BROADCAST ENGINEERING®
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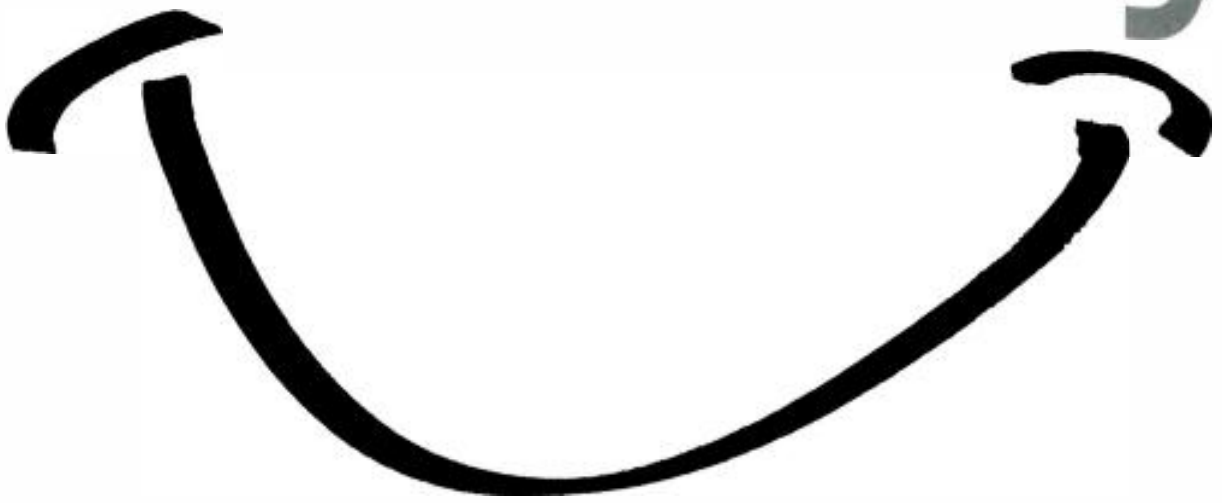
December 1992/$4.50

Exploring new technologies

Interactive TV: tomorrow's opportunity

Maintaining video monitors p. 65

Real-time, real friendly.



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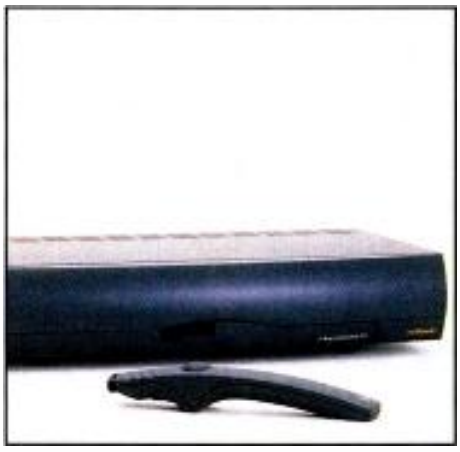

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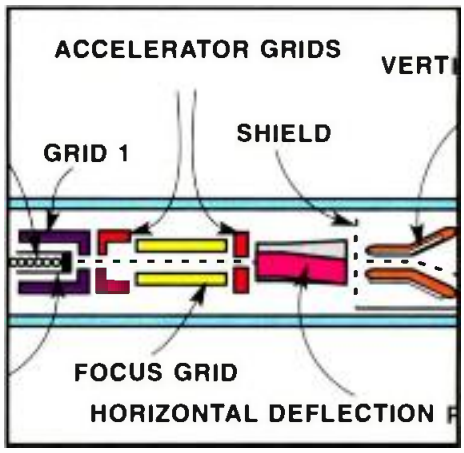

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EXPLORING NEW TECHNOLOGIES:

As 1992 comes to an end, our thoughts turn to 1993. Perhaps more so than in recent years, a sense of optimism and belief that the worst is behind us has pervaded the industry. This viewpoint is reflected in our readers' 1993 spending plans. Based on those projections, better times may be just around the corner.

DEPARTMENTS:

FEATURES:

OTHER FEATURES:

ON THE COVER

As HDTV moves closer, production and broadcast facilities are searching for ways to transport the large amount of data required. Fiber-optic equipment is now available, making that process easy and straightforward. (Cover credit: fiber-optic transmitter provided by Dynair; world image by Jim McCloud; computer art by Robert Russ, San Diego Supercomputer Center; Ikegami HDTV monitor; Arcom fiber-optic cable; photography by Douglas Schwartz Photography; electronic photo imaging by Joe Hanf and Phil Di Marino, Color Net.)

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TELEX

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

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News

By Dawn Hightower, senior associate editor

One-step process needed for FM upgrades

The National Association of Broadcasters (NAB) has urged the Federal Communications Commission (FCC) to OK a 1-step process that would allow existing FM stations to upgrade their facilities and expand the coverage area of their signal.

Broadcasters are also recommending a fundamental review of the FCC's FM allocation policy. In a letter to the FCC, NAB asserted this allocation policy has oversaturated the airwaves with too many stations, more than half of which lost money in 1991.

NAB said the 1-step process would reduce the processing time for existing station upgrades, and help eliminate delays and uncertainties attached to upgrading efforts. However, NAB still backs certain safeguards when considering upgrades.

Broadcasters are urging the commission to offer this process to co-channel and adjacent-channel upgrades and only in situations where the applicant would comply with the commission's applications and allotment criteria.

NAB presses court to hear appeal of FCC forfeiture

The National Association of Broadcasters (NAB) has asked a federal appeals court to deny the Federal Communications Commission's (FCC) motion to dismiss a challenge to the FCC's new table of fines and forfeitures.

NAB, which has joined the U.S. Telephone Association (USTA) in challenging the forfeiture order in the U.S. Court of Appeals D.C. Circuit, agreed with USTA that the fine schedule violates the Administrative Procedure Act as well as the Communications Act and the commission's rules.

NAB said the fine schedule functions as a substantive rule and not as a policy statement, because the forfeiture order has been applied uniformly to impose higher penalties on broadcasters and other FCC licensees than before its adoption.

SBE names new director

John L. Poray, CAE, has been appointed executive director for the Society of Broadcast Engineers (SBE).

Poray began his duties on Oct. 1. He is the society's first full-time executive director, and will be located at the Indianapolis headquarters.

Poray has spent more than 15 years in association management, most recently as manager of field operations, North America, for Kiwanis International. He earned the Certified Association Executive designation from the American Society of Association Executives in 1989.

BBC World Service TV goes D2-MAC in Europe

BBC World Service Television has announced that Philips will be its strategic partner for Europe. It will also adopt a new transmission format and encryption system for its European channel.

From mid-autumn, the BBC's 24-hour general entertainment channel will be broadcast across Europe in D2-MAC. The signal will be encrypted by Eurocrypt M, and subscribers will be able to access the channel using addressable Smartcards.

Digital Radio on test — via space

British Broadcasting Corporation (BBC) engineers have begun to test broadcasts of a digital radio system that produces sounds comparable to compact discs.

The BBC is working with the British National Space Centre (BNSC) and other European collaborators to speed the development and introduction of digital audio broadcasting (DAB).

As a result, DAB will be tested with a series of experimental transmissions via the European Space Agency's (ESA) Olympus satellite. The BNSC is providing the BBC with access to the direct broadcasting transponder on Olympus.

Over the next nine months, the BBC will use the test transmissions to research the distribution of DAB signals to terrestrial transmitter sites, and explore the potential for satellite delivery of DAB for public reception. The Olympus satellite will also be used to study aspects of picture-scrambling systems and the distribution of digital television.

