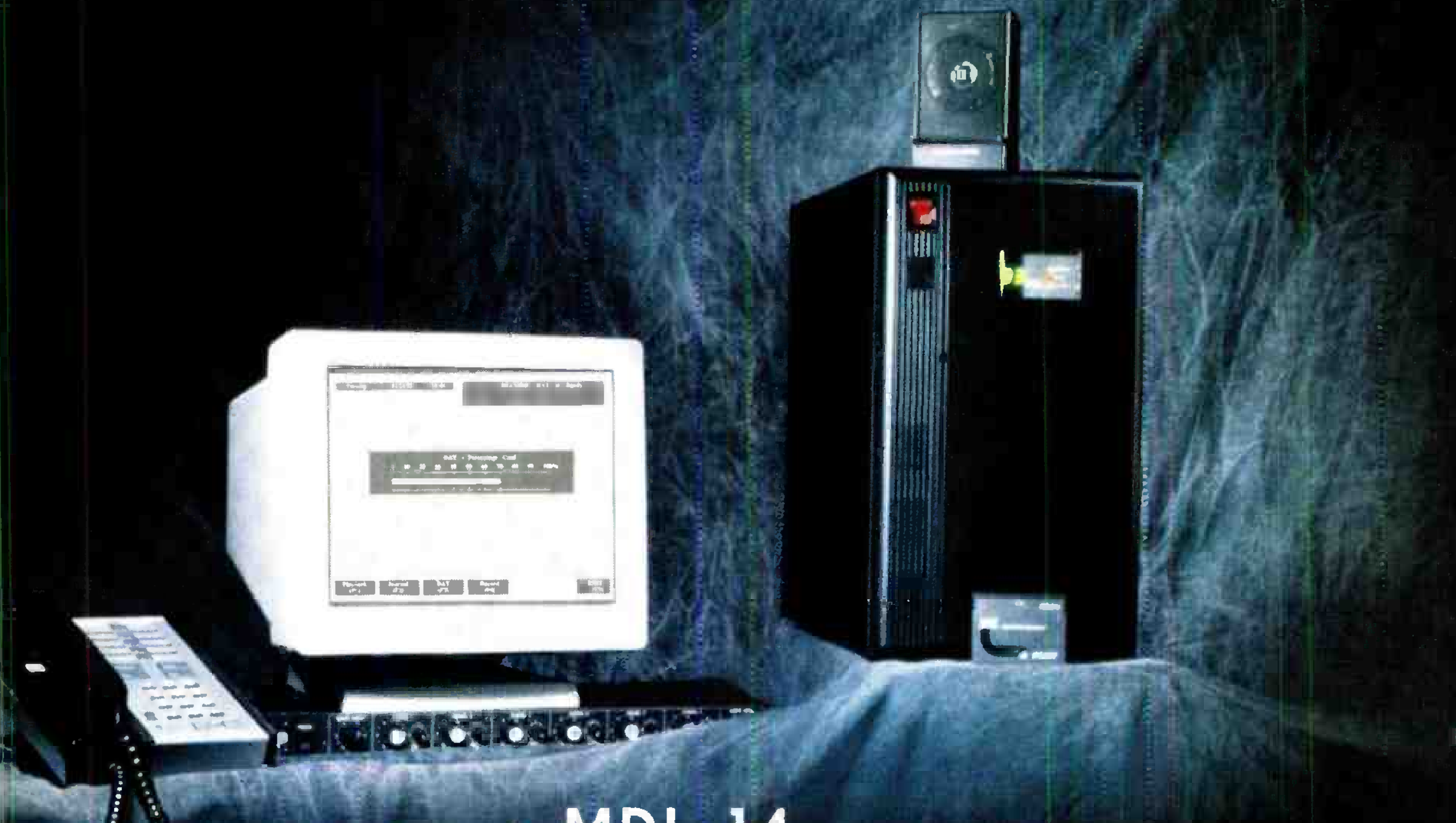

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chines (and even a few "pro" units) with SCMS copy protection have no place in the broadcast facility. You may not use the digital input/output (DIO) capacity of the machine today (and so may not notice these shortcomings immediately), but you will in the future. Other DIO incompatibilities on AES/EBU and S/PDIF ports may also be encountered, especially between units from different manufacturers.

### Digital "cart machine replacements"

Despite all of our grousing about cart machines over the years, none of the systems that have been introduced as "cart machine replacements" have lived up to expectations.

The familiarity and longevity of the cart format makes it hard to give up, especially with the extensive commitment (to a successor of uncertain life span) that such a move would require. In fact, recent trends indicate that there might not ever be a universally accepted, "discrete" hardware replacement for the cart, but that it will be supplanted by a more "global" transition to one or another kind of mass storage system.

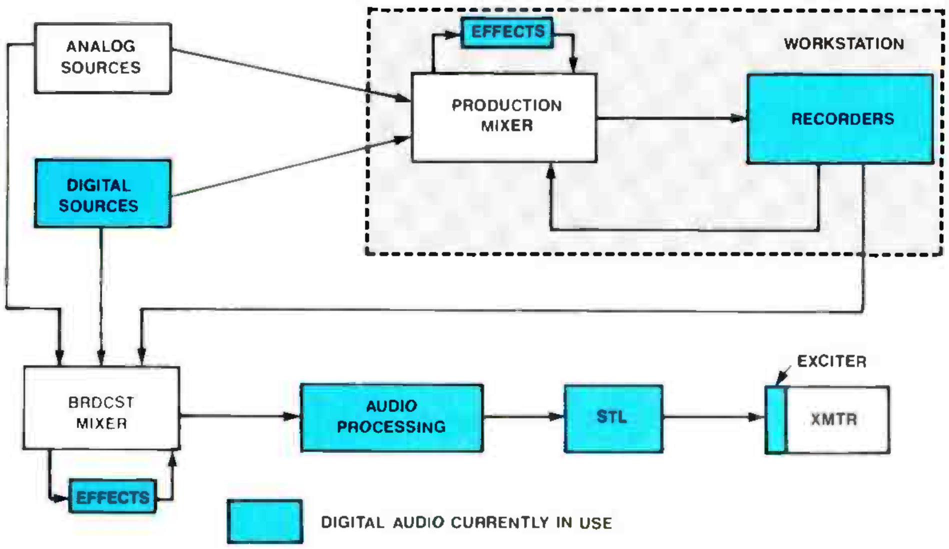
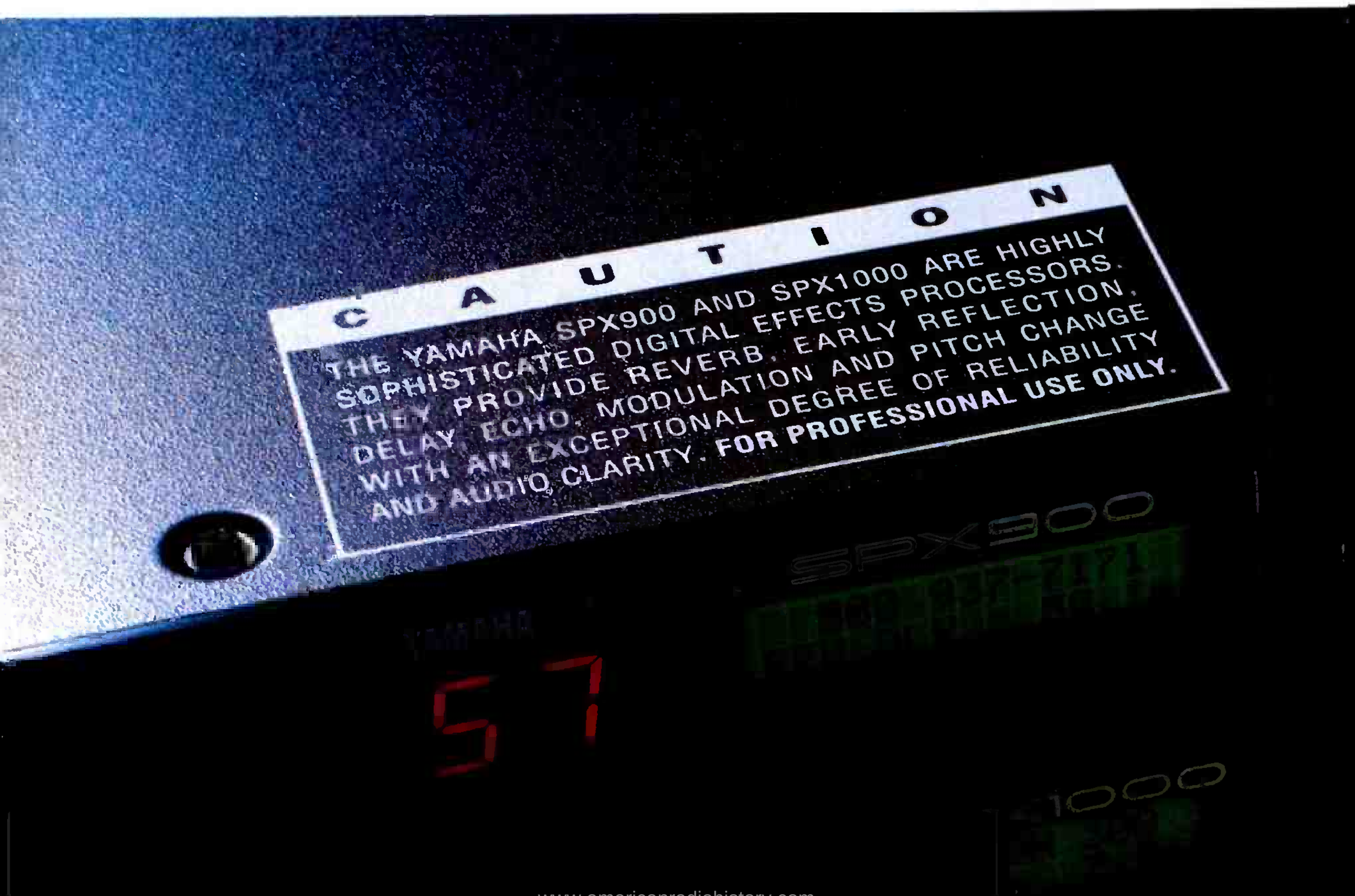



*Figure 1. A block diagram of a typical radio station's signal path, showing components where today's digital audio technology is generally advantageous.*

### Digital audio workstations

Digital audio workstation systems offering multitrack capabilities can entirely eliminate the multitrack recorder and console from the broadcast production studio. This means less space, less wiring and lower costs when a production facility is installed.

Audio quality is improved because recording, mixing and editing all occur in the digital domain. You also can preview and undo edits, slide tracks independently in time and overlook generation loss. Furthermore, there is no multitrack tape stock, no head wear, no alignments and no moving parts. The cost savings in parts, materials and maintenance can be significant.



Some systems include a variety of audio-processing functions, minimizing the need for external effects. It may also be possible to eliminate the studio console altogether. Many systems also allow networking, which is essential for broadcast applications.

### Data compression

The recent development of digital audio bit-rate reduction (data compression) algorithms has opened a new world of possibilities for broadcast, such as digital 950MHz STL channels, or program transmission on fractional T-1, DS0, ISDN and Switched 56 telco lines. An increase in the number of channels-per-transponder for satellite program distribution has also evolved, as have various removable and hard disk recording systems.

Eventually, these compression systems will be employed in digital radio broadcasting for direct delivery of digital audio to the consumer. Meanwhile, how do these technologies fit into our evolving digital radio station? More specifically, how will audio signals fare after passing through multiple generations of such compression?

### Digital STLs and RPUs

If you have serious signal-strength problems on your microwave STL, and phone lines are a sonically inferior, unreliable and costly alternative, then a digital STL may be the answer. A digital link may require only 10mV for full quieting, 10% to 20% of the signal strength required for minimum performance from an analog link.

> ***A typical production studio is a hybrid of digital and analog audio technology.***

Broadcasters who have already installed this equipment have found it to be an excellent investment. Here the digital system solves a problem that cannot be solved by analog equipment. But the broadcaster who does not face these problems probably will not find a good reason to convert to a digital STL system. These systems cost more than the analog equivalent and the data compression used may introduce some audible artifacts under certain conditions.

If multichannel STL/TSL is required (for main and SCA audio to get to the transmitter and satellite and RPU audio to be returned from the transmitter site, plus remote control and communications lines), consider telco T-1 (also called DS1) service. If it is available, a T-1 (or fractional T-1) digital transmission system can offer such multiple, bidirectional data and audio paths between sites, typically at a cost-effective rate.

When considering a digital STL in the context of the digital stereo generators included in some new audio processors and the recently introduced digital FM exciter, there may soon be a number of analog-to-digital conversions that could be eliminated, all occurring downstream from the studio. This area is currently under investigation by several manufacturers to possibly establish a standard interface for broadcast use.

### Hard disk storage systems

A growing number of systems are available that can store commercials, jingles and music on hard disk for direct playback to air. Because CD-quality digital audio generates so much data, these systems often use some type of data compression.

Consider how well these might interface with any existing computer systems and work routines at your station. (As a part of this process, establish who will be responsible for executing this eventual interface.) Also evaluate the audio quality of the system. Not all data compression algorithms handle all audio equally well. Remember that more data compression/expansion cycles might be encountered downstream.

### Digital consoles

Digital consoles have recently found their way into film, video/audio post-production, live theater and music production facilities. The audio specifications, features and performance of some units are spectacular. Other useful elements include space savings from "virtual control" (e.g., one assignable equalizer for 16 inputs), automation, computer and MIDI interfaces and massive expandability. Some even offer a hybrid of analog and digital inputs, with flexible routing, microphone muting and provisions for remote control.

Digital consoles that can match the features found in a premium 24-input analog broadcast console can cost three to 10 times more than the analog equivalent. Meanwhile, your facility's audio quality may not be significantly improved. Their cost alone prevents routine use in today's radio broadcast environment.

### Recordable CDs

Recordable CDs may provide some stations with great archiving ability, but less-expensive DAT technology will also give this ability. Nevertheless, for true random access of disc media, and for stations that air CDs directly, this technology could allow analog audio sources to be transferred to the CD format, eliminating the decline in quality inherent in carts and LPs.

For group owners with significant music crossover among their stations, the recordable CD could be a good means of exchanging material in a format that is directly playable on air. Program syndicators might also consider it for program distribution. However, at $30 or more per blank disc, these uses may not prove practical, especially because small runs of manufactured CDs are now surprisingly inexpensive. In addition, current recordable CD systems are of the write-once, read-many (WORM) format, meaning that the media cannot be erased and reused. (It also means that there are no retakes when recording one.) The current cost of CD recording hardware also makes them cost effective in only a few broadcast applications.

### Digital broadcast processors

A few digital processors for the broadcast air chain have recently been introduced. Digital technology has no great fidelity advantage over analog in this area of processing (see "Digital Audio Processing," July 1991), but it can offer additional elements of control. For this reason, some signal-chain elements in this new crop of devices remain analog but under digital control.

This facility provides unprecedented ability for customizing a station's (or a group of stations') sound and retaining it consistently. Changes to "the sound" that may be under consideration can be directly A/B compared with the current settings. Some systems can be remotely controlled from a PC via modem. (Password protection is included.)

Probably the most useful function of these processors is *daypart processing*, by which a station's signal processing can be tailored to the time of day or the program type.

### The future

The short history of digital audio products shows that the performance and features of a product take some time to develop and that performance and price improve after the product has matured. Many of today's digital devices exceed the capabilities of analog systems at a reasonable price. Some have already become quite indispensable.