Although the BBC has made no decisions about DAB, reports suggest that the test system, which is being developed under the Eureka program of collaborative European high-tech research, could be up and running in the second half of the decade. ■

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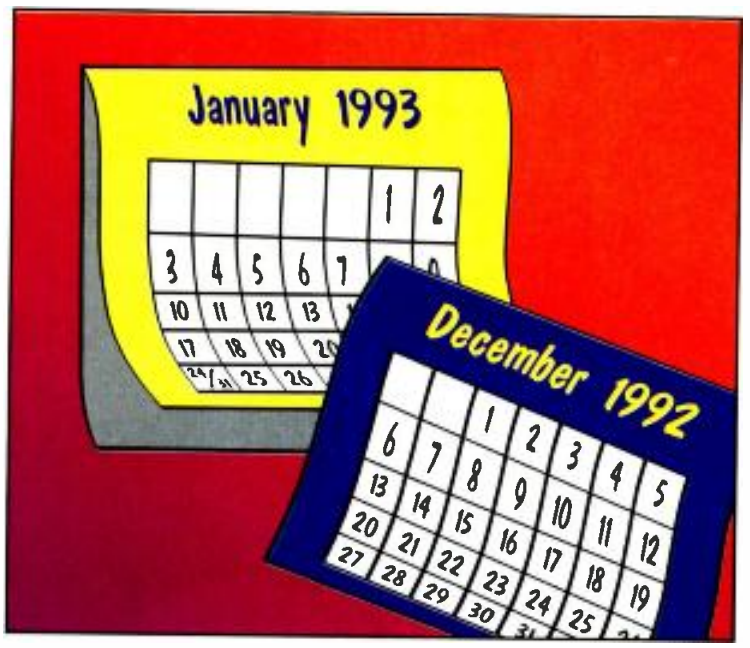
Editorial

A light at the end of the tunnel

As 1992 passes into history, I breathe a sigh of relief. There were times when I thought the electoral process of the past year would never end. I've had enough political commercials to hold me for the next four years. The whole process leads me to a variation on a famous line: *There are lies, damned lies and the politician's version of the truth.*

While the political wanabees were crying doom and gloom the sky is falling, the political haves were saying it wasn't so bad and that things were getting better. Meanwhile, the press was pelting us with news about how bad everything was, and many in the broadcast industry were echoing end-of-the-business scenarios. We heard that times were tougher than ever before. Stations couldn't afford to buy any equipment. Layoffs would continue.



No one is doubting that recent years have been tough for many broadcasters. Times definitely aren't as good as many would like, but then the glass is always half full. However, this year, while many were crying about how bad things were, signs abounded that our industry is not in the throes of a depression. In fact, things are much better than the media would have us believe.

This issue of *Broadcast Engineering* contains a brief overview of a survey conducted with *BE* readers. Rather than confirming all the bad news, the readers, although concerned about many aspects of the business, say that their stations are planning to increase equipment purchases in 1993. And even better news, in most cases, the planned increases in spending are in the double-digit range.

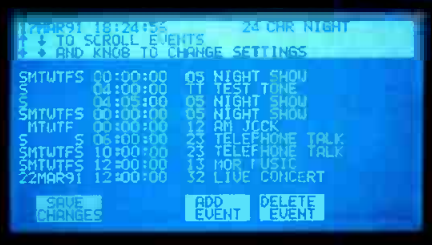
Planned equipment spending for the top 100-market TV stations is up 14% for next year. The top 100-market radio stations plan even more aggressive purchases, a whopping 40% over 1992 expenditures. A summary of the survey results begins on page 26.

As we enter 1993 and our newly elected officials take office, remember what Winston Churchill said about politics, "Political ability is the ability to foretell what is going to happen tomorrow, next week, next month, next year...and the ability afterward to explain why it didn't happen." I don't expect to see any difference in the politicians' approach this time.

Brad Dick

Brad Dick,
editor

PURE DIGITAL.



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FCC Update

Satellite DAB proposed

By Harry C. Martin

The FCC has proposed the allocation of 2,310-2,360MHz to establish a satellite-delivered digital audio broadcasting (DAB) service. Existing users of that spectrum will be permitted to continue operation until Jan. 1, 1997 or until satellite DAB begins operation. The commission's proposal would be a major step in accomplishing its goal to improve the sound quality of audio services.

In a related issue, the commission initiated a further inquiry to solicit comments on the technical developments and general policy issues relating to satellite and terrestrial DAB. The agency wants to refresh its record on DAB developments since its 1990 inquiry proceeding.

Misconduct reporting rules relaxed

The commission has relaxed its requirements on reporting non-FCC misconduct that might bear on the character qualifications of broadcast licensees, permittees or applicants. Relevant non-FCC misconduct includes all felonies, fraudulent representations to government units, mass media-related violations of antitrust or other laws dealing with unfair competition, and a pattern of adjudicated non-FCC-related employment discrimination.

- *Annual reporting.* The modified rules require that final adverse adjudications of relevant non-FCC misconduct be reported annually. Thus, to exercise the necessary "due diligence," licensees, permittees and applicants should conduct annual surveys of all persons with attributable ownership interests. Additionally, those persons surveyed should be instructed to promptly advise the licensee/permittee/applicant of any new reportable adjudications. Any new persons gaining attributable interests between annual surveys should be surveyed at the time they obtain their interests. The commission said it also will apply the same due diligence standard in connection with reporting the denial of federal benefits pursuant to the Anti-Drug Abuse Act of 1988.
- *Pending litigation.* The commission will no longer require applicants to report pending litigation. However, it will retain the discretion to request such information and to take appropriate action on a case-by-case basis.
- *Misconduct by related entities.* Under the modified rules, the commission will require the reporting of relevant non-FCC misconduct that involves non-licensee entities that share an officer, director or cognizable shareholder or partner with a broadcast entity only where the licensee principal 1) was in control of the other non-licensee entity; or 2) was adjudicated to be directly involved in the other non-licensee entity's misconduct. Whether such reported misconduct will then affect the licensee's character qualifications will be determined on a case-by-case basis. It will take into account the actual involvement in the misconduct of the broadcaster's principal, as well as the person's involvement in the activities of the broadcast entity.

With respect to parent companies or related subsidiaries, relevant non-FCC misconduct must be reported when 1) there is a close ongoing relationship between the parent (or non-broadcast subsidiary) and the broadcast subsidiary; 2) the two have common principals; and 3) the common principals are actively involved in the operation of the broadcast subsidiary. Such non-FCC misconduct would then be considered relevant to the licensee's qualifications only where there is a sufficient association between the broadcast subsidiary and the parent company or related subsidiary.

FCC clarifies main studio rule

The rules currently require licensees to maintain a "meaningful management and staff presence" at their main studios.

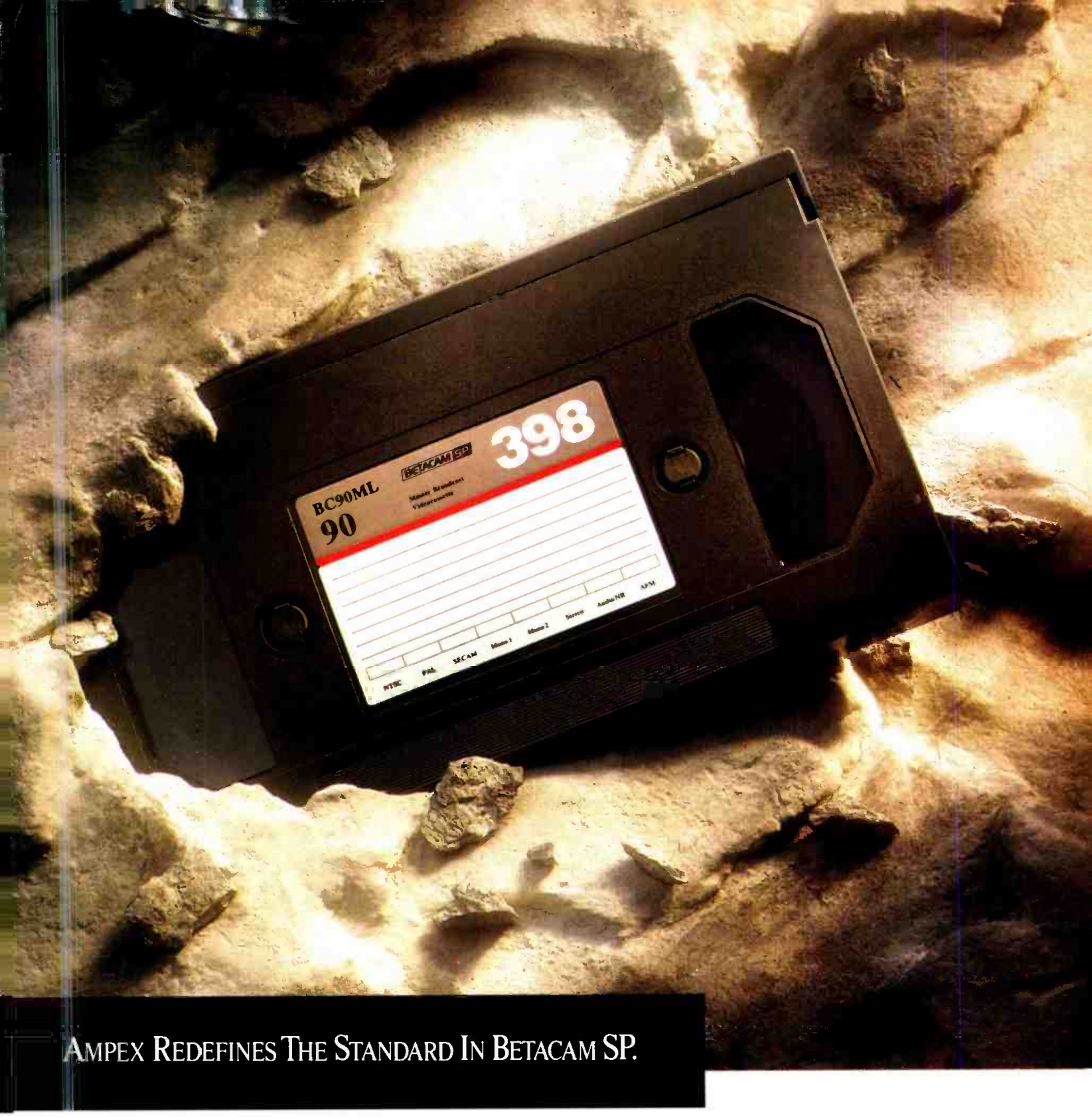
In October, the commission clarified its interpretation of "meaningful management and staff presence" by stating that this requirement may be satisfied through 1) a full-time office worker; and 2) a full-time chief engineer who would also serve as the station's news director during morning and afternoon drive time hours (5:30 a.m. - 9:30 a.m. and 3:30 p.m.- 6:30 p.m., Monday through Friday), when the station's news operations originate from its main studio. The fact that the chief engineer would double as the station's news director during certain dayparts was consistent with the commission's overall view that a chief engineer holding managerial duties constitutes a managerial position. The commission noted, however, that if the chief engineer did not perform additional news director duties, it would require the licensee to show that its chief engineer was authorized to make typical managerial decisions relating to facilities, equipment, programming, sales and emergency procedures.

The commission has determined the following list of positions to constitute a meaningful managerial presence at the main studio: president or other corporate officer, general manager, station manager, program director, sales manager, chief engineer with managerial duties, news director, personnel manager, facilities manager, operations manager, production manager, promotion director, research director, controller and chief accountant.

Because some of the listed managerial positions may require the persons occupying them to conduct significant business outside the office, the FCC will not require management personnel to remain tied to their desks at the main studio during normal business hours. Rather, the commission will require management personnel to report to work at the main studio on a daily basis, spend a substantial amount of time there, use the studio as a home base, and remain responsible for whatever station operations occur from that studio.

With respect to staff personnel, the commission stated that to the extent the staff person may fully perform his/her station functions with additional time to spare, and coverage of the main studio permits, the staff person may also engage in activities unrelated to the station operations (e.g., serving as a receptionist for another local business), as long as the main studio remains attended during normal business hours. ■

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



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Part 2

Strictly TV

Digital distribution and routing

Digital video

By Graham Roe and Robin Caine

Early parallel digital video routers highlighted problems of parallel digital signal management. They also introduced concepts of clock regeneration and skew errors. Second-generation routers have not exceeded the 32×32 barrier with dignity. Most suffer from large connectors and multiple signal planes. Today, a practical serial standard using LSI circuitry permits a single plane router based on analog topology.

Interfacing caveats

Cable and jackfields for a serial digital environment require a different approach than analog systems. BNC terminations show 60dB return losses at 10MHz, but exhibit only 14dB at 270MHz. Low-loss video cable is barely adequate, with 15dB-18dB attenuation per 100m at 270MHz. As a result, most equipment requires input equalization, even for short cable runs. Pre-equalization is not practical.

Poor wideband return loss may not be critical, because transmission losses will reduce third time echoes well below primary signal levels. Thus, the most important criterion is the ability to recover data under all conditions.

There are two approaches to equalization. One treats circuits as broadband analog and with established methods to correct amplitude and phase response. An alternative is *adaptive equalization* based on variable gain stages. An adaptive approach is useful when equipment must be connected to various input circuits. However, it disguises the equipment's vices, which may produce an unexpected, unwelcome response.

Excessive jitter puts data recovery at risk. Therefore, an essential building block for serial digital video is a reclocking circuit to return data to a pristine condition. For this, a high stability oscillator locked to the incoming stream can eliminate irregularities and return data to standard specifications. The data structure of D-1 and D-2 proposals requires reclocking circuitry to cope with long strings of data of the same polarity, clearly conflicting with demands for rapid locking. If video remains in serial form without decoding, ASIC devices readily carry out reclocking.

Nothing standards-specific is required. Systems capable of common NRZI data formats should handle future digital standards, as well as solve problems if proprietary chips become unavailable.

A signal with a bandwidth of 100MHz needs different engineering techniques. Liberties taken with impedance and terminations for baseband video do not satisfy wideband digital signals. Reflections on traces only a few centimeters long will matter. Busing becomes high risk, although computer-aided simulation can predict the performance of proposed arrangements of components and circuit board traces.

Using basic building blocks of a serial digital environment, the distribution function becomes straightforward.

Many system problems await discovery. Various interpretations of the standards will lead to different designs. The first generation of distribution routers must be designed cautiously. A second generation will more fully exploit the standards.

Serial digital video DAs

Using basic building blocks of a serial digital environment, the distribution function becomes straightforward. Power consumption and physical size of DAs demand less than an analog unit. The card outline and frame architecture permits direct placement of analog units. Balanced, transformer-coupled inputs precede equalization and data reclocking. Signals remain balanced throughout the router to minimize crosstalk and interference. Six outputs are transistor-aided to drive long lines. Loop-through inputs can be too risky at digital bandwidths.

It would be helpful if routers for serial digital video had analog characteristics. Systems from 8×8 to 256×256 are needed. IC crosspoints to switch data to 300Mbit/s are available, but they usually contain large arrays.

Avoid signal distribution on unmatched lines when designing routing architecture. Input buffers must drive crosspoints feeding various outputs. With ideal drive impedance and predictable load conditions, distribution of buffered inputs to small groups (four) of adjacent crosspoint units is realized without the risk of most broadband transmission problems.

The connection between crosspoint units and output buffers is more difficult. Crosspoints are usually closely grouped to facilitate input distribution. However, their outputs may be distributed throughout the frame/system.

Unmatched motherboard or wiring methods fail because physical lengths can produce reflections. One solution is an output busing scheme with matched transmission lines. This technique allows large switchers in multiple racks without internal impedance problems. Output data regeneration guarantees the integrity of data leaving the switcher and confirms that valid data is present.

Control of these switchers is identical to or comparable with other systems. A serial digital level can be added to or replace parts of existing router systems.