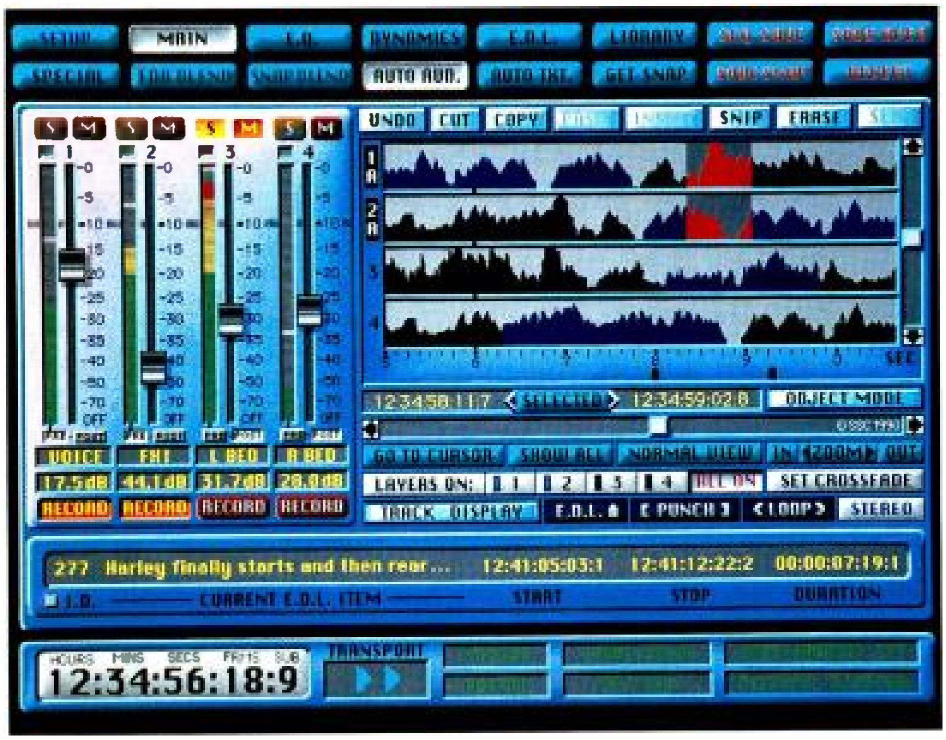
***Analog systems still offer a price/performance combination that can satisfy broadcasting's requirements.***

It is also clear that the current depth of product offerings is not yet sufficient to allow broadcasters to build a complete, end-to-end digital audio signal path for a radio station (although this should be the eventual goal of every facility). Meanwhile, analog systems still offer a price/performance combination that can adequately satisfy radio broadcasting's requirements in many areas.

An area requiring particular attention in the future on the manufacturers' and the users' parts is that of digital signal interconnection. As more successive components of the audio chain become digital, these units' DIO capacities will become increasingly useful and important.

Some measure of "immortality" is also offered by digital systems, in that software upgrades may allow later improvements without significant cost or upheaval. "Open architecture" systems may allow upgrades created by the user or by third parties to be accommodated as well. Over time these benefits will become more widely appreciated.

The road ahead will no doubt yield continued improvement in digital audio technology. If you cannot find exactly what you want today, look again tomorrow — you'll find it in the digital future.

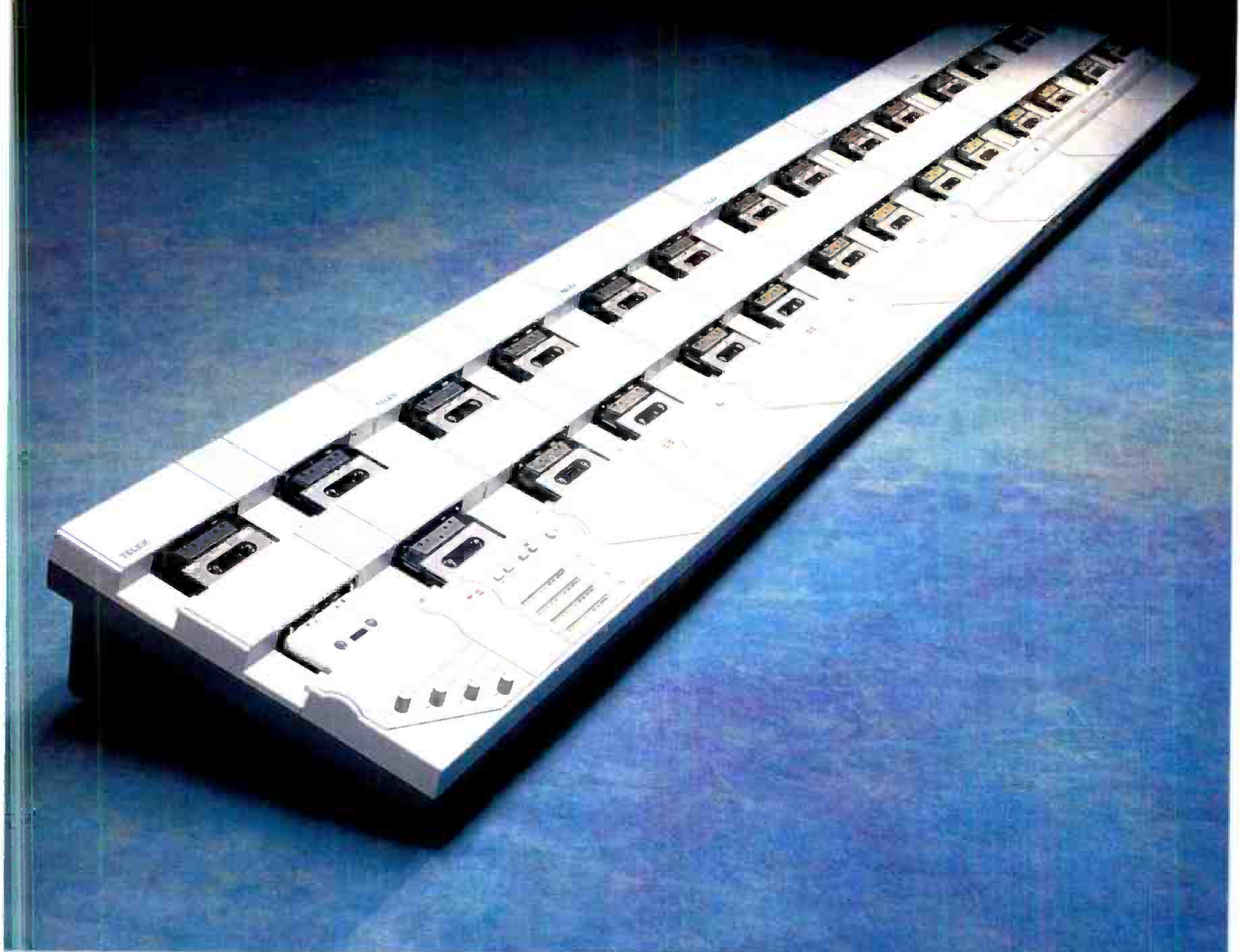



*The future of digital audio production may look something like this. (Courtesy of Symetrix.)*

➡ *For more information on digital products for radio circle Reader Service Number 548.*

■

# Go forth and multiply.



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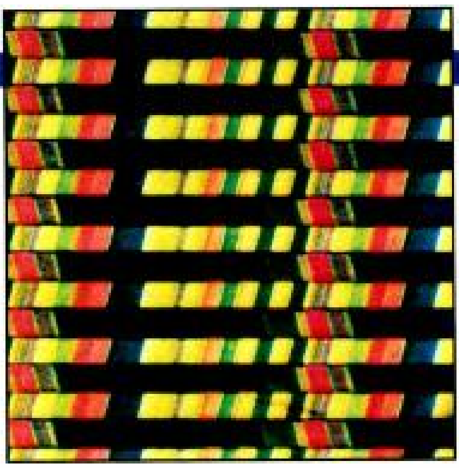
# High-performance recording tape



By Skip Pizzi, technical editor

**Tape performance continues to improve for analog and digital applications.**

### The Bottom Line

*Not long ago, magnetic tape was the only recordable storage medium in town. Today, disk-based media challenges its supremacy. But tape still holds a few aces, particularly in the price/performance category. Meanwhile, tape manufacturers continually improve their products to better serve broadcasters' needs and develop new ones to fit the formats of the future. Not all tape is created equal, however. A facility's choice of product affects its balance sheets of today and its legacy of tomorrow.*

$

Like the Greek god Janus, tape manufacturers must always be aware of progress along *both* directions of the time continuum. Just as that double-headed deity looked fore and aft at once, these media-makers must keep their eyes on future competition while also scrutinizing the continuing performance of their older products.

Most of these products' shelf lives takes place after their initial use, during which time the consumer expects them to remain unchangeable aural documents of days gone by. So a tape manufacturer lives the life of a prophet — its product is only as good as time proves it to be.

Meanwhile, on the opposite horizon, optical and magnetic disk formats present a growing challenge in the recording media marketplace of tomorrow. The random-access revolution has forced tape companies to seek any competitive edge they can muster. Thus, the progress of time pushes past and future magnetic tape products to increasingly difficult limits.

#### New directions

Of greatest concern to tape makers (and users) today is the future viability of any recording media that is inherently incapable of random access. Although earlier speculation of tape's demise has proven premature (see "Is Magnetic Tape an Endangered Species?" November 1990), the number of applications for which magnetic tape is ideal may be dwindling in some corners of the industry. Nevertheless, tape manufacturers have taken on the challenge to optimize those areas where tape still plays a role. In the broadcast world, these applications remain numerous: archiving, time-shifting, field recording, long-form program delivery and broadcast. With the exception of the actual production and editing processes, the front and back ends of the broadcast process are still essentially tape based and are likely to remain so (at least in long-form applications) for some time.

Although tape may not be the optimum medium from a production standpoint, it is often the more cost-effective choice. Improvements in this area are also a subject of tape manufacturers' continued pursuits.

Finally, because of the growing penetration of digital and random access systems, those portions of the process that remain analog and/or linear access are required to perform to their utmost ability. This justifies R&D efforts today that before may have been considered unwarranted by manufacturers.

#### Goals in formulation improvements

For digital and analog applications, new tape formulations have moved along several frontiers in the recent past in search of higher performance. First among these is increased *maximum output level* (MOL), which places a lower burden on playback amplification, traditionally the most challenging part of the magnetic recording process. If MOL is increased without a concurrent rise in the noise floor of the tape formulation, signal-to-noise ratio is also improved.

Another important parameter is great-

er *particle density*, allowing more magnetic information to be carried in a given area. This provides improved performance and/or allows lower tape speeds and narrower tape tracks to be used.

Higher *remanence*, another goal, refers to the amount of magnetic energy retained on the tape compared to the energy applied to it — a sort of "efficiency rating" of a tape's playback output level vs. its recording input level.

Reduced *spacing loss* is a further objective by which the tape head's physical separation from the magnetic signals on the tape is minimized, thereby increasing high-frequency response.

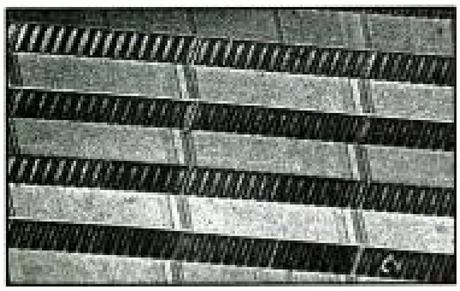
Moving away from the lab and onto the factory floor, improved *uniformity* in materials and manufacturing is always sought in the fabrication of tapes. This pays a number of dividends, including reduced print through, noise and distortion, as well as increased durability. High uniformity is also a factor in achieving some of the design goals.

All the materials and techniques chosen for a particular tape formulation have theoretically ideal parameters, but actual products and processes will occupy a range of such values. Minimizing the deviation within this range (narrowing the bell curve) provides results that more closely approximate the hypothetical performance limits.

For example, the narrower the range of particle *coercivity* (the amount of energy needed to reorient a domain's magnetic polarity), the less print through will result from low-coercivity (or easily magnetized) particles being affected by neighboring tape layers. In another case, the more uniform the coating thickness, the lower the spacing loss and the less modulation noise caused by "bumps" in the tape surface. Finally, the more uniform the physical alignment of particles in the tape, the more closely their domains' magnetic axes will align, and therefore the greater the additive effect any coherent magnetization will have (i.e., higher MOL).

Other interactions can also occur between many of the separate design parameters previously mentioned. Increasing remanence while holding other things equal will naturally increase MOL as well. Improving particle density while other factors remain unchanged will raise remanence and therefore MOL, and so on.

Finally, the *costs* of materials and manufacturing processes are also an issue in this complex function, as are considerations of downward compatibility (when they apply). Each of these factors plays a role in the careful compromise of a mag-



*The trend toward increased recording density is clearly visible in these magnetically "developed" micrographs. At left, a 50× magnification of Betacam's component analog format is shown (darker tracks are C, lighter tracks are Y). At right, the component digital D-1 format is shown at the same magnification. (Courtesy of 3M.)*

netic tape's formulation.

**Attaining these goals**

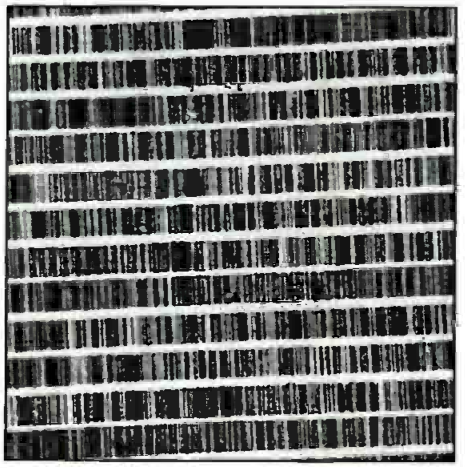
To achieve this increased uniformity (and other improvements), new materials and methods of fabrication have been developed. Equally heightened sensitivity in measurement and testing has been simultaneously required, as shown by the micrographs in this article.

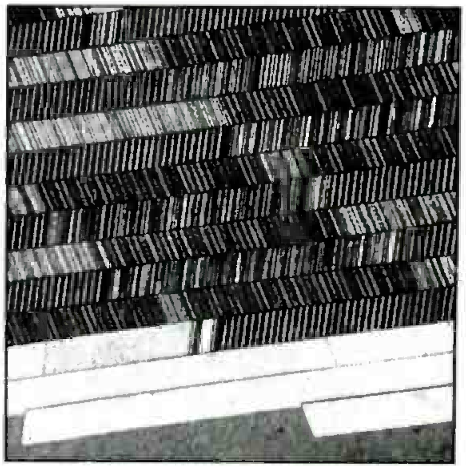
As a result of this research, most of the new formulations have moved away from oxide-based magnetic materials to pure metal particles (MP). This has allowed the higher densities, remanences and uniformities desired, along with reduced spacing losses. But it has also required higher coercivity, resulting in increased demands on record- and erase-circuit amplifiers and heads.

Most recently, even greater improvements in these areas have been achieved by removing the traditional binder from the tape-coating process. (The binder is a glue-like substance used to bond the magnetic particles to the plastic base material of the tape.) In this new approach, metallic particles are vaporized in a vacuum chamber, whereupon they permanently stick to a specially prepared backing in a "binderless" bonding process. A protective coating is later applied to this extremely thin magnetic layer. This *metal-evaporated* (ME) method provides superior densities and uniformities, allowing further performance enhancements.

The thinness of an ME tape's magnetic layer can be advantageous for the high densities of video and digital recording. The reduced depth of its magnetic layer minimizes spacing loss because all magnetic signals are kept near the surface and therefore closer to the playback head. (Contrary to earlier beliefs about magnetic recording depth, which held that higher frequencies are recorded only near the top surface of the magnetic layer, more recent study shows that they are in fact recorded throughout the depth of the tape but that playback heads are only sensitive to them at close proximity.)

But the thin layer of the ME process





*Digital video formats D-1 (left) and D-2 (right) are compared at 100× magnification. Note D-1's guardbands and uniform azimuth relationship, whereas D-2's alternating azimuth recording allows the elimination of guardbands, providing greater density. D-2's helical tracks actually overlap slightly, as shown at bottom right. Effective track widths are nearly identical between formats, but D-2's linear tape speed (5.18ips) is less than half of D-1's (11.3ips). (Courtesy of 3M.)*

renders it more vulnerable to physical damage from scratching, especially over repeated plays on rotary head hardware. The protective coatings used over ME tapes' recording layers can help, but work on improving these formulations' durability continues. Some metal particle tapes, such as those used in DAT cassettes, are also "encapsulated" by a protective coating to shield them from rigorous handling.

### Applications in broadcasting: analog and digital, audio and video

The improvements offered by new formulations have found their way into several real world applications. (See Figure 1.) Yet significant differences exist between digital and analog formats' requirements. Further distinctions occur between audio and video applications within each camp. As new formats develop, tape manufacturers must continually expand their catalog of offerings.

In many ways, analog recording is a more difficult challenge to the tape maker because of the direct and wideband effects of magnetic recording's inherent nonlinearity on the audio or video signal. Consider also that many analog video formats use helical scan for video and stationary head(s) for audio, meaning that two different effective write speeds are used on the same tape. The move toward AFM and PCM audio has lessened this requirement and significantly improved audio quality.

Furthermore, the wide variety of bias levels and frequencies, record-head gapwidths, standard recording levels and tape speeds used in analog recording present a formidable range of conditions under which a tape must perform adequately.

Because digital formats use *saturation recording* (record current applied to the tape is at a constant, maximum level), bias is not required. Digital recording's tape speeds, record levels and other parameters are also typically fixed (or at least minimized in their variation compared to analog formats) to reduce the variables and compromises encountered by a tape manufacturer for such a format. The biggest difficulties faced in a digital tape's formulation are high density, low dropouts and stability over time or repeated playings.

Recording tape's requirements are also substantially different between the audio and video worlds. Unlike the "format du jour" of the video marketplace, new audiotape formats have been developed at a more moderate pace. The continued popularity of open reel audio formats minimizes the complex processes needed for design and manufacture of cassette shells. DAT is the only new cassette-based professional audio format that has been introduced recently. But the last decade has brought a variety of analog and digital cassette formats for video to the market (with more expected soon).

Meanwhile, improvements in analog recording hardware have liberated tape manufacturers from some of their previous limitations in tape-formulation design. For example, some new analog audiotapes have foregone the earlier restriction to remain bias-compatible with previous formulations, thereby providing significantly improved performance but at different bias levels from earlier products. This is acceptable because newer recorders are typically equipped with switchable bias settings and/or automated bias adjustment. (Earlier manual bias readjustments were particularly distasteful to the multitrack user — changing tape types on a 24-track system could take half a day.)

Some newer machines also exhibit unprecedented headroom in their record and playback electronics, allowing higher MOL to be designed into a tape without risk of increased distortion occurring in recorders that exploit this feature.

### Showing their age

In the past few years, a number of significant aging problems have been noticed on audiotapes, particularly on those of early 1980's vintage. These difficulties have not been limited to any particular

*Continued on page 83*

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# Fundamentals of studio grounding

Courtesy B&B Systems

By Richard Majestic

**Proper grounding ensures safety and low electrical noise.**

## The Bottom Line

*The primary reason for providing a good grounding system is for personnel safety. A second is to ensure a high-quality signal. It takes diligent engineering to produce these results, because designing a proper ground system requires careful coordination between the building electrical needs and the needs of the signal system. A facility that is either unsafe, or that produces noisy, distorted signals, can be a pain in the financial backside.*

$

The National Electrical Code (NEC) defines *ground* as a connection, whether intentional or accidental, between an electrical circuit or equipment and the earth or some conducting body that serves in place of the earth.[1]

Good grounding is crucial for the financial and technical success of any facility. If the accidental path for current mentioned above includes an employee, then the issue of liability is raised. If the intentional path prevents stray electrical fields from contaminating your product (audio or video signals), then you get an edge in the market.

This article will overview the issue of studio grounding. It will address some of the basics to follow and will explain some of the problems a poor ground system can cause.

### Safety first

The most important ground in any facility is the building *electrical safety ground*. Its purpose is to shunt quickly to earth stray voltages, especially those caused by equipment failures, such as short circuits.

All of the electrical equipment in the facility should connect to the electrical safety ground. This is often done by means of the U-shaped tabs found in most electrical outlets. Voltages that occur on these tabs follow the third (green) wire contained in most electrical cables to a *ground bus* in each electrical breaker box.

Majestic is chief of the Special Projects Division, Voice of America, Washington, DC.

All of the ground buses connect to a *primary ground point*. This is the point at which the building makes an intentional electrical contact with the earth. The primary ground point should be located at the building power service entrance ground and should be connected to a conductive water well casing or municipal water system.

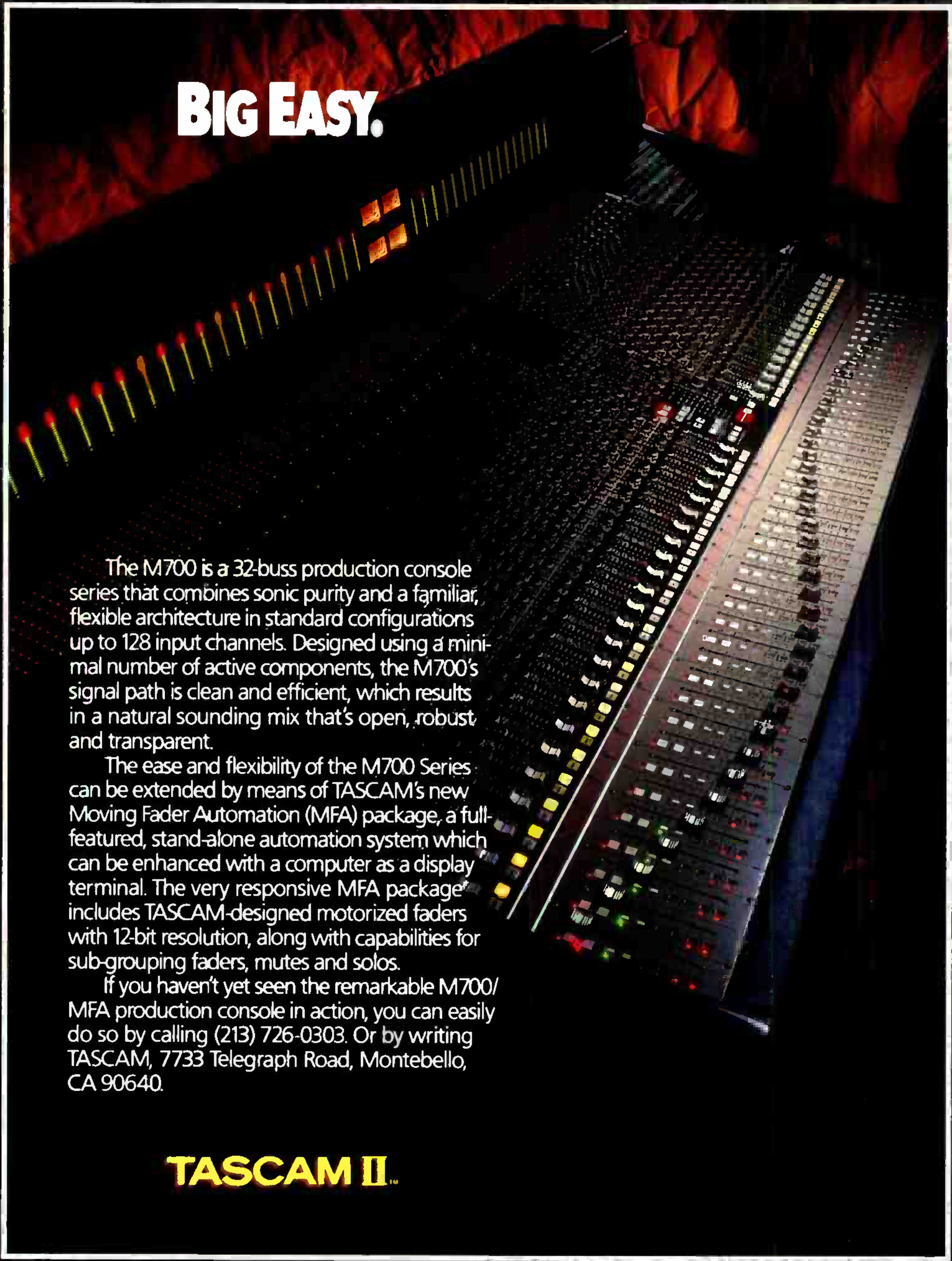
In a larger building, the primary ground point should connect to the building's piling supports and/or structural steel members that are below grade.

A conductor making connection to the earth is called a *grounding electrode*. The earth is a complex conductor. Resistance varies with soil moisture content and type. Ground current flow depends on soil conditions, contact area of the grounding electrode and the frequency of the current.

In some areas it's impossible to have a good earth connection. Other means of grounding have to be applied to reduce noise and provide electrical safety. The facility could have a potential difference with respect to earth but have all its electrical systems properly protected and provide a noise-free environment for all types of signal equipment.[2]

### Signal ground system

Surrounding us are electrical fields of all frequencies and descriptions. The 60Hz AC current with which electronic equipment is powered is a major producer of such fields. Radio frequency interference



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(RFI) and electromagnetic interference (EMI) are other examples of these fields, as is static electricity.

These voltages, although not inherently dangerous, can impinge themselves into a facility's signal system where they will be manifested as noise. A separate, but related, grounding system is needed to shunt these stray signals harmlessly down to earth. This is called the *technical ground* or *signal ground* system.

The building electrical safety ground, if it has been installed properly, should offer a low-impedance path to earth. However, when it comes to grounding, electrical contractors do not always take the path of least resistance. A water pipe ground, for instance, can vary in its impedance on a weekly basis. Fewer people are in the building on weekends, so less water flows. As water sits in the pipe, its chemical properties can change, affecting impedance.

Many facilities combat this by augmenting the service entrance ground with a ground system composed of one or more copper or copper-clad steel ground rods. These rods are typically $^{1}/_{2}$-inch in diameter and six to 10 feet long. Ground rods are installed by driving them into the earth and by contact with the ground water.

The copper cladding protects the steel rod from rust. Galvanized rod is not suitable. The zinc in the cladding may become a sacrificial anode and disappear into the soil.

A circular trench surrounding the rod may be filled with conductive materials, such as sodium chloride, calcium chloride or bentonite. These chemicals must be replenished annually to ensure peak effectiveness.

These efforts will pay off for the low-noise facility. System noise, caused by external interference, is directly proportional to the impedance of the ground system wiring and earth ground impedance.

### Ground system wiring practices

Electrical codes define the methods used for electrical safety ground wiring. For technical ground wiring, facilities use their discretion. Many philosophies abound, but no single method provides all the answers. However, there are a few ground rules. If followed, these will eliminate most ground system problems from the start.

The first principle of proper grounding is *to use good conductors*. The technical ground system must conduct to earth extraneous voltages of many frequencies. To achieve the lowest impedance may require the use of a ground strap or bus bar. These can carry greater current than cable, and they offer lower impedance to high-frequency noise due to *skin effect*.

Next, *make connections securely*. The ground system wiring from the primary ground point to each equipment area must be uninterrupted and of low impedance. Connections and joints should be silver-soldered to ensure permanence. A firm mechanical connection, such as an appropriate electrical compression fitting, may further increase reliability.

One interesting technique is Cadweld welding. The Cadweld system eliminates the need for heat or power sources in making ground connections. (See the related article, "Cadweld Process," pg. 76.)

A *home run* system will provide the best results. Although this implies that each piece of equipment has an independent wire back to the central ground point, this is seldom practical. Instead, ground each piece of equipment to a local ground bus bar. A copper bar 2"×12"×$^{1}/_{4}$," tapped with size 10-32 holes, will provide a convenient grounding plate for each control room or equipment rack. The wire between each piece of equipment and the local bus bar should be at least AWG-10 copper (solid or stranded) and no more than 10 feet long. These ground wires should be insulated and color-coded green to prevent mistaken identity. Terminate each wire with a crimp-on spade connection. Coat the screw and connector with silicon grease before tightening.

Connect each local ground bus to the ground strap or primary ground point with stout cable, AWG-4 or larger, again insulated and color-coded green. Ground audio signal wires at the low-impedance end only.

Stray electrical signals and interference must not couple into signal wiring. To avoid this, most professional devices interconnect with shielded cable. As stated earlier, the lower the impedance of the ground system, the more electrically quiet the facility. To shield the cables from stray fields, connect the ground at the source, which is typically of lower impedance than the destination.

There is one exception to this rule. The shield wire in a balanced microphone must ground only to the microphone preamplifier. This prevents ground currents from contaminating the low-level microphone signal. Figure 1 shows how this would be implemented in a typical audio console. The grounds from the microphones to the pre-amplifiers are connected at both ends. The wires from the preamplifiers to the console inputs connect at the source (pre-amplifier) ends. The console's outputs would be grounded at their source (the console).

### Glitch, tickle, pop: about ground loops

Why not shield the system completely by connecting grounds at both ends? If you did this, it could create a particularly vexing noise source called a *ground loop.*

Every piece of equipment can develop static or electrostatic potentials. This can come about because of faulty bypass capacitors, induced voltages in metal parts near the equipment's power transformer or several other sources. If the drain wire in an audio cable connects at both ends, and there is a difference of potential between both pieces of equipment, current will flow. The return path for such currents will be the ground plane of the facility, hence the term *ground loop*. (See Figure 2.)