Positive conclusions

Degradation of signals in an analog domain is progressive. Once cable loss, crosstalk and noise have taken their toll, total restoration of the original signal is impractical. With digits, provided the distortion remains below a critical threshold, the signal can be restored. Another digital advantage is the ability to multiplex audio and data with video signals. The optimum approach in a given environment depends upon the overall system concepts and plans for expansion of the digital core. ■

Roe is technical director and Caine is head of digital audio for Pro-Bel Ltd., Reading, England.

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Part 1

re: Radio

Progress toward in-band digital radio

IBOC AM and FM tests

By Skip Pizzi, technical editor

Since this column's last look at digital radio broadcasting's progress last June, some significant developments have occurred.

The most noteworthy are the in-band, on-channel (IBOC) system demonstrations presented by USA Digital at the NAB Radio '92 show in New Orleans last September. The proponent used on-air broadcasts to show attendees the current state of development for its Acorn FM and AM IBOC systems.

Acorn FM system details

The Acorn FM IBOC system test in New Orleans used the broadcast channel and audio program of WWNO-FM (89.9MHz). At the fixed digital receiver in the convention center (approximately eight air miles from the transmitter site), listeners could compare the FM signal to the digital, and view the combined signals on a spectrum analyzer. The digital signal sounded slightly better. More important, the digital and analog signals exhibited complete mutual non-interference.

A trip to WWNO's transmitter site revealed that despite earlier expectations for the IBOC system, the digital signal was *not* injected at the exciter, but was combined with the analog FM signal downstream of the transmitter. This means that the digital signal requires a transmitter of its own, albeit a small one. On the other hand, it also means that modification to an existing FM transmitter or exciter will not be required, and that more conventional RF combining hardware can be used to mix the signals downstream of the transmitters. Although less efficient from a power standpoint and more costly in conversion, this could simplify installation and add reliability and long-term flexibility. (The WWNO-FM test system literally was installed overnight.)

The need for a separate transmitter involves the Class C RF amplifiers used in FM transmitters, which do not have sufficient linearity to adequately handle critical, wide-bandwidth digital signals. (This is similar to the issues faced in digital TV transmission — see "HDTV: Transmitter Requirements," August 1992.) A low-power Channel 6 TV transmitter was used for the WWNO installation. It provided more than adequate bandwidth and good linearity (running Class AB).

The actual RF combiner used in this system is a special case. Unlike typical combiners, the two combined signals here are at the same frequency, and they are at widely different power levels (approximately 1,000:1). In the New Orleans demonstration, the FM signal was 18kW TPO, while the digital transmitter output was approximately 350W. The combiner presented less than a 1dB loss to the FM signal, but a hefty 13dB loss to the digital signal. Thus, the digital signal's actual TPO out of the combiner was only about 18W. (ERPs were 50kW for FM and approximately 50W for digital.) An improved combiner design with reduced losses is possible.

The audio quality of the digital AM broadcast was much improved over the standard AM signal.

"Hula" modulation

Another wrinkle in the Acorn FM system is the addition of more spectral redundancy. Instead of its previously announced 21-orthogonal carrier system, the format now employs 42 carriers, duplicating the same 21 carriers above *and* below the channel's center frequency in order to increase frequency diversity. Occupied bandwidth approaches 350kHz, which remains within the FM mask because of the digital carriers' power level of −35dB or lower relative to the FM carrier.

Furthermore, to combat the worst-case multipath condition known as *stoplight fade*, the 42 carriers are no longer at fixed positions within the channel. Rather, their center frequencies are continuously shifting. The reference signal governing this carrier shift is simply the analog FM deviation. (The wiggling look of these shifting carriers on the spectrum analyzer gives rise to the name "hula" modulation.)

According to the designers, a few elements have yet to be added to the system that will further increase its robustness and resistance to multipath. Once complete, the system's multipath mitigation may rival that of much wider bandwidth formats, such as Eureka 147.

Acorn AM

The development of an IBOC AM system is about a year behind the FM system, according to USA Digital engineers. Therefore, the developer is less forthcoming with system details at present. Nevertheless, the on-air demonstration of its work in progress at Radio '92 was a significant milestone. Unlike the FM broadcast, the AM test was *not* on-channel with an existing AM station, but was contained on a standard AM channel (currently unoccupied) in the expanded band. It duplicated the signal of New Orleans AM station WNOE (1,060kHz) in digital form on 1,660kHz. WNOE's audio program was fed via a digital land line from the station's studios to the low-power, digital AM transmitter located on the roof of the convention center. Standard AM and digital receivers were available to compare the two signals.

Also unlike the FM system, the audio quality of the digital AM broadcast was much improved over the standard AM signal. The digital AM system's 15kHz stereo, 96dB S/N performance had the greatest industry resonance at these demonstrations, especially with regard to the potential market value of AM stations.

The system's designers still have much to accomplish. Although the bandwidth obstacle has been overcome (the system operates in 37.5kHz, which is within the NRSC-2 AM mask at the low power level used), an on-channel arrangement showing signal extraction and freedom from interference has yet to be demonstrated. However, an encouraging sign was shown in the New Orleans test — the digital signal on 1,660kHz sounded like simple white noise when tuned in by a standard (expanded band) AM radio, indistinguishable from any other vacant channel on that end of the dial.

The industry — and for that matter, the world — is closely watching the continuing development of these new formats. More on digital radio next month. ■

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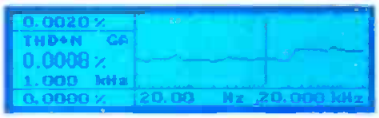

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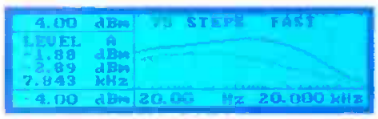

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Part 4

Management for Engineers

Dealing with the difficult employee

The passive-aggressive employee

By Judith E. A. Perkinson

Passive-aggressive people are one of the most difficult types of problem employees. You may know someone who fits into this category. However, passive-aggressive people are not easy to describe. They are the employees who never finish the job but won't take responsibility for their poor performance. Dealing with them can be an elusive and time-consuming process.

Passive-aggressive employees use pat answers when the work you asked them to do wasn't finished, wasn't on time or wasn't done correctly. Although many of us occasionally use the following phrases, they are standard responses for the passive-aggressive employee:

- I was going to do it next/later/ tomorrow.
- I forgot.
- I didn't understand what you wanted.
- You didn't tell me that.
- I thought you wanted me to wait until...
- You want that now?
- I'm sorry.
- I'll try harder.

Sad, but true

The problem is passive-aggressives employees are not sorry, they will not try harder and they probably will not change. Why should they? Their behavior is effective at getting them out of work, responsibility, new assignments and trouble.

As a supervisor, you may have the least success in changing this type of employee. Passive-aggressive employees provide their own self defense. After all, how can you blame or discipline someone who didn't understand, was just about to do something, didn't hear you, or is repentant and vows to try harder? In addition to sounding sincere, passive-aggressive employees often are nice, polite people. They don't cause trouble; they simply don't pull their weight or take responsibility for their actions. These factors make them difficult and frustrating to supervise.

Dealing with passive-aggressive employees

A passive-aggressive employee can be dealt with in several ways:

- *Understand the task you are undertaking.* First, decide if you want to tackle the passive-aggressive employee's unsatisfactory work performance. They are frustrating to work with, but even harder to dismiss. Passive-aggressive employees are successful because they wear people down. Do not attempt to discipline them and quit before you finish. You will only make the situation worse, because you have allowed the employee to succeed once again.
- *Develop a strategy.* Begin with a review of the 5-step employee improvement process. (See "Management for Engineers," Oct. 1992.) Once you understand the process, begin your work.