A ground loop can also develop whenever there is more than one ground path between a piece of equipment and the in-

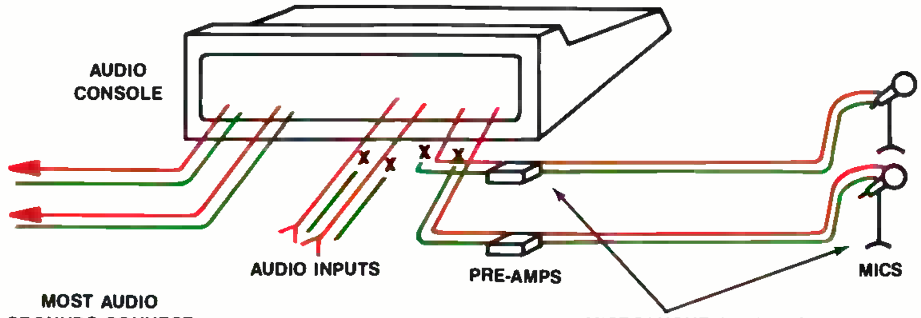


***Figure 1.*** *Audio grounds are nearly always connected at the low-impedance end, which is the source. This facilitates draining interfering signal to ground. The one exception is microphone pre-amplifiers, which are grounded to the pre-amplifier chassis because of the low (−60dB) mic levels.*

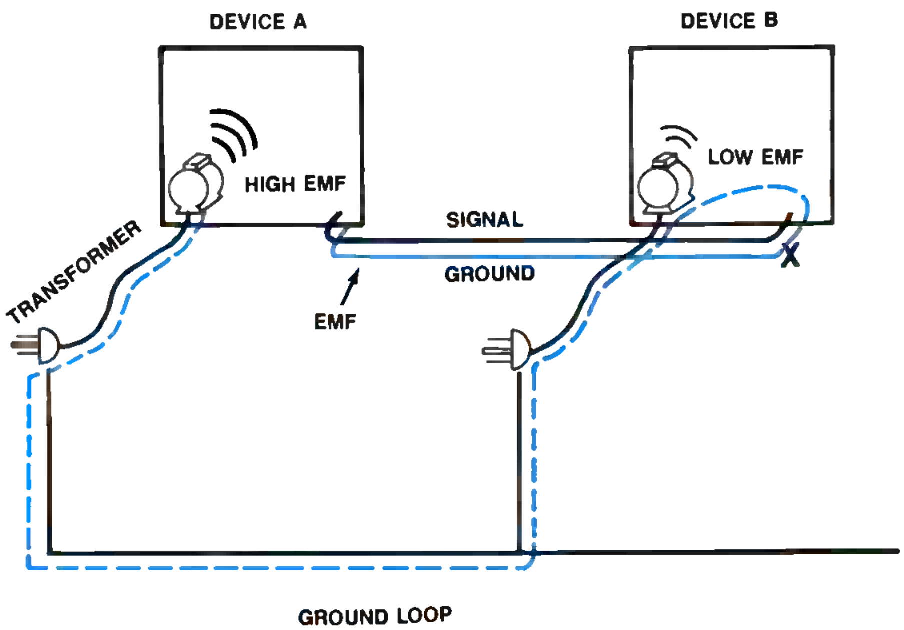


*Figure 2. A ground loop when stray currents flow between two devices with different potentials along the ground system. Grounding only at the low-impedance end can prevent formation of ground loops.*

tended primary ground. These alternate paths can include the AC safety ground system, inadvertent touching of equipment or racks that should have remained isolated.

In some cases, the deck is stacked against the facility. TV facilities, for instance, can go to great lengths to keep the audio wiring properly grounded, only to find that a problem is developing in the video equipment, which typically is grounded at both ends. A mixture of balanced and unbalanced inputs and outputs on audio equipment can cause the same effect.

Ground loops may occur at nearly any frequency. In some cases, the electrical length of the loop may act as a tuned circuit. It may act as a receiving antenna and pull extra distortion into the system. It can also act as a radiator and emit interference of its own.

Preventing ground loops can be one of the most challenging problems facility engineers face. Fortunately, these problems can be resolved: an orderly and methodical design approach can prevent most problems before they happen.

### Good AC comes first

Because so many of the noise problems in a typical facility are caused by the building's AC feed, this is a logical place to start. A facility should have a clean, independent AC power supply. The transformer or transformers should be located near the origination point of your grounding system. It is usually best to make sure that each equipment area has its own separate power branch circuit dedicated to equipment. Keep these circuits separate from those that feed lights and utility power outlets.

In some areas, contrary to code, electricians have been known to tie the electrical neutral bus to ground. This solves certain electrical problems. Although it may be convenient for some electricians, this practice can create tremendous difficulties for the facility's signal system and should be avoided. The neutral bus must remain insulated from ground.

### Signal wiring

Although a properly designed facility grounding system can eliminate many electrical noise problems, taking care in signal wiring can prevent problems from occurring in the first place.

Use good cable. Use shielded, twisted pair cables for audio wiring. A high grade of double-shielded coax should be used for video.

Inductive coupling of AC and signal currents may degrade signal purity. Avoid this by using good wiring techniques. Group and bundle together cables with like signals and levels. Useful classifications might include:

- Microphone and low-level transducer cables
- Line level (100mV or greater)
- Loudspeakers
- Control circuits
- Telephone
- Video
- Computer and digital audio circuits
- AC power feeds

Separate the cable bundles as much as possible, at least four inches.

Separate, enclosed metal trays or raceways are recommended for low-noise systems. If cables must share a raceway, the following groupings may be acceptable:

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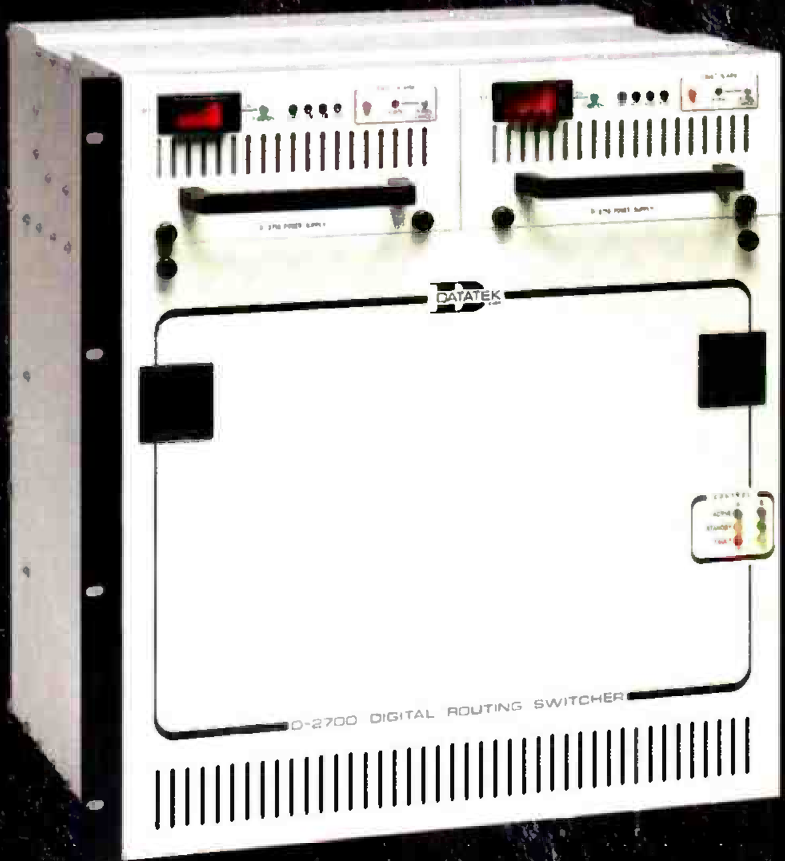


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Above all, never bundle any signal cable of any type with AC power wiring. If unbalanced audio or video cables must cross AC power circuits, do so at as close to right angles as possible. This will minimize the possibility of inductive coupling.

### Wiring in high RF environments

Many facilities include a transmitter, microwave system or satellite uplink. These environments can present unique roadblocks to achieving a low-noise facility.

When audio equipment is installed in high RF fields, the cable shield may have to be connected at the non-grounded end with a low ESR ceramic capacitor. Start with 0.1$\mu$F, 100V and adjust the value until best results are obtained. The capacitor provides RF grounding. This helps prevent RFI from entering the audio equipment-integrated circuit amplifiers, while still detaching the low-frequency ground loop path.

In high RF fields it may be necessary to trim signal cables to a non-resonant length by adding or removing cable.

### From the ground up

Gain a firm knowledge of the facility's electrical system. Note how power is distributed in the building. Be aware of situations in which different sections of your facility are powered by different transformers.

Next, ensure that the building ground is adequate. Seek advice on measuring it and improve it if needed.

Design the facility ground starting from the power system ground and working back to each piece of equipment, using good grounding conventions. Follow your plan while installing the ground system wiring. In a new installation, or if extensive electrical rework is occurring, provide the electrical installation contractor with copies of the signal system drawings and documentation. Make the contractor aware of the signal system noise-free requirements.

If a problem surfaces during electrical and signal system installation, refer to your blueprints. Check the design for suitability, then check that the system as built conforms to the drawings. Don't ignore the problem or the perceived problem. It might be a serious flaw that will be more expensive to correct later.

Record any modifications immediately. A well-planned and well-documented ground network will make it easier to troubleshoot noise problems later. This can only occur if each ground run or signal cable shield that can carry ground currents is known to the technician.

### Silence is golden

Only carefully planned, coordinated electrical and signal system engineering will produce a ground system that can meet the needs of today's facilities. Those who must deal with them know that a poor ground is the source of much grief. You have the power to prevent headaches and loss of revenue by rethinking and perhaps reworking your facility from the ground up.


References

1. National Electrical Code, 1987, 1990.
2. R. Morrison, W.H. Lewis, "Grounding and Shielding in Facilities," John Wiley & Sons 1990, pp. 1-4, 181-190.


## The Cadweld process

The Cadweld process joins copper to copper or copper to steel without using outside heat or power. Figure 1 depicts the technique used to join a conductor and a ground rod. Powdered metals (copper oxide and aluminum), held in a graphite crucible, surround the joint. The chemicals are ignited by a flint lighter.

Reduction of the copper oxide by the aluminum (exothermic reaction) produces molten copper and aluminum slag. The copper flows over the conductors, melting them and welding them together. (The process also works with material other than copper.)

By virtue of its molecular bond, a Cadweld-welded connection will not loosen or corrode. Additional Cadweld metal will sleeve the conductors beyond the weld itself, providing extra mechanical strength and further protection from corrosion.

The connection's current handling capability equals that of the conductor. *Cadweld* is a registered trademark of the Erico Corporation.

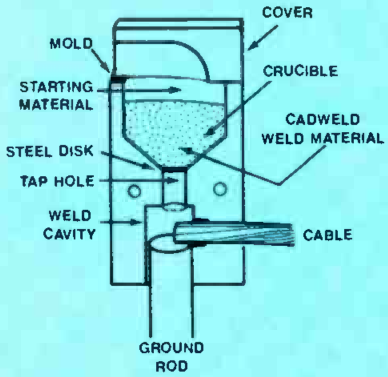
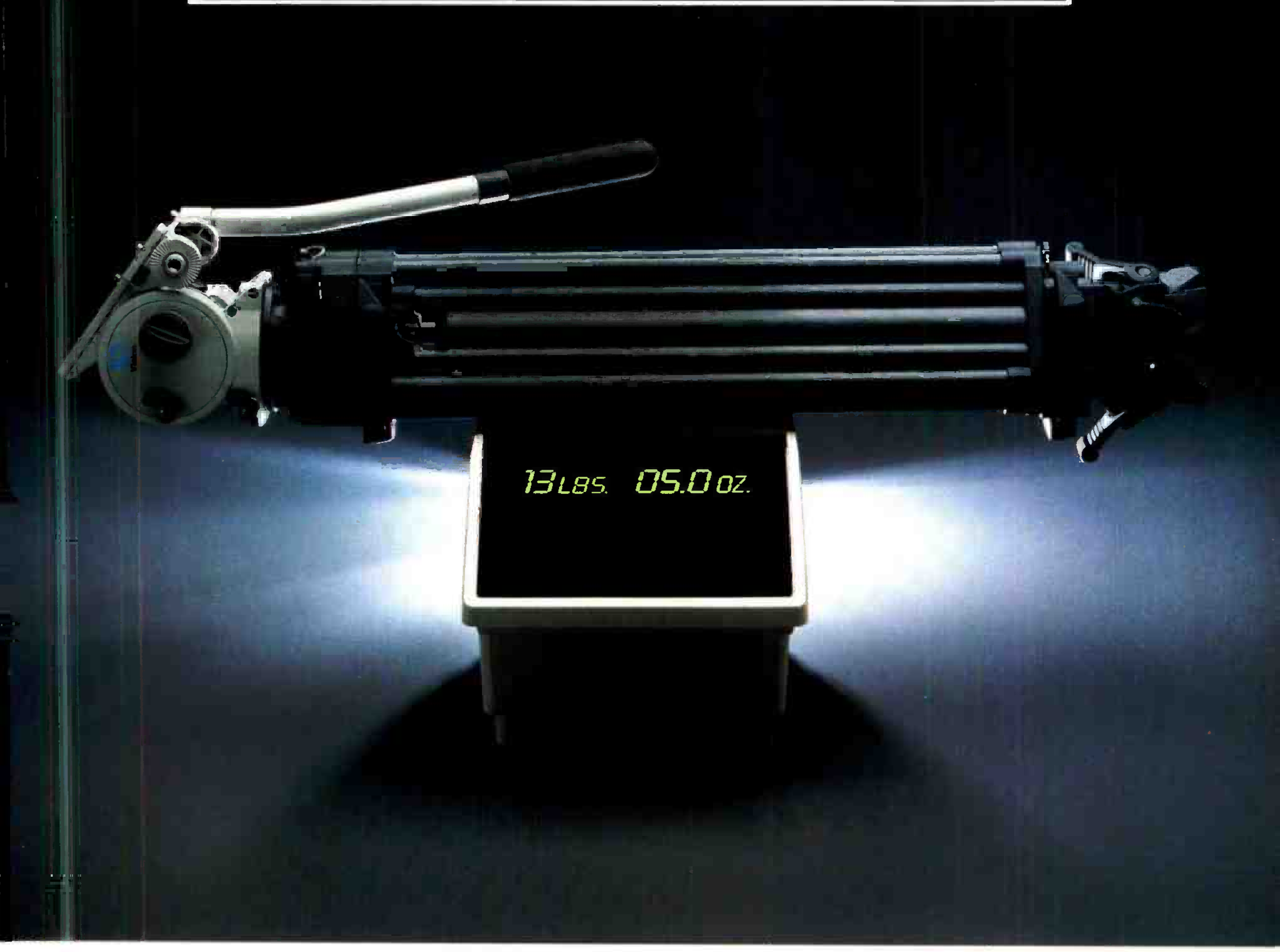



***Figure 1.** The Cadweld welding process ignites metal powders in a graphite crucible to meld metals with a molecular bond. User applies spark with flint lighter.*

**Editor's note:** Figure 1 was adapted from, "How to Install Low-Inductance Ground Rods and Connections," Block, Roger R., *Mobile Radio Technology*, Jan. 1986, p.44-46.

# It's carbon fiber. See the difference. Feel the light.

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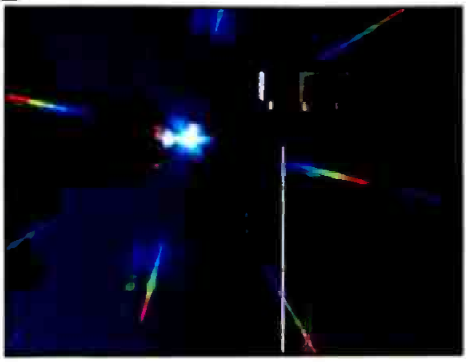

# Conflict resolution on the Ampex ACR-225

By William F. Carpenter

The goal of station automation is to reduce operating costs while improving efficiency and accuracy. For most stations, an automated cassette or cart system can be thought of not only as the station's cash register, but also as the cornerstone of its automation system. The function of a cart system is to reduce labor and operating costs, improve spot handling, reduce errors and make-goods, while presenting a consistent on-air quality.

One way to achieve these goals is through the use of multi-event-per-cassette systems. These are automation systems that store multiple spots of varying lengths or longer program segments on a single cassette. Multiple event systems have some important advantages. They allow random access to a vast on-line library (typically more than 10,000 30-second spots). They also require fewer cassettes than on-spot-per-cassette systems. The result is a savings in media costs and library space.

### Multi-events/multiple conflicts

Because more than one spot can reside on a single cassette, there is the likelihood of playlist conflicts. Two conditions form the basis of most irreconcilable playlist conflicts. First, two or more events are on the same cassette but reside physically at different locations, making it impossible to play them back-to-back. Second, short-duration events are below the system's minimum cycle time for back-to-back operation. The minimum duration factor varies between designs and is predetermined by a transport's acceleration, threading and cuing speed and the system's robotic speed.

The number of available transports also helps to determine the workability of the system. For example, if three transports place a minimum duration requirement per event of 10 seconds, adding an additional transport might permit the time to be shortened to seven seconds. Even with these short times, program elements less than the minimum duration time must be manually assembled onto a buffer copy in advance of their scheduled air time to avoid a conflict.

### Searching for solutions

Solutions used by some stations to reduce potential conflicts include making duplicate copies of events on other cassettes, and instituting a stricter organization on the library than would otherwise be required. These approaches can increase labor and media costs. Therefore, they are relatively counterproductive.

A different approach to the problem has been taken toward playlist conflict resolution in the Ampex ACR-225 automated cassette system. This software utility, called *AutoResolve*[TM], implements automatic detection and correction of play-

Carpenter is manager, new product/market development, Ampex automated recording systems, Ampex, Redwood City, CA.

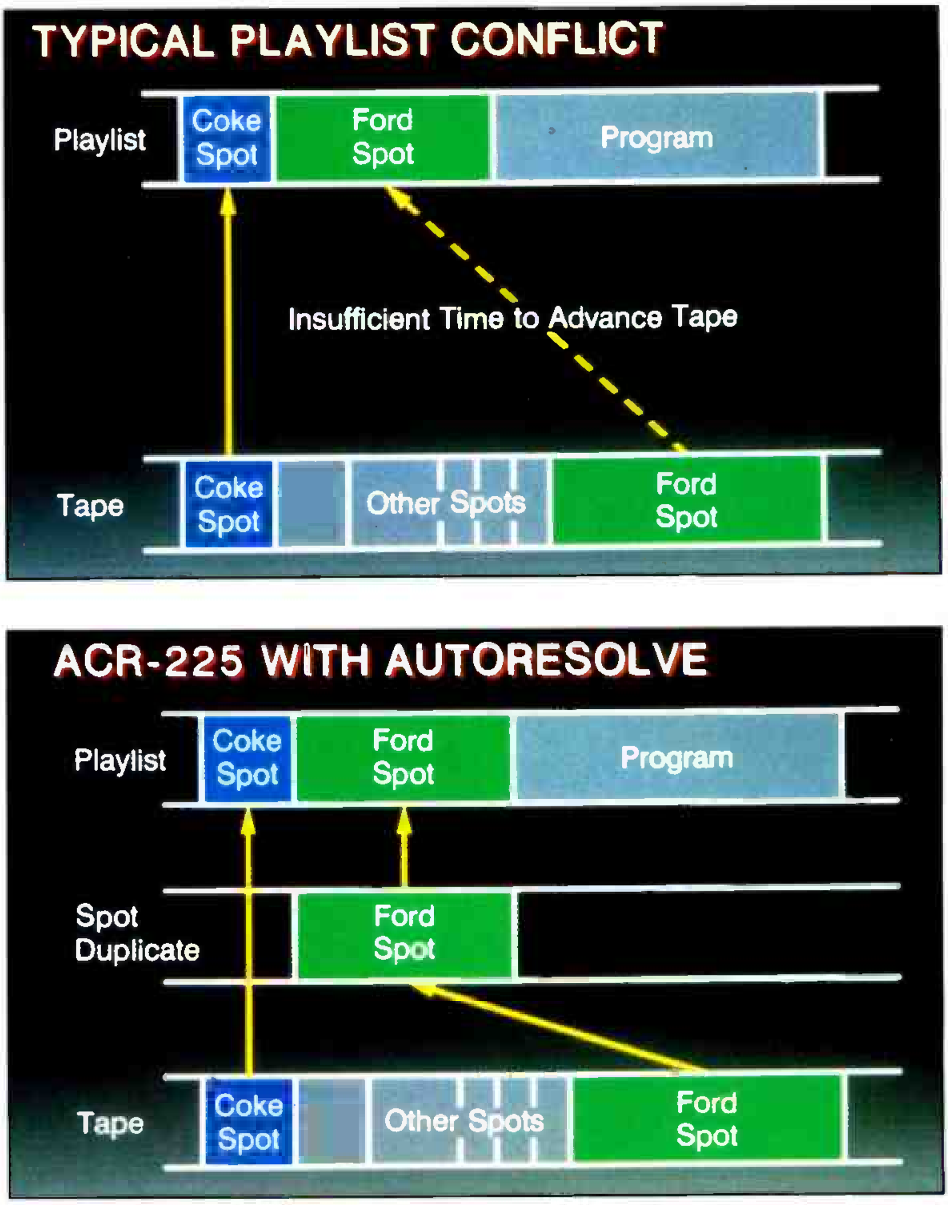


*Figure 1. Basic example of conflict resolution.*

list conflicts without operator intervention or adjustment to the playlist.

In advance of airtime, the program compares the selected playlist with the contents of the on-line library. During the process, it identifies any segments that cannot be executed as specified. Next, it precues the events and automatically uses an operator-designated *work* cassette to create a buffer copy of the segments presenting conflicts during system idle time. As a result, the station regains unrestricted access to any portion of the on-line library at any time. (See Figure 1.)

### Reduced spot costs

In today's network affiliate station, a realistic library might contain between 1,500 and 2,000 individual elements, counting commercials, IDs, promos, opens, closes, bumpers and public service announcements. Because a copy of each element is normally kept in an off-line library, the space for such a library becomes a major consideration. At the same time, the investment in cassettes (ranging from $20 to $70), depending upon the format (quadruplex, ½-inch or D-2), represents a major investment in media.

If proper organization and storage of that many cassettes is difficult for the affiliate station, consider an independent TV station. The count of video elements needed by an independent station can be 50% to 100% greater than that of the affiliate broadcaster.

One of the advantages of the multi-element automation scheme then becomes apparent. Based on D-2 cassettes of 32-minute lengths, a maximum of 42 30-second spots can be stored on one cassette. Each segment requires an overhead of 15 seconds: a 5-second header, which may include a slate; a 5-second tail that contains black or, for some operational preferences, the last image of the spot frozen; and an additional 5-second buffer zone between each cut. If a cassette costs $65, the price of storage for each of the 42 segments is $1.54, a dramatic reduction in cost from the single-cut-per-cassette approach.

### Automating the station log

The driving source of a program automation system is the station log, typically prepared by the traffic department. The log for a given period of time may be introduced to the automation system in one of several ways. It can be provided as a printed list, which an operator must enter into the computer. Although this approach is the least expensive to implement, it is also a method prone to error from the traffic department and in the entry procedure. More efficient methods include importing a file into the system by means of a floppy disk or using a direct local area network (LAN), linking the traffic department to the automation computer. (See Figure 2.) Either of these latter two methods means information is entered into a computer only once. Using a network approach offers the added advantages of bidirectional communication between the traffic and the automation system.

### Conflict recognition

The first step in resolving conflicts in a playlist is to determine that conflicts exist. Conflict recognition begins by searching through the database to determine if all program elements requested by a log are listed in the system. Each of a maximum of 256 cassettes is identified by a 6-digit number that is encoded on a 2-of-5 bar code label. The bar code is scanned by the automation robot when a cassette is placed into the library and is entered into the database. It might be useful to think of the overall system as a warehouse. Each cassette is a storage shelf containing a group of products. The playlist is the shipping order that picks a product from

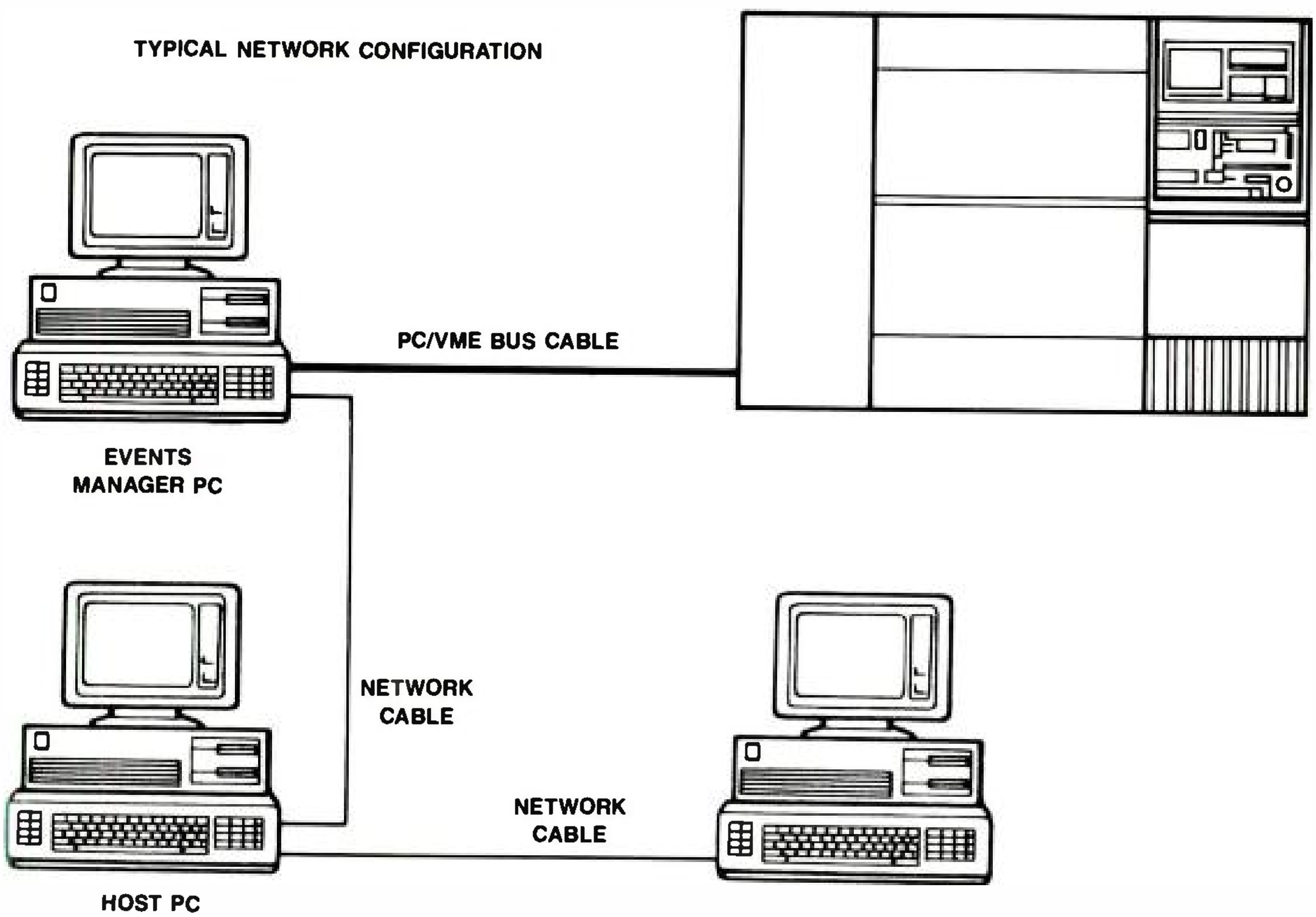


*Figure 2. Typical network configuration.*

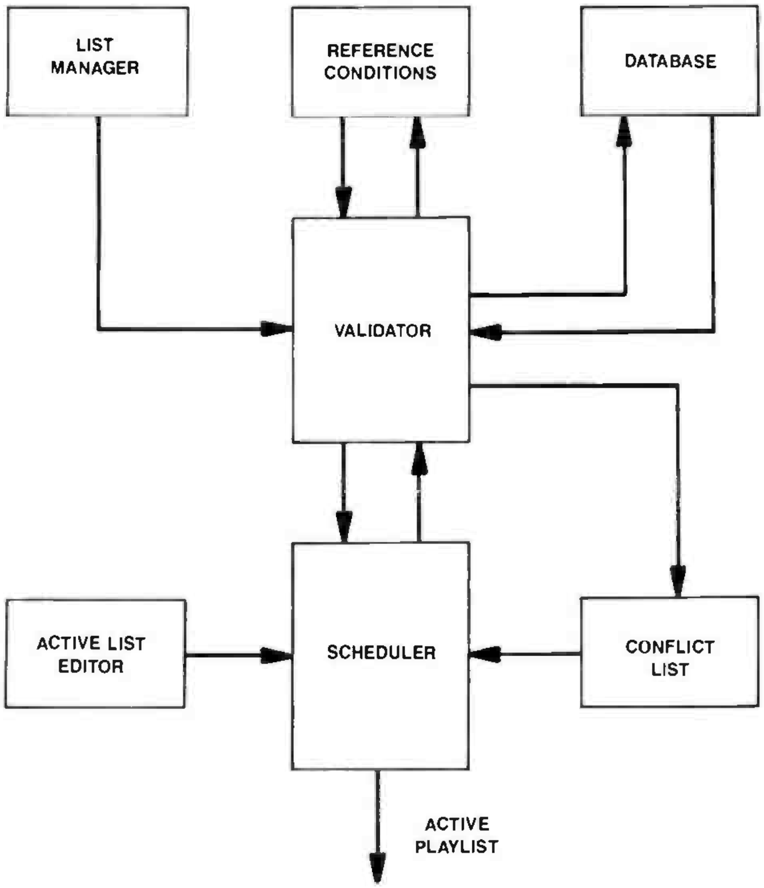


***Figure 3.*** *Flow diagram depicting the major elements of the AutoResolve system.*

a shelf and sends it to the customer. (See Figure 3.)

Within the database, each cassette number is related to a series of 16-character alphanumeric house numbers that identify individual spots. Linked with each house number or spot is other pertinent information, such as the start of message (SOM) in time code, the location from the beginning of message (BOM) on the cassette by tape time count, a time of duration, last play date and the quality of the last playback.

Following the completion of the inventory check, conflict recognition continues as playlist requirements are compared with available resources. The standard ACR-225 configuration includes three transports. Options provide for a fourth transport to be installed, as well as the use of an external transport operating under the system's control facilities. As the number of available transports increases, the probabilities of conflicts decrease, depending upon the other events requested by traffic. However, if one transport is involved with a recording, it is unavailable for playback use and the chance of conflict rises.

A measure of successful operation of the system depends upon the speed of the transport, that is, its cycle time. Cycle time

is the total length of time required to rewind a tape, return the cassette to its assigned location in the library, pick out the next unit, place it in the transport and advance the tape to the correct element. The transports used in this system have a minimum cycle time of 20 seconds.

### Making the break tape

As AutoResolve compares the playlist with the resources, those situations where a sequence cannot be performed as requested are reported and, at this point, conflict resolution is initiated. In its automatic mode, the system resolves the conflict automatically by using one or more cassettes (up to 10) that have been designated/as work or buffer tapes by the operator. These are used to record dub copies of sequential elements that present conflicts. The system may elect to dub only those segments that present problems or to assemble edit a series of events representing all or a portion of a station break. The D-2 digital recording format used by the system for making dubs avoids multigeneration signal degradation, as error correction and error concealment help maintain a high signal quality in the recording and playback processes.

The practicality of creating entire break sequences on the buffer tape is determined by the operation at a particular station. How stable are the items listed on the log? If last-minute changes to playlists are common, then the approach to making longer sequences containing complete station breaks might be wasted effort.

Different approaches to conflict resolution may be used in different situations. For example, sometimes it is practical to check an entire day's playlist for conflicts. Other stations may find it more suitable to resolve a portion of the playlist, such as the length of time of one engineer's or operator's shift.