> ***When the situation becomes difficult, this type of employee may accuse you of miscommunication, unfair treatment or discrimination.***

- *Define your goals.* Select three or four areas for improvement. Be sure to include timeliness and accuracy. Next, make a list of the possibilities, then choose those that have the greatest impact on other business operations or co-workers. By doing this you will justify why you want a change in the employee's work habits.
- *Plan the conversation.* Passive-aggressive employees have a knack for sidetracking the conversation. Diverting attention is a survival skill. Be ready. Practice keeping the conversation focused.
- *Begin the process.* Call the employee into your office for a private conference. Don't discipline employees in public. Explain that you have identified areas in the employee's job performance that need improvement. Define them, and be specific about how you will monitor progress and when you will meet again. Emphasize that you want the employee to improve.
- *Be specific.* "I want all of your reports on time" is too general. Instead, tell the employee, "Have your monthly inventory report in by the second Tuesday of each month."
- *Don't blame.* Focus on behavior and the effect of that behavior — not right or wrong. For example, say, "I don't want to blame you, I want to discuss the effects of your behavior." By not attacking the employee, you will have more success.
- *Avoid being put on the defensive.* The employee's initial reaction to being criticized may be to accuse you of trying to be hurtful. Regardless of how you feel about the employee, continue to stress that these problem areas must be improved and that it is not personal. This is a good time to explain the effect the employee's behavior is having on the department and/or co-workers.
- *Document everything.* Put your expectations into writing. Also, keep notes on your conversations with the employee. Be sure to follow your company's personnel disciplinary policy. This documentation is your protection. When the situation becomes difficult, the employee may accuse you of miscommunication, unfair treatment or discrimination. If you properly document the process, then the employee will not have a case against you.
- *Follow the 5-step employee improvement process.* By using the 5-step employee improvement process with a passive-aggressive employee, you are protected from being accused of mistreatment or discrimination. Repeat the process until an adjustment is seen in the employee's behavior, or the person is terminated.

No easy task

This task is neither easy nor a guaranteed overnight success. However, if you are persistent, your problem will be solved. Genuinely confused employees will change their behavior when their expectations are clearly defined. Passive-aggressive employees often will find another job when they realize their tactics aren't working.

Next month, we'll examine employees with substance abuse problems. ■

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

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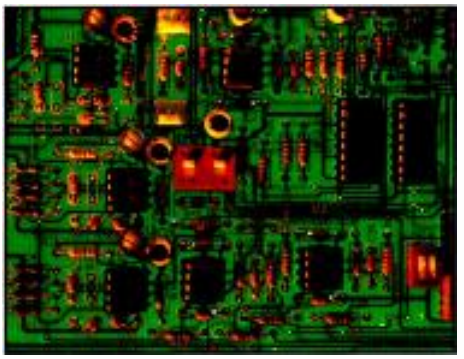
Circuits

Numbers and counting



By Carl Bentz, special projects editor

Most of us grew up learning to count by tens. Was it a matter of convenience because the majority of people have 10 fingers and 10 toes? Evidence exists that units of five were once an important means of counting. (Modern man has always had five digits on each hand and each foot.) With the recent trend of expanding digital technology, a new way of looking at numbers is helpful in understanding how things work.

Our numbering system contains 10 unique counting elements: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. These can be used to form any number by the manner in which they are positioned. As long as a single element is used, we are working with *units*, as we were taught in elementary school. But what happens when there are no more units — that is, our number 10? Some confusion exists here because our decimal number system is based on 10s.

Our numbering system contains 10 unique counting elements: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

For the moment, let's call 10 a *decade*, consisting of 10 units. Fifteen is one decade and five units; 20 is two decades; 73 is seven decades and three units. Going farther, a *decade of decades* (100) is one century. And so it goes, with each position having a specified value.

Zeros and ones

To better understand digital concepts, it is helpful to count in several different number systems. (See Table 1.) Each system is based on the same concept as the units, decades and centuries. The primary systems in use are *binary* (2), *octal* (8) and *hexadecimal* (16).

For binary, there are only two counting elements — 0 and 1. For convenience, the value of positions as ones, twos, fours, eights, sixteens and so on are determined by the positions of the two elements. That is, 10 is one "2" and no "1." Seven is one "4," one "2" and one "1" or 111. Forty is one "32" and one "8" or 101,000. Needless to say, the number of positions quickly gets out of hand.

Let's try numbers based on eight, that is, units, eights, sixty-fours, etc. There are the octal elements 0, 1, 2, 3, 4, 5, 6, 7. When each of these elements has been used once, we arrive at one "8" or 10. Eight "8s" is 64 or 100. Nine "8s" (72) is 110. This cuts down on the position values, but it still presents problems.

To go another step, to a system based on 16, there are the hexadecimal counting elements of 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F. In other words, what is usually called 10 becomes the element A. Ten in *hex* is really one "16" and no "1." How about AE? Ten "16s" and 15 "1s" (165) and 16 "16s" is one 256 or 100. This is the basis of almost all computers in operation today.

Bits and bytes

In digital work, the smallest piece of information is the *bit*. That single bit can indicate the status of a switch — *on* or *off*. This is workable, but if a large number of single bits must be used, the work isn't done as fast. For that reason, bits are combined into *nibbles*, *bytes* and *words*. In other words, instead of single bits, we consider several bits simultaneously. Rather than working with a bitstream as a series of single events, we work with eight streams in parallel, where a small portion ($^1/_8$th) of each event arrives simultaneously on each of the eight streams.

If 0s and 1s only are used, there are 16 ways that four positions (a nibble) can be filled using the two elements. By using two sets of four bits (a byte), 256 different combinations (zero through 255 or 00 to EE) are derived.

NUMBER SYSTEMS

Decimal	Binary	Octal	Hexadecimal
0	0000	00	0
1	0001	01	1
2	0010	02	2
3	0011	03	3
4	0100	04	4
5	0101	05	5
6	0110	06	6
7	0111	07	7
8	1000	10	8
9	1001	11	9
10	1010	12	A
11	1011	13	B
12	1100	14	C
13	1101	15	D
14	1110	16	E
15	1111	17	F
16	10000	20	10

Table 1. Different numbering systems.

In digital work, the smallest piece of information is the bit.

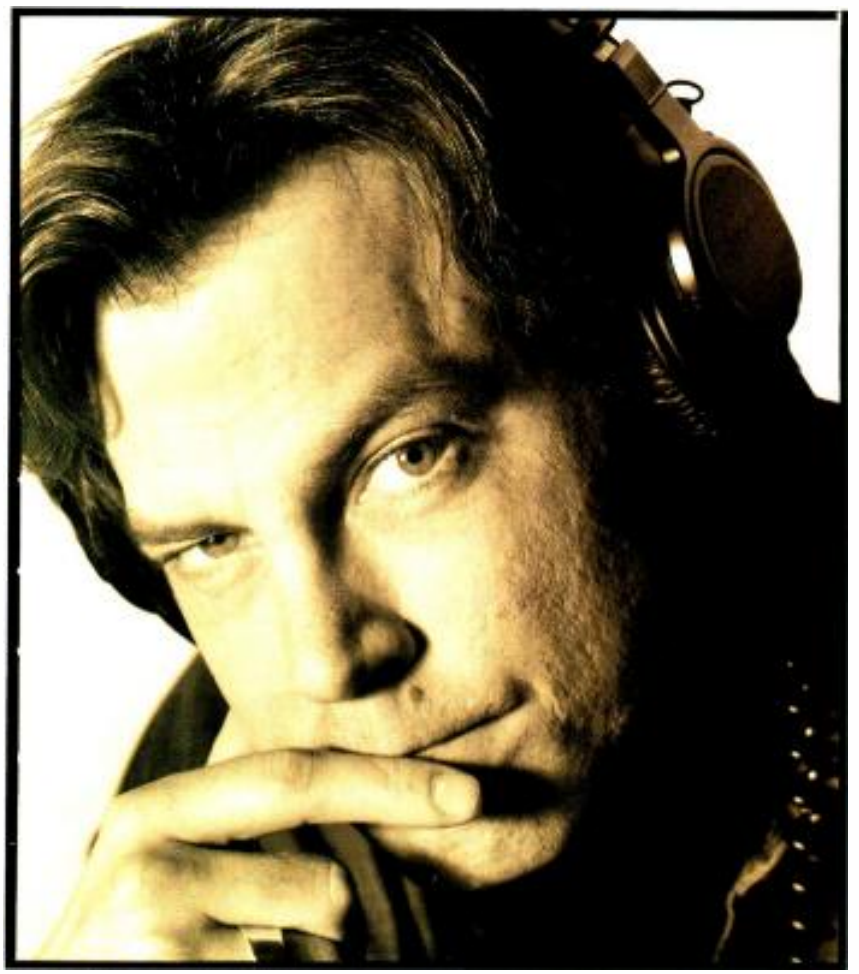
If you're familiar with PCs, you probably know that the 8086, 6502 and 6800 series microprocessor chips operate on 8-bit architecture. More recently, the 80286, 80386 and 68000 series devices work with 16-bit information. Only in certain cases have those been put through their paces, because a majority of programs used with PCs today are still written for the 8-bit concept. Now the 80486 offers 32-bit architecture and a 64-bit device has been promised within the next year.