One of the advantages of the LAN connection between the traffic department and the automation system is the ability to use the conflict resolution capability offline. The traffic department may check portions of the schedule before a playlist is activated. This means that the traffic department can be aware of pending problems and consider alternatives even before a playback schedule is completed. Only when the schedule is activated by the operator will the system begin the process of making dub copies to resolve the conflicts.

The first round of verifying a playlist is typically accomplished prior to signing on-air with the first program. However, if sufficient idle time exists between the scheduled automated events, it is possible for the utility to resolve any alterations that may have been subsequently made to the original schedule. In general, the idle or standby time defaults to three minutes. Longer times may be programmed. In this way, additional sections of the playlist can be resolved while the cart machine awaits its next playback activity. For a typical day's playlist used in most stations, approximately eight to 10 minutes may be needed to create all of the buffer copies necessary to resolve the conflicts.

### Last-minute changes

Last-minute changes in a program log represent a potential hazard under any condition. A function of AutoResolve, called *edit active*, provides the operator with a means to manually override the previously scheduled events. In normal operation, a cursor moves through the menu on the system monitor, highlighting each event as it occurs. Edit active introduces a second cursor, which can be scrolled through the available elements to select and initiate any single-event edit even with a playlist activated. Although this could conceivably result in less than optional



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resolution of a conflict, the override capability can mean the difference between a second or two of dead air, compared to 30 seconds of black, should an element be missing from the library at air time.

The evolution of automation for television has brought many changes to systems' designs. One of the most significant steps in meeting the purposes of automation is the multi-event cassette system. The ability to keep multiple messages on each cassette reduces the number of cassettes required to store a large number of spot elements on-line. The total cost of media is reduced, as well as the amount of space needed to contain the cassettes. Multi-event systems have the important benefit of the shortest usable back-to-back segments, just as with one-element-per-cassette methods.

**Reduced labor costs**

Another advantage of keeping all active elements available on-line is a major reduction in labor costs. For example, one station recently replaced its two existing automated cart systems with two ACR-225s. The station realized a labor reduction of approximately 85%. Originally, the station required three operators per day, seven days per week (upward of 160 man-hours). The current system has made it possible for one person, scheduled for five hours per day, five days per week, to attend to dubbing new material into the system from an external transport and other system housekeeping duties. The operator time no longer required for tape duty can be used in more productive ways around the station.

Conflict recognition and conflict resolution utilities are an effective way to solve the problem of too many segments in too short of a time span. The result makes the multiple-element-per-cassette automation approach economical and practical, without sacrificing on-air signal quality or programming discontinuities. ■

*Continued from page 68*

manufacturer, so many in the audiotape-making community have investigated solutions.

Most of the problems involve binder breakdown over time, causing portions of the binder to ooze out of the surface of the tape onto the heads, guides and rollers of the tape mechanism. Once accumulated, the stickiness of the substance impedes the movement of tape (any tape, even from perfectly good reels loaded on this deck later), resulting in an increase of scrape flutter noise until an audible squealing accompanies the audio during playback. In fast-wind modes, tape movement can be slowed or even stopped entirely from the accumulation of these deposits on lifter posts.

Because the binder deposits are often invisible, observation of these symptoms (especially the fast-wind case, which typically appears first) may send the troubleshooter on a wild goose chase, such as suspecting reel-motor or transport logic failures. In fact, a thorough tape-path cleaning is all that is required to cure the tape deck's ills, but the tape's problems are another story.

Manufacturers' research indicates that

*Continued on page 86*



Circle (46) on Reply Card

# SBE Update

## SBE extends its worldwide reach

By Jerry Whitaker

The Society of Broadcast Engineers has signed a cooperative agreement with the Broadcast Engineering Society (BES) of India. The agreement, signed in a ceremony during the first annual BES exhibition and seminar (held in New Delhi on Dec. 7), marks another milestone in SBE efforts to build a network of broadcast engineers worldwide.

The BES has approximately 800 members in India. It was founded in 1989 with the same basic goals and direction as the SBE.

S.P. Bhatikar, president of BES, signed the agreement. Chuck Kelly, chairman of the society's international committee, represented the SBE. During the ceremony, Kelly praised the agreement affiliating BES with SBE as one that will provide for increased communication and understanding within the profession of broadcast engineering.

The agreement with BES is identical to documents signed last October with the Korean Broadcast Engineers and Technicians Association (KBETA), and the Mexican Broadcast Engineers Association (AMITRA). It allows for the interchange of public documents between SBE and its affiliates, as well as providing for an exchange of information regarding the technical regulation of broadcasting in various countries. The agreement does not bind either organization financially, and confers no voting privileges.

### Supporting HR3501

Now that Congressman Don Ritter (R-PA) has introduced HR3501 (the Federal Communications Commission Engineering Sciences Qualifications Act of 1991), its success will in large part hinge on whether SBE members — and the members of other engineering societies — write their representatives in support of the bill. A sample letter in support of HR3501 is provided.

SBE members should also write to the other members of the House Telecommunications and Finance Subcommittee, which are listed in Table 1. SBE members are encouraged to copy Congressman Ritter's office on any correspondence they send to their representative. Congressman Ritter's address is: The Honorable Don Ritter, United States House of Representatives, 2202 Rayburn House Office Building, S. Capitol St. & Independence Ave., S.E. Washington, DC 20515; telephone 202-225-6411.

This effort represents a challenge for SBE members, and a significant opportunity as well. Please write your representative in support of HR3501.

Whitaker, a technical writer based in Beaverton, OR, is vice president of the Society of Broadcast Engineers.

**Sample letter**

The Honorable (name)
United States House of Representatives
Washington, DC 20515

Dear Representative (name):

I am writing to ask you to support HR3501, introduced by Congressman Don Ritter on Oct. 3, 1991. HR3501, the Federal Communications Commission Engineering Sciences Qualifications Act of 1991, would require that at least one of the five FCC commissioners have an engineering background.

As an (engineer/technical person) working in the field of (broadcasting/telecommunications), I know that the decisions the FCC must make often involve highly technical issues. Yet, of the 64 past and present FCC commissioners, only eight have been engineers. Furthermore, although each FCC commissioner is entitled by the Communications Act to appoint three professional-level assistants, only Commissioner Quello has seen fit to select at least one assistant with an engineering background.

I believe the adoption of HR3501 would help ensure that the numerous technical issues that individual FCC commissioners must consider receive the best possible balancing of technical, economic, legal and political considerations. Therefore, I urge you to (support/co-sponsor) Congressman Ritter's legislation.

Sincerely,

(name, address, telephone number)

cc: Congressman Don Ritter

| NAME | PARTY | DISTRICT | STATE | TERM |
|---|---|---|---|---|
| Joe Barton | R | 6th | Texas | 4th |
| Michael Bilirakis | R | 9th | Florida | 5th |
| Thomas J. Bliley | R | 3rd | Virginia | 6th |
| Rick Boucher | D | 9th | Virginia | 5th |
| John Bryant | D | 5th | Texas | 5th |
| Jim Cooper | D | 4th | Tennessee | 5th |
| Dennis E. Eckart | D | 11th | Ohio | 6th |
| Jack Fields | R | 8th | Texas | 6th |
| Tony P. Hall | D | 3rd | Ohio | 6th |
| Claude Harris | D | 7th | Alabama | 3rd |
| William Lehman | D | 17th | Florida | 10th |
| Thomas J. Manton | D | 9th | New York | 4th |
| Edward J. Markey* | D | 7th | Massachusetts | 8th |
| Thomas McMillen | D | 4th | Maryland | 3rd |
| Carlos J. Moorhead | R | 22nd | California | 10th |
| Michael G. Oxley | R | 4th | Ohio | 6th |
| Bill Richardson | D | 3rd | New Mexico | 5th |
| Matthew J. Rinaldo | R | 7th | New Jersey | 10th |
| Don Ritter | R | 15th | Pennsylvania | 7th |
| Dan L. Schaefer | R | 6th | Colorado | 5th |
| James H. Scheuer | D | 8th | New York | 13th |
| Jim Slattery | D | 2nd | Kansas | 5th |
| Michael L. Synar | D | 2nd | Louisiana | 6th |
| Ron Wyden | D | 3rd | Oregon | 6th |

* Chairman

*Table 1. Members of the House Telecommunications and Finance Subcommittee.*

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THE PESA CHYRON GROUP

*Carrying the torch*

PESA CHYRON CMX AURORA

*Continued from page 83*
"baking" these tapes at about 150°F (65°C) for approximately one hour restores them to their original condition. But soon the breakdown process begins again on these tapes, and after several months of storage, the same symptoms may be detected.

Tape manufacturers have recommended a number of different procedures: some offer to bake affected tapes for their customers, others offer advice to customers on how to bake tapes themselves in a standard (not a microwave) oven. Some recommend immediately dubbing the masters after they cool from baking, while others claim that the baking may be repeated as often as necessary on the original tapes, therefore advising that the masters should be retained and not replaced by dubs.

Apparently, no damage to the audio on the tape is caused by either the binder loss or the baking process (if done properly). Furthermore, the binder loss is not indefinitely progressive — it reaches a certain level and stops. So unlike nitrate-based film stock, for example, an entire archive is not terminally endangered by this phenomenon, and its owner need not race against time to check and treat each reel before it is reduced to a pile of dust in its box.

Ambient storage conditions also seem to have little effect on the binder-loss process. But one caveat in treating these tapes by baking involves the traditionally held concept that an increase in *print through* is caused by high ambient heat.

Tape-baking advocates counter with research that shows maximum print through occurs after about one month of storage, after which no more will occur, even if the tape is later subjected to increased heat. Under this thinking, tape baking will not worsen an archival master's print through because it has already reached its maximum potential. But this only holds true if the tape is baked before it is rewound. Rewinding the tape reshuffles each layer's contact with its neighbors, providing the potential for new print through to occur.

If a tape is stored tails-out (as is the practice of most archives) and then baked after rewinding, the addition of new print through may be accelerated from heating, and "double print" (typically both pre- and post-echo) might occur. If binder loss is not detected until after a rewound archival master is being played back (as is often the case), the tape should be rewound to the head and fully play-wound back to a tails-out condition, then baked.

Often, a broadcast archive is called upon to provide a short clip from an old program at a moment's notice. Here, baking of a problematical archival tape is not feasible because of time constraints. Nevertheless, short segments may still be dubbed from such a reel by frequent, repeated cleanings of the playback deck's tape path during the search-and-transfer process. Afterward, the master reel can be fully treated by baking (and possible replacement), when deadlines are not pressing.

### The ties that bind

It is only when this kind of problem is encountered that radio or TV professionals worry about the cultural preservation that their storage bins represent. Unlike archivists and librarians, broadcasters generally don't think much beyond price/performance ratios when considering magnetic tape. Yet these products must deliver the programs of today to the audiences of tomorrow. The manufacturers of magnetic tape must look to the future while currently remaining competitively viable. For those companies, this implies high-speed travel on a 2-lane highway. A day in the life of a tape-maker clearly requires a lot of looking both ways.

**Acknowledgments:** Thanks to Steve Smith at Ampex, Jonathan Hirshon at Sony, and Jim Hoskins, Del Eilers and Don Rushin at 3M.

*For more information on magnetic tape circle Reader Service Number 540.* ■

# Industry Briefs

## BUSINESS SCENE

**Panasonic Broadcast Systems**, Secaucus, NJ, has sold its Broadcast and Television Systems Group's MII format to West Virginia's WYVN-TV. The group has sold another such system to WPCB-TV in Greenburg, PA, and to two TV production centers in South Dakota: KESD-TV in Brookings and KUSD-TV in Vermillion.

Panasonic also has sold cameras and MII-format equipment to Great Trails Broadcasting's WHAG-TV in Hagerstown, MD, and MII and S-VHS equipment and cameras to WLTX-TV in Columbia, SC, and to WJCL-TV in Savannah, GA.

Panasonic Broadcast Systems also has sold to CTV Television Network in Toronto, Canada, a D-3 ½-inch digital format. KJRH-TV in Tulsa, OK, has bought Panasonic's M.A.R.C. 400 multicassette library system.

**TV Answer**, Reston, VA, has reached a manufacturing and marketing agreement with Hewlett-Packard (HP) Company. It allows HP to use TV Answer's patented wireless interactive technology to manufacture and market interactive TV home units to control a 2-way TV system at home.

**A.F. Associates**, Northvale, NJ, has sold AVS's Manuscript character generator to ChromaVision, Micro Video Learning Systems, and Video Dub, all in New York City.

Radamec EPO, Surrey, England, has sold robotic camera systems to two chambers of the French National Assembly in Paris. A.F. Associates is its North American representative. Radamec also has won a contract to furnish ATN7 Television of Australia with two such systems for coverage of the Summer Olympics.

**Sony Broadcast and Communications**, Basingstoke, UK, has constructed a TV outside broadcast vehicle for Polish Radio and Television in Warsaw, Poland. It is the third such vehicle Sony has built for Polish RTV in the last four years.

**Sony Corporation of America**, Park Ridge, NJ, has sold its D-2 digital format to Swedish Television (STV), replacing STV's existing 1-inch VTRs.

**Solid State Logic**, Oxford, England, has sold a ScreenSound digital post-production system and a SoundNet digital audio network for use in the 1992 Olympic Games to Duy Studios in Barcelona.

**Getris Images**, Los Angeles, has sold Venice Anim 144 digital equipment to Beta Imagen in Mexico. Beta Imagen is the first facility in Mexico to be fully digitally equipped.

Getris has also sold its Venice videographics system to Third Avenue Productions in Seattle and to Televisa Tijuana of Mexico. Getris also sold to Third Avenue Productions the first Aramis system sold in the United States. Venice and Aramis systems were developed by Getris Images in Meylan, France.

**GLW**, Nashville, has sold its Harrison consoles to Belgium's Network RTBF and Network BRT. RTBF will receive one TV-4 and two TV-3s, while BRT will receive a SeriesTen B.

**Synergistic Technologies**, Pittsburgh, PA, has won a contract to design and install new broadcast facilities for Western New York Public Broadcasting Association.

**Quantel**, Darien, CT, has sold to WFAA-TV in Dallas a Quantel Harriet dynamic graphics system and three Picturebox still-store systems. WFAA will use them for broadcast-quality animation and graphic stills.

**AMEK/TAC**, North Hollywood, sold to CNN in Atlanta two BCIII consoles. Turner Broadcasting's Atlanta facilities now own 10 such consoles. AMEK also sold two BCII consoles to Kentucky Educational Television and a chassis version BCII to Denver's KWGN.

**Avid Technology**, Burlington, MA, has opened a European headquarters in Monaco and direct sales and service offices in England, France and Germany.

**Trident Audio USA**, Torrance, CA, has sold its Vector 432 console to CBS Television City in Los Angeles. CBS will use it for its teleproduction studios.

**Aphex Systems**, Sun Valley, CA, has appointed Stirling Audio as its new equipment distributor in the United Kingdom.

**Leitch**, Chesapeake, VA, has sold Viewguard, its TV scrambling system, to ABC. ABC wants to protect transmissions to its affiliates from unauthorized viewers with satellite dishes.

Leitch also has moved offices. Its new address is 920 Corporate Lane/Chesapeake, VA 23320; phone 804-548-2300; fax 804-548-4088.

**Canon U.S.A.**, Englewood Cliffs, NJ, has sold its first J33aX11B IAS in Latin America territory and a J14aX8.5B IRS lens to Radio Cadena Nacional in Bogota, Columbia. KPTV in Oregon has bought 15 of Canon's lenses to upgrade its station from MI to SP Beta format. Canon has sold several other J33aX11B IAS lenses: two to Victor Duncan, which supplies video and film equipment, a third to P.J. Video Services, and yet another to CBS Network News Division.