Processing potential

What does this mean in terms of operating potential? For each additional bit, the total possibilities are doubled. For N bits, there are n^2 conditions. In one clock cycle, the 80486 can deal with 32 times the information of a single switch, four times that of an 8086, assuming the same clock rates.

To our advantage, technology permits the 80486 to operate at speeds eight to 10 times faster than the 8086, for a conceivable speed increase of 4×10 (bit width × clock rate).

Starting in January, the "Circuits" column will explore the world of digital circuitry, from the basics of logic gates to the mysteries of a digital VTR or CD system and beyond. Combinations of these gates are what makes much of our world tick. Join us in this journey into today's future and tomorrow's reality. ■



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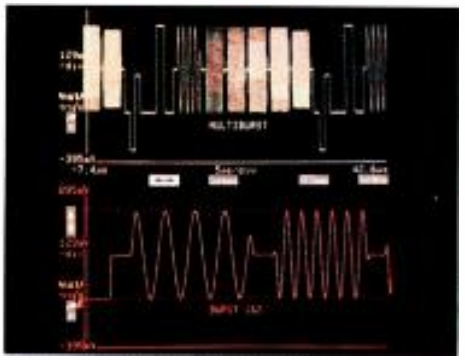
Part 4

Troubleshooting



Maintaining telephone systems

PBX-to-phone interfacing

By Steve Church

This month's column examines the telephone sets that are connected to PBXs. Unlike the old mechanical key systems, modern PBXs use sophisticated serial data schemes to allow the phones to communicate with the main PBX box. The technique is similar to the data communication that connects modems to PCs. Unfortunately, PBX manufacturers do not use a standard (a problem that may be resolved in the future with the introduction of ISDN).

Although the systems are tremendously varied, in all cases the cable from the phone closet to each phone must convey:

- power to operate the phone.
- a 2-way data path to signal user actions from the set to the switch, and operational and display status from the switch to the set.
- the speech audio.

How it's done

The following is a brief listing of the approaches used to accomplish this:

- *Each function placed on a separate pair.* The early electronic phones used a separate pair for each of the three functions, and thus required three (or more) pairs. The center pair on the modular plug (RJ-11) is typically used for audio.
- *Two pair, phantom power.* The most common approach used for electronic phones is the 2-pair, 4-wire scheme. In this scheme, the audio and data each use one of the two pairs. The power is "phantom," applied between the two pairs in a way similar to the method used for the phantom powering of condenser microphones in studios. A transformer at each end of the audio pair permits the phantom power to be added. The data pair will probably use resistors to obtain a "center tap," rather than transformers, because the data signal has a DC component that could not pass through a transformer. (See Figure 1.)
- *Two pair, power not phantom.* Some other 2-pair systems also put the data on one pair and the audio on the other, but place power directly on only one of the pairs. If power travels on the audio pair, that pair resembles a central office line, allowing phone ports to be universal — either single-line sets or feature phones can be plugged in without hardware changes in the PBX.
- *Data over voice.* One system uses a unique scheme that requires only one pair for all three functions. The data is amplitude-shift modulated onto a 32kHz carrier "over voice," and then the combined voice and data are AC coupled across the DC power voltage.
- *Pure digital.* The most advanced systems use a pure digital bitstream for voice and data. Each phone set contains codecs for conversion to and from the analog and digital domains.

Once you know a bit about how your phones work, you should be ready to tackle troubleshooting. Fixing a non-working phone starts with tracing the path from the PBX to the phone jack. The best troubleshooting tool may be a known good phone, which can be connected at various points along the path. Should the phone substitution method fail, further insight into the problem may be obtained by using test equipment, such as VOMs and oscilloscopes. With scopes, a balanced input is usually required to properly look at the phone line signals, because a connection to ground can often disrupt operation.

Usually, you'll find the problem to be wiring. But if the problem is either the phone set or the PBX module, a replacement may be available from one of the sources described in last month's column.

Audio performance

A common troubleshooting concern for PBXs at radio stations is the system's audio quality when calls go on the air. Unfortunately, troubleshooting here is primarily a matter of pre-purchase prevention. Designers of business phone systems generally pay little attention to audio quality. They don't expect calls to be heard on anything other than the phone's handset or a small speaker. The usual impediment is noise, most often the result of the data signals leaking into the audio. Sometimes, buzz from the power supply finds its way into the audio. Often, frequency response is limited by undersized line-coupling transformers or from other causes.

Few PBX manufacturers publish specs on audio performance. Ask your dealer to try getting you audio performance data. If nothing is available, measure and audition a system before you purchase it.

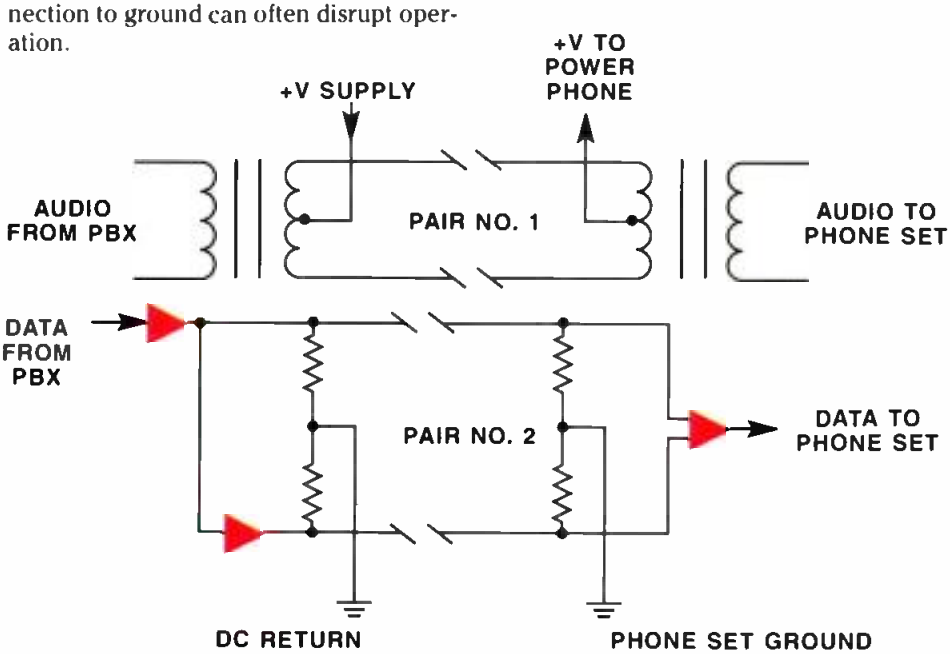


Figure 1. A common electronic phone wiring scheme using two pairs and phantom power. (Diagram shows data flow in only one direction for simplicity.) ■

Church is president of Telos Systems, Cleveland, OH.

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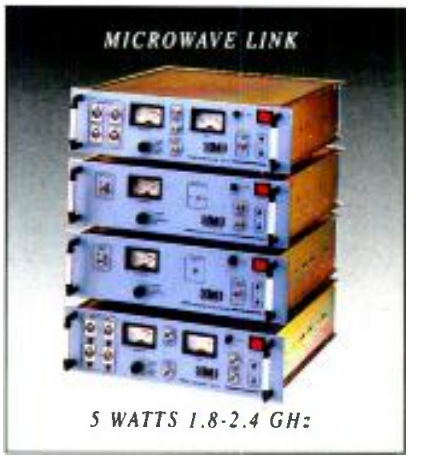

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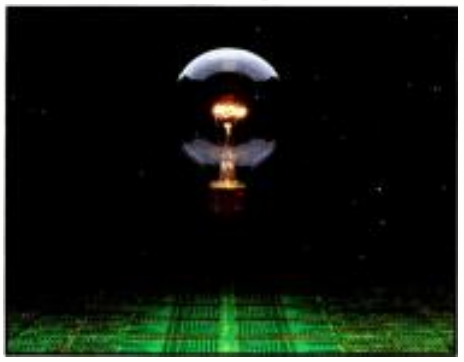
Part 2

Technology News



N-Way technology

More on the TeraSwitch

By Curtis Chan

Last month we began discussing some foibles of networking systems and hinted that a new development could handle signals from voice to HDTV simultaneously. With the best parts of ethernet and token ring, *N-way* technology would satisfy local to wide area networking.

Imagine a number of modules that can be linked and controlled easily by a reliable broadcast (all server/client messages will be sent and received accordingly) protocol. These modules can be integrated into existing telephone systems. The modules can be ganged and linked to reduce the 'hopping number' (the number of jumps needed to reach a predetermined destination). The cost savings to the broadcast and telecommunications industries can be substantial.

The solutions

Recently, International Network Communications, a start-up company in Irvine, CA, patented a Reliable Broadcast protocol and is developing support software for release during the first quarter of 1993. The potential benefits of the protocol and subsequent software, and the coming of the TeraSwitch concept, can have enormous implications for the broadcasting and telecommunications industries.

The software solution

For the problem of 10 friends example (which was discussed last month), the new solution uses a coordinating computer approach with a transparent software protocol. That is, a software shell resides below and envelops the current ethernet or token ring application and its respective programs. Little or no modifications to the existing software base are needed. From the "friends" scenario, friend 1 and friend 2 must obtain a global message sequence (GMS) number from the coordinating computer prior to sending their invitations. The targeted parties then determine which invitation they should accept, based on the GMS, and go to the party of choice.

In a server/client relationship, there are distinct advantages. The server provides the following functions:

- Manages group communications or conferences.
- Maintains and grants the GMS, conference record sequence and time information.
- Handles abnormal or error situations.
- Acknowledges, temporarily stores and retransmits stored broadcast messages to clients who missed the broadcast.

The client also provides certain guarantees to its users or programs:

- The proper sending of conference messages.
- Selective reception of conference messages.

The concept is simple, but it has a direct impact that can save networks and companies thousands of dollars in a small environment and millions of dollars on a network or national level. Low-cost PCs, MACs or workstations can serve in place of minisuper or mainframe computers to perform the housekeeping by just adding more as the need arises. The direct benefits are:

- reliable broadcast of all messages and information;
- automatic message serialization;
- network journal for recording and playback of broadcast messages;
- parallel operation; and
- WAN-simulated broadcast.

For example, imagine a chief editor reading through various important news releases from a dozen correspondents. He decides to go to lunch and turns off his computer, then later trips on the cord, disconnecting himself from the network. It takes another five hours to get him back on-line. Under the new system, all of the previous information up to the point of his coming back on-line will be updated automatically. Also, he has the ability to link as many of the correspondents on-line with him to create a "conference" where everyone can communicate in real time, an impossibility in today's environment.

Wiring the hardware

The TeraSwitch combines favorable aspects of ethernet and token ring, while eliminating their drawbacks. Its topology connects all user computers to a central switch, which contains many tiny computers or intelligent processors (IPs). Each IP serves one of the user units. Information from a user computer is sent to its tiny computer on a one-to-one basis.

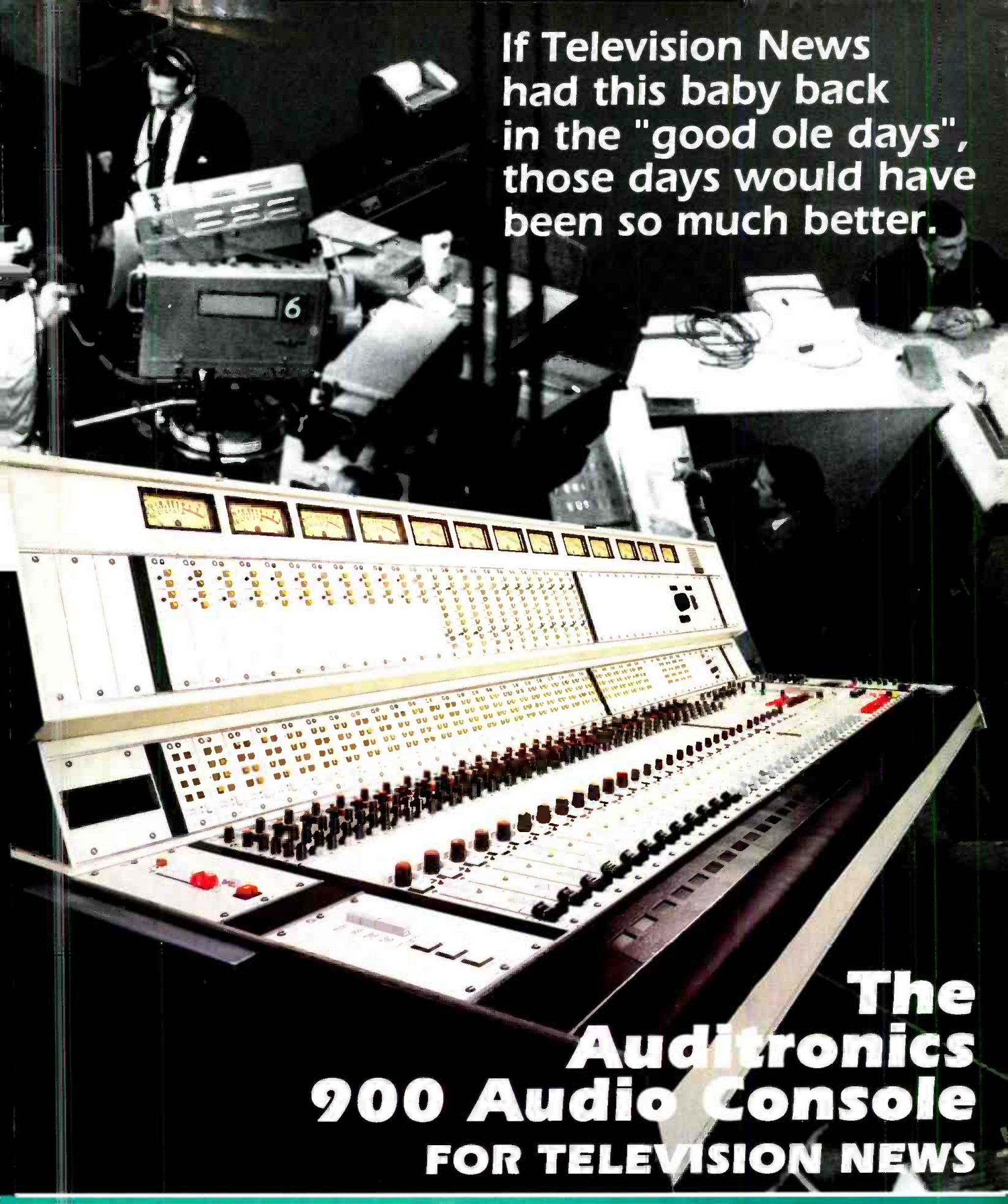
Substantial savings are possible if you could route and switch a multiplicity of signals within a single integrated environment at low cost and size.