Canon has also sold 14 of its J55X Super lenses and eight J18X8.5B IRS lenses to NEP Super Shooters. Duke City Studio, a rental warehouse in Albuquerque, NM, bought three J18X8.5 lenses. Three of Canon's J20x Super lenses were sold to WUSA in Washington, DC, and WCTI in North Carolina bought two J20 Type C lenses, two MC-100 pedestals and two SC-15 camheads.

**Snell & Wilcox**, United Kingdom, has sold a DEFT conversion system to DuArt Video, a division of DuArt Film Laboratories. DEFT, Digital Electronic Film Transfer, now is available for sale in the United States.

**Dynatech Broadcast Group**, Madison, WI, has changed its name to Dynatech Video Group, reflecting post-production, cable and corporate-industrial business. The phone number is 800-531-7119.

**Digital Audio Research**, Surrey, England, has sold its 16-channel SoundStation SIGMA digital studio production system to Liebert Recording Studios in New York City.

**Harrison Systems Ltd.**, Beltsville, MD, has completed another modification of an existing transmitter system to allow for the operation of high-efficiency final amplifiers.

The WVIZ-TV PYE-TVT 60kW transmitter system has been refitted to use the new high-efficiency EEV K3755 HBCD, 70kW,5-cavity klystron tube.

**Pinnacle Systems**, Santa Clara, CA, has sold two of its 2100 series production video workstations to NBC News Channel in Winston-Salem, NC, and to WYSM-TV in Lansing, MI. The workstation offers 2-D effects, paint, 3-D modeling and animation.

Pinnacle has also sold its Prizm video workstation, offering 3-D digital effects, to four broadcast and cable TV systems.

**Vistek America**, Palo Alto, CA, has established more technical support for its standards converters, routers, color correctors, mixers, encoders and decoders. Vistek will also support the A.C.E. product line, which it obtained last year.

**Gentner Communications**, Salt Lake City, has signed a letter of intent to purchase all products and technology of MacroMedia of Northfield, MA. It will not assume any MacroMedia liabilities.

**Ampex**, Redwood City, CA, has sold four VPR-300 D-2 videotape recorders, an AVC Century switcher and a 3-channel ADO 3000 digital effects system with Infinity effects option to Empire Video, a Manhattan post-production facility. The sale also included nine Zeus advanced video processors with Zeus Port capabilities.

Ampex also has sold 27 ADO 100 3-D digital effects systems to Rome's broadcaster RAI-TV and two more ACR-225 automated cart systems for multiplex feeds to HBO in New York. Ampex has also sold its first ADO 500 digital effects system in China to Shandong Provincial Television in Jinan. It also has sold six ACR-225 automated cassette systems to the Canadian Broadcasting Corporation and 29 VPR-300 D-2 digital studio recorders to Home Box Office in New York.

## PEOPLE

**Dennis B. Brunnenmeyer** has been appointed director of marketing at Sierra Video Systems, Grass Valley, CA.

**Ronald W. Butler** has been named Western regional zone manager for Panasonic Broadcast & Television Systems Group, Secaucus, NJ.

**Stephen F. Rollison** has been named Western regional sales manager for BAF Communications Corporation, Peabody, MA.

**Forrest Krisco** has been appointed district sales manager for Arkansas, Kentucky, Louisiana, Mississippi and Tennessee by Richardson Electronics, Ltd., LaFox, IL.

**Paul Brett, Bill Dumm** and **Christina Kallay** have been appointed to positions with RF Technology, Norwalk, CT. Brett is director of sales and marketing, Dumm is national sales manager and Kallay is sales administrator and manager of the Faraday products line.

**George "Gus" E.R. Kinnear II** and **Brian N. Hamel** have been named to positions with New England Digital Video, Lebanon, NH. Kinnear is vice chairman and Hamel is vice president, finance and chief financial officer.

**John R. Peeler** has been appointed president and chief executive officer of Telecommunications Techniques Corporation (TTC), Germantown, MD, and corporate vice president of Dynatech, TTC's parent company.

**Tokuo Kubo, David E. Mundell**, and **Philip J. Quigley** have been elected to the board of directors at Varian Associates, Palo Alto, CA.

**Patrick Bradbury** has been appointed vice president and business center manager for the Portable Products line of Microwave Radio Corporation, Chelmsford, MA.

**Wayne Ruting** has been appointed president and chief executive officer of Columbine Systems, Golden, CO.

**Mike Smyth** has been named U.S. operations manager for Audio Processing Technology, Los Angeles.

■

*Continued from page 43*

ability to find and fix bugs as well as about future upgradability of the system.

5. What is the commitment to continued maintenance and support? Does the company have a program to add features and increase benefits? What is the policy for upgrading to a new system?

6. Determine the financial strength of the vendor. Will the company be around in the future to support the system? Companies without the financial strength to endure the hard times are more likely to leave you stranded without future support.

7. Does the company offer a completely integrated package? Too often a company without all the answers incorporates work by several different vendors. When a problem occurs, there is a tendency to point fingers and not solve the problem.

Most important, don't be afraid to ask questions. The most expensive questions may be the ones you did not voice. Those vendors who have quality products will be more than happy to answer your questions and show you the inner workings of their systems. ■

# Preview

## May...

### *RF TRANSMISSION SYSTEMS UPDATE*

- **Multichannel TV Antennas**

As tower space becomes more difficult to obtain and more expensive, stations are looking toward sharing facilities.

- **Considerations in Building a 1,000-Foot Tower**

Building a "tall" tower requires special considerations. The advantages are improved coverage and the option of renting space to a variety of customers.

- **Lightning-Protection Systems**

There's an old engineering axiom, "The probability of any antenna or tower being struck by lightning is directly proportional to its value (cost multiplied by the square of revenue lost and bad PR accrued due to downtime.)

- **Radio On a Budget**

Radio stations are hanging on by a thread in many markets. The article will look at ways radio stations can operate without having to spend a lot of money.

- **Solving RPU Intermod Problems**

Remote pickup systems are critical to many radio and TV stations' operations. The article will detail "tricks of the trade" in keeping RPUs up and operating properly.

- **Acoustics for Engineers**

Acoustics is often a mystery to engineers. The article will examine the major elements to consider when designing rooms and locating equipment within them.

## June...

### *NAB CONVENTION REPLAY*

- **From the Convention Floor: A Perspective**

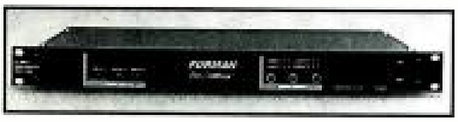
A look at what technical and station managers saw on the convention floor and in the meetings.

- **Pick Hits of '92**
- **Engineering Conference Report**
- **Show of Shows**

# New Products

### *Power protection*
*By Furman Sound*

• **PS-8, PS-8R:** sequencer applies power to equipment rack in a 3-step sequence; sequence reversed for power-down; includes spike and surge protective varistor components; PS-8R permits remote control of unit.



**Circle (372) on Reply Card**

### *Digital audio accessory*
*By CEDAR Audio*

• **Phase/time corrector:** senses and corrects phase change and time delays between left and right channels of a stereo signal; correction range to 10ns; real time system adds minimal noise to signal; for mastering of soundtracks, CDs, film.

**Circle (359) on Reply Card**

### *Signal tracing*
*By Cyclone Systems*

• **YIBBOX:** 400Hz tone source of test signal to be inserted into equipment being examined; balanced, unbalanced output from −50dBm to 0dBm; LEDs show presence of phantom power; 9VDC unit; electret mic allows voice tests to be made during testing.

**Circle (362) on Reply Card**

### *Video production system*
*By Data Translation/Multimedia*

• **Media 100:** on-line, non-linear production in NTSC or PAL; Macintosh-based System 7 PC digitizes analog video-audio from tape with SCSI device storage; picture-based interface; records finished product back on tape; VTR control, virtual waveform, vector displays.

**Circle (363) on Reply Card**

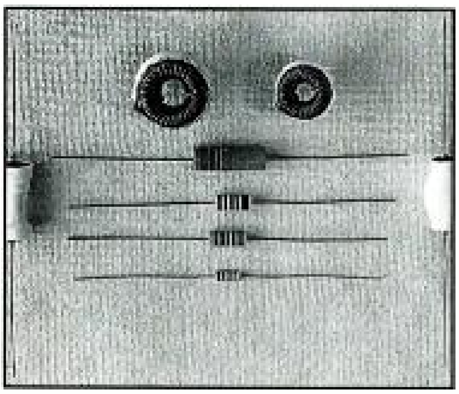
### *RF/microwave connectors*
*By Amphenol Corporation*

• **RF/IS&C catalog:** 120-page publication covers 619 products in 50Ω and 75Ω types; includes 15-page RF/microwave selection guide.

**Circle (354) on Reply Card**

### *Replacement parts literature*
*By Ohmite*

• **Inductive components catalog:** several product lines of small inductor devices, including H series RF molded choices and toroidal chokes.



**Circle (403) on Reply Card**

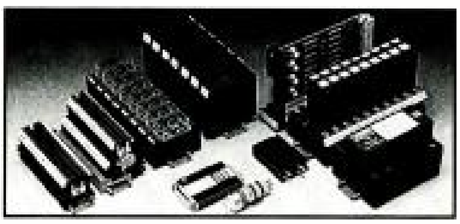
### *FO enhancement*
*By Math Associates*

• **Option -7:** permits Fiberlink, Fibervision analog, video and digital transmission systems to operate with single-mode fibers; transmission range extended up to 40km lengths.

**Circle (393) on Reply Card**

### *Product literature*
*By Phoenix Contact*

• **TRABTECH brochure:** describes TRansient ABsorption TECHnology surge voltage protective products.



**Circle (409) on Reply Card**

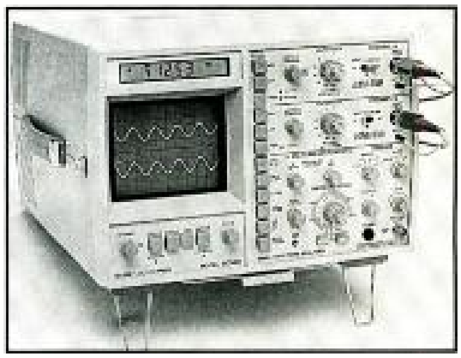
### *Product data sheets*
*By Loral Microwave/Narda*

• **Literature:** informative material on XSS323BDHS high-speed transfer switches, super slim 2-18GHz PIN switches and power divider/mixer/directional couplers.

**Circle (388) on Reply Card**

### *Signal analysis*
*By Sencore*

• **SC 3080 waveform analyzer:** 2-channel oscilloscope with digital readout of both channels; single probe for all measurements; "delta" features for PPV, Time and 1/Time.



**Circle (414) on Reply Card**

### *Current measurement*
*By A.W. Sperry Intruments*

• **DSA DIGISNAP series:** Snap-around-style meters; current reading ranges from 20-300a and 40-400a; also provide AC/DC voltage, resistance features; one model includes temperature, frequency functions; meet IEC-348 Class II standards.

**Circle (351) on Reply Card**

### *Production accessory*
*By High Density Circuits*

• **SY-191 video invervalometer:** does time lapse photography with Sony professional or industrial camera; controls start/stop functions, number of recorded frames, iris aperture, time between takes; some adjustment ranges determined by VCR used.

**Circle (374) on Reply Card**

### *Modular test accessories*
*By ITT Pomona*

• **Modular probes:** interchangeable O-scope probes for measurements from 100-300MHz; ×1, ×10 or switchable attenuation features; all units are constructed of replaceable parts, allowing repairs to be made in the field.

**Circle (379) on Reply Card**

### *Equipment database*
*By Equipto Electronics*

• **CAB-NET:** includes 10,000-item database with descriptions, prices; technical drawings; search capabilities; three versions differ in amount of hard drive memory required, graphic capability and amount of text descriptions; with registration, direct electronic link via modem with factory available.

**Circle (368) on Reply Card**

### *RFI protection*

*By Equipto Electronics*

- **Shielded cabinet:** equipment cabinets, racks providing RFI attenuation at frequencies to 1GHz; attenuation level of 120dB below 1GHz; heavy-duty frame meets various Mil-Std requirements and can meet seismic requirements to Zone 4.
- **Design assistance:** engineering services from planning proper panel space to complex installations of multibay custom enclosures.

**Circle (369) on Reply Card**

### *News terminal*

*By Mainstream Data*

- **Mainstream Newscast:** uses Macintosh as desktop news terminal for reception, filtering and display of data from multiple news services; operates in background; mainstream IDR FM/satellite receiver, software, FM/satellite antenna.

**Circle (389) on Reply Card**

### *Sound reinforcement*

*By Optim Audio*

- **Force 9 series:** loudspeakers by Wharfedale (England); high sound clarity from SMS coaxial driver; 12-inch silicon impregnated paper cone, 1-inch titaniam compression driver with common magnet.
- **Programme series:** high acoustical performance with rugged compact enclosures; bass, midrange drivers matched to cabinet; tuned port, dome tweeter, internal crossovers.

**Circle (406) on Reply Card**

### *Connector adaptations*

*By Pasternak Enterprises*

- **PE9341, PE9344, PE2506:** 50Ω coaxial adapters include BNC male-to-mini-UHF female, UHF female-to-mini-UHF male and type N female-to-BNC female types; all cover spectra to 2GHz or beyond.

**Circle (408) on Reply Card**

### *Monitor hood*

*By OpTex*

- **Chipbox:** sunshade with filter eliminates reflections from monitor screen; constructed of vacuum-formed GRP; currently for 9-inch Sony 8020/8021, 9020/9021 and SteadiCam EFP monitors.

**Circle (405) on Reply Card**

### *Maintenance tool*

*By Jensen Tools*

- **Shortsqueek:** assists in location of short circuits; tone-ohmmeter system produces aural output to indicate an impedance range from 0Ω to 500Ω; sensitive to 0.01Ω; AC powering; sized to fit in pocket.

**Circle (380) on Reply Card**

### *Digital audio converter*

*By Sony Business & Professional Group*

- **DAF-4000 system:** 20-bit D/A, A/D conversion equipment; includes frame and converter boards; 4-bit Delta Sigma A/D conversion, 8× oversampling filter for 20-bit D/A function.

**Circle (416) on Reply Card**

### *RDAT equipment*

*By Sony Corporation*

- **PCM-2300:** digital audio recorder; 32kHz, 44.1kHz, 48kHz sampling; standard mode records two hours of 16-bit linear stereo audio; long play mode doubles time with 12-bit non-linear recording at 32kHz sampling.

**Circle (417) on Reply Card**

### *Variable transformer reference*

*By Superior Electric*

- **Pub. PVT491:** catalog covers full line of 534 standard POWERSTAT variable transformer models, including 1296D high-power frame series for 240VAC 35a constant current loads.

**Circle (418) on Reply Card**

### *Communications feature*

*By Symbolics*

- **PACE Professional Animation Control Engine:** Videomedia V-LAN control network for as many as 31 video devices from Unified Graphics system; drivers configure any V-LAN-compatible device.
- **Digital disk recorder support:** for Recognition Concepts (RCI) VideoDISK-120 or Abekas A66 real time disk recorders; for PaintAmation and XL Animation systems.
- **PaintAmation text:** enhanced interactive kerning, rotation, position and scaling of text; special feature places text along curves.

**Circle (419) on Reply Card**

### *Storage/shipping reference*

*By TekMedia*

- **Catalog No. 500:** includes products for tape and film care, storage and shipping; includes multicassette shippers for Beta, VHS media.

**Circle (420) on Reply Card**

### *Signal drive outputs*

*By Tektronix*

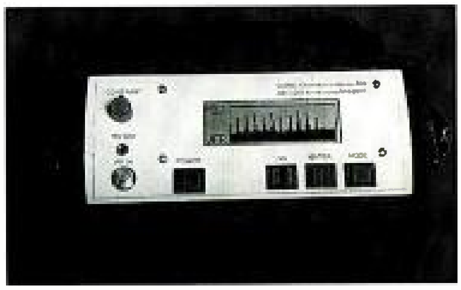
- **TSG 1001 upgrade:** horizontal and vertical drive outputs; hardware and software enhancement; release 2.3 of SDP 1000 signal development program has signal drive libraries for most HDTV formats as well as 525-/625-line component digital signals.

**Circle (421) on Reply Card**

### *VSAT antenna alignment*

*By Global Communications*

- **GS-1000:** portable spectrum analyzer; 0.95-1.45GHz range for alignment of C-, Ku-, L-band equipment; includes +18VDC power supply to operate LNB; no additional ancillary equipment is required; easily portable at 4.6 pounds.



**Circle (373) on Reply Card**

### *LCD projection*

*By nVIEW Corporation*

- **ViewFrame SpectraPlus:** active matrix LCD panel; for use with video projectors; 32,000-color capability can be used with computers, VCRs, laserdisc players; models available with multiple inputs.

**Circle (401) on Reply Card**

### *Automation interface*

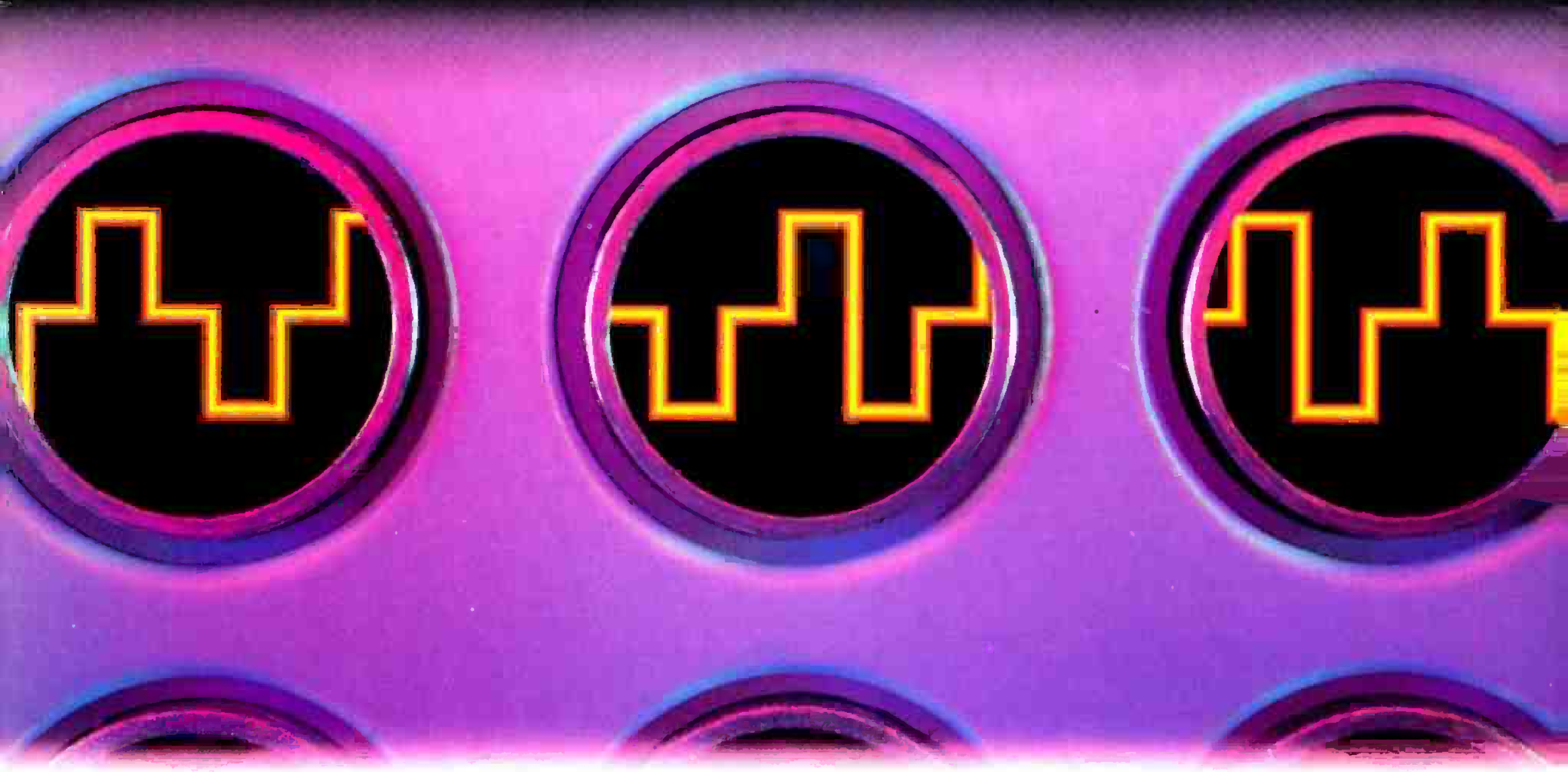
*By Cycle Sat*

- **Automation Protocol Converter (APC):** Cycle Sat (in association with Sony) has announced an automation interface for use with its satellite recording system. Software drivers are available so that a Sony Library Management System (LMS) using the 2100 series multicut version software can automatically record commercials directly from a satellite feed. Video, stereo audio and time code are delivered into the LMS where each commercial is carted automatically and an operator then prompted to verify the recorded feeds.

**Circle (430) on Reply Card**

■

# The Digital Video Jack For The Future...



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**MIDWEST VHF NETWORK AFFILIATE** seeks Chief Engineer with strong people skills, technical expertise, experience in project management, plus solid understanding of FCC rules and regulations. EOE. Send resume to: P.O. Box 12901, Broadcast Engineering, Box T-13, Overland Park KS 66282. 4-92-1t

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## HELP WANTED

**THE OFFICE OF DISTANCE EDUCATION TECHNOLOGIES** at the University of Maine at Augusta (**UMA**) is seeking a **CHIEF ENGINEER** for its interactive television system. **UMA** is one of seven campuses in the State University System. Its mission is to serve both regional and statewide constituencies as the Community College of the University of Maine System. Instruction is delivered at on-campus and off-campus facilities and by interactive electronic technologies. The main campus is located in the state capitol of Augusta which is midway between the scenic coast and the mountains/lakes regions of the state.

The Chief Engineer will be responsible for the engineering planning as well as management of the ongoing maintenance of the University's statewide ITV System and related systems and equipment. Other responsibilities include planning, designing and developing equipment specifications and construction of video, audio and related instructional technology systems; scheduling and training of technical support staff; maintenance of technical liaisons with staff at other campuses; development of budgets for capital equipment and operating supplies in support of ITV objectives. Some travel required. Five years of management experience as well as oversight of maintenance and design functions within broadcast television and related industries is required. Current experience in microwave/ITFS technology is also required. Must be able to develop technical systems, to meet deadlines and to maintain knowledge of state of the art equipment and systems in field. Salary for this position will be low to mid forties (depending on qualifications and experience). Screening of applications will begin immediately and will continue until position is filled. To apply, send letter of application; current resume; and the names, addresses and phone numbers of three current professional references to:

Chief Engineer Search Committee
University of Maine at Augusta
Augusta, Maine 04330

The University of Maine at Augusta is an affirmative action/equal opportunity employer. 4-92-1t

## HELP WANTED

**ENGINEER TO MANAGE** Growing Service Department of Sony Broadcast Dealer in Arizona. Applicant must have 3-5 years Senior Engineering experience including system design and installation. Electronic or Broadcasting Degree helpful. Report to top management. Supervise department of four (4). EOE. Send resume or fax (602) 274-7416 to: M. Temen Audio Video Recorders, 3830 North 7th Street, Phoenix, Arizona 85014. 4-92-2t

European Distributor of Professional Equipment for Radio TV Stations is looking for an Experienced Sales Representative. Please send your resumé in confidence to:
**P.O. Box 6312, Jersey City,**
**New Jersey 07306-0312**
**Attn: Janine L. Algar Human Resources**

**TEXAS GULF COAST TV STATION** is seeking qualified Chief Engineer. Candidate must possess knowledge in all facets of Television maintenance and Engineering. Administrative and people skills a must. Hands on and quality driven. Please send resume to Broadcast Engineering, P.O. Box 12901, Dept. 730, Overland Park, KS 66282. 4-92-1t

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Contact Renée Hambleton, at (913) 541-6745, for information on frequency and pre-payment discounts. To place your classified ad send your order and materials to Broadcast Engineering, Classified Ad Mgr., P.O. Box 12901, Overland Park, KS 66282-2901.

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**Will sell individual items.**
**Call M.D. Smith (205) 533-3131**
**M-F, 9AM-4PM.**

**TEKTRONIX 1780R NTSC TEST SET. INCLUDES** Portable Carry Case. $8,000.00. Tektronix 2445A Oscilloscope. Options 01, 05, 06. Warranty Till 6/15/93. $5,500.00. Sony BVU-820 Dynamic Tracking VCR. Completely Rebuilt. Excellent Condition. $3,500.00. Ikegami TM20-10RH High Resolution Color Monitor. $3,500.00. Leader 430 Video Sweep Generator Never Used. $1,200.00. Phone (215) 481-0424. 4-92-1t

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Need to genlock your video system? The BSG-50 from HORITA generates black-burst, composite sync, and a 1-KHZ audio tone. Provides 6 separate outputs of any mix of up to 4 each of RS-170A black or sync. Also provides subcarrier, blanking, drive. UNCONDITIONAL GUARANTEE. Contact your local video dealer or
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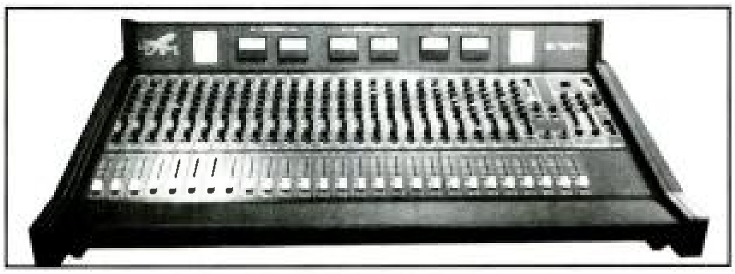

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**TUBES 4CX25000A, 3CX5000A7 UNUSED, MAKE OFFER,** Call Mr. Bean 800-523-2596 Fax: 215-540-5837.4-92-1t

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For Sony 8020 and 8021. Either RGB, Y/R-Y or B-Y monitoring in the field from a BVW 35, BVW 25 or camera. Fits inside monitor. $450.00 - installed price.
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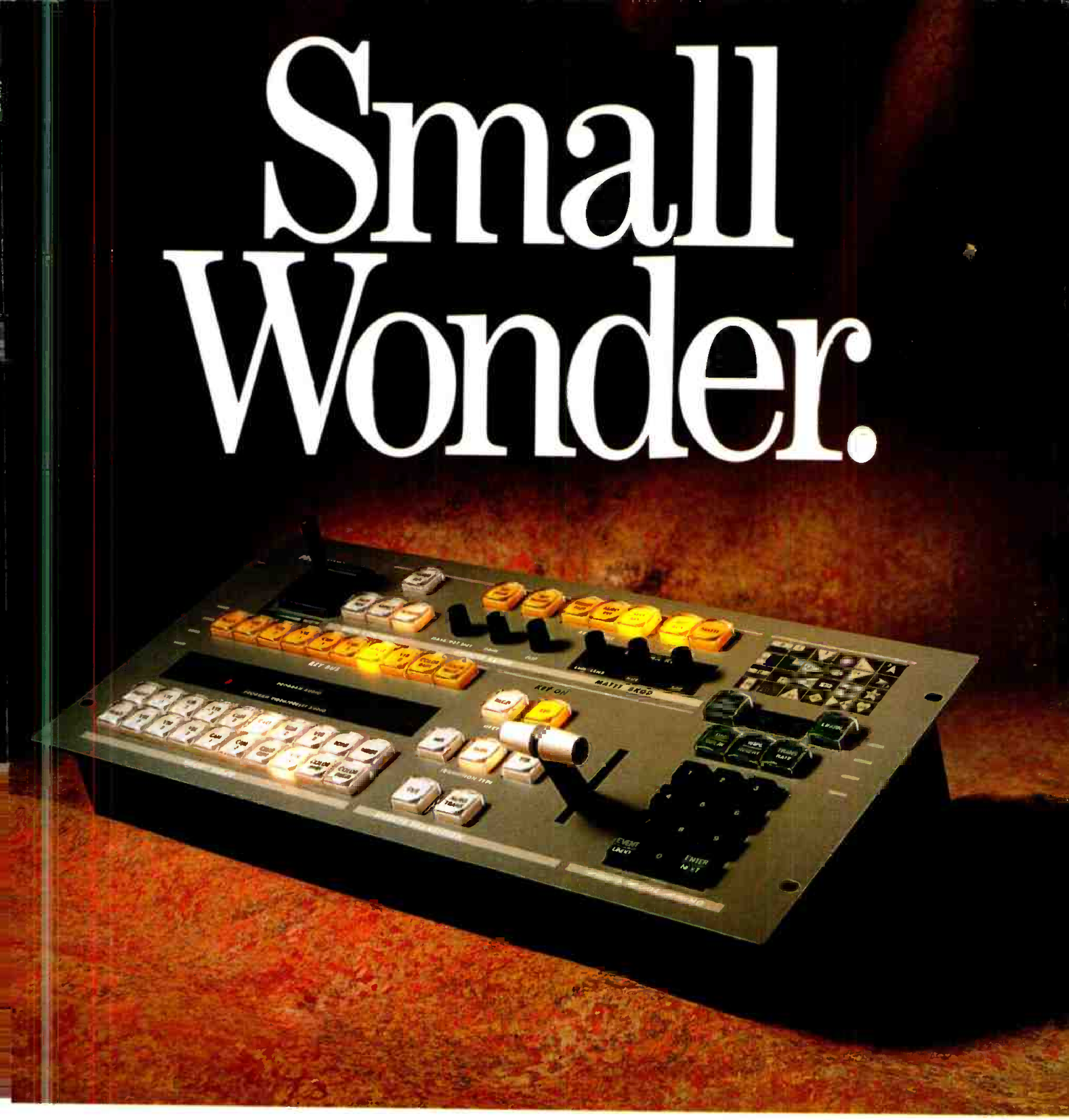


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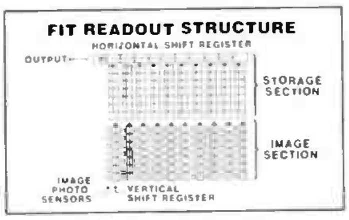
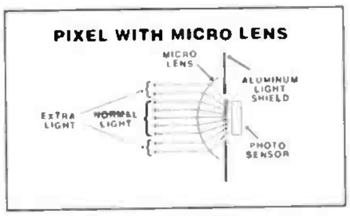



*The KY-17FIT system nearly eliminates vertical smear.*

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