Inside the switch the IPs are connected to each other in at least two ways. One way is in ring fashion, similar to a token ring, but *dataless*. The other is through a common cable similar to ethernet, but *collisionless*. This concept separates the mechanisms for circulating tokens and for sending and/or receiving data. The dataless token ring carries no user data or messages. Likewise, the collisionless ethernet experiences no data collisions. This arrangement simplifies logic and increases data throughput. Because data communications occurs mainly inside the switcher, there can be multiple tokens and multiple collisionless ethernets. Collisionless ethernet cables can be dedicated to video (HDTV), addressing, control and voice. The result is a direct replacement of existing ethernet and token ring networks, as well as the existing telephone systems.

The TeraSwitch has the potential to combine data networks used in computers, as well as voice and cable networks. The impact on telecommunications and TV industries would be staggering. If this hybridization of two networking technologies bears fruit, the solution promises to drastically cut the cost of implementing on-line transaction processing systems, distributed databases and fault-tolerant systems, expanding networking capabilities far beyond today's systems.

Chan is a principal of Chan & Associates, Fullerton, CA.

Editor's note: The author would like to thank Larry Tseung, president of Multipac Inc., Irvine, CA, for providing information for this column. ■



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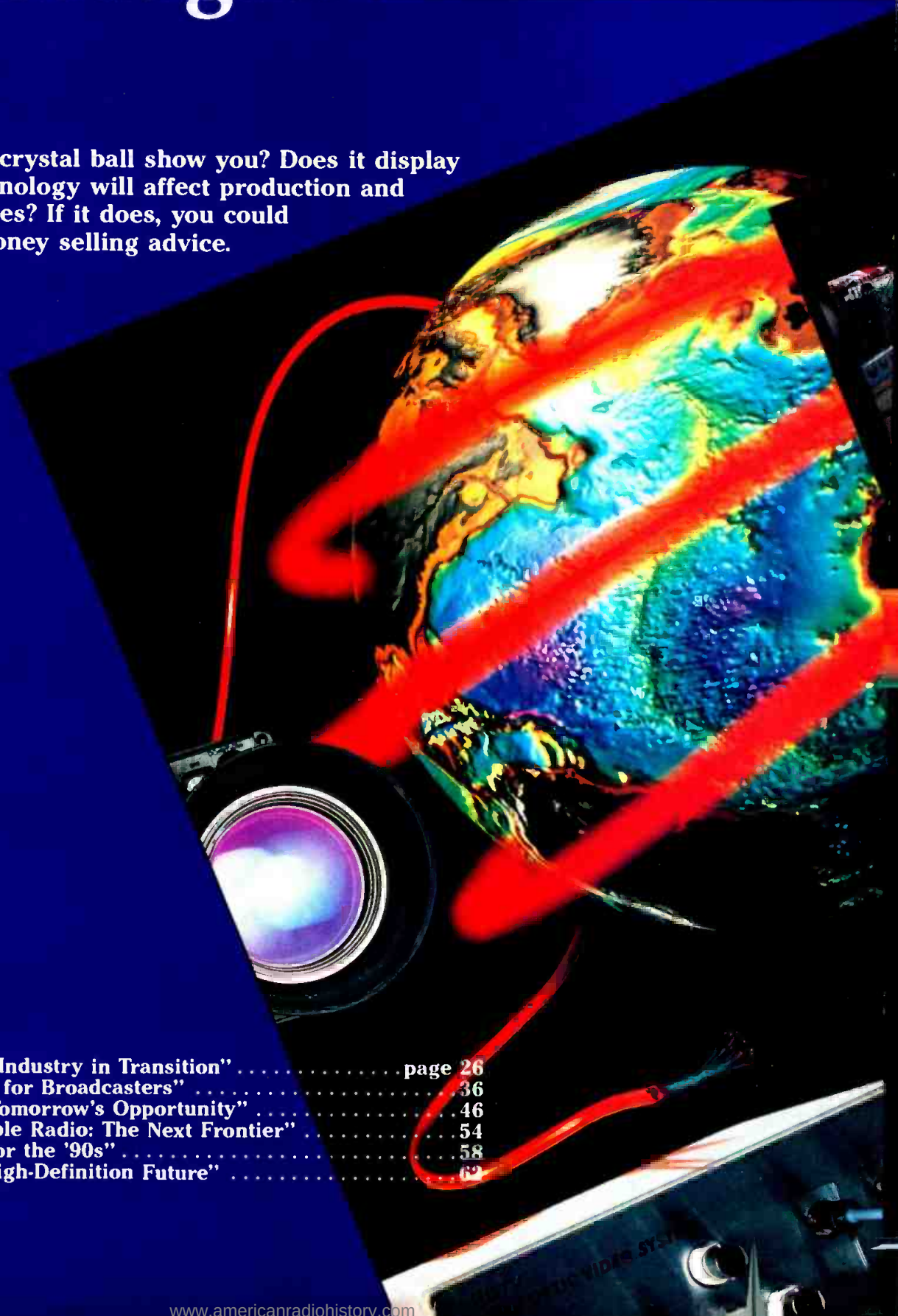
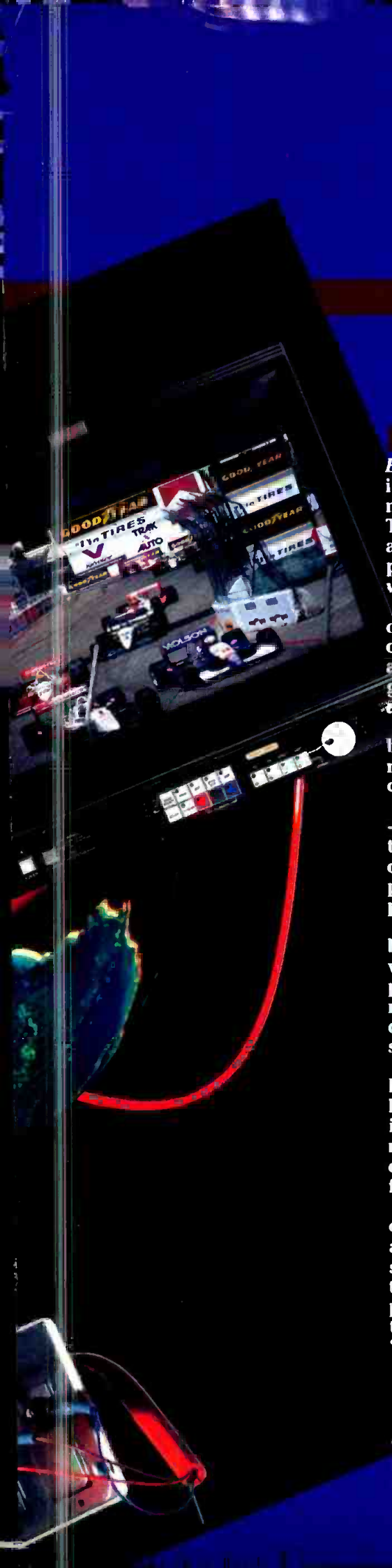
Exploring new technologies

What does your crystal ball show you? Does it display clearly how technology will affect production and broadcast facilities? If it does, you could make a lot of money selling advice.





Even if you don't have a crystal ball, this month's issue of *Broadcast Engineering* can help you better understand where technology is moving the industry. I say moving the industry because technology now moves us, we are no longer pushing forward the edge of development. That's not so bad because, in many cases, it allows the industry to take advantage of developments from other areas. The result is that new products are available to us faster and at lower costs than might otherwise be possible.

To help you plan for your facility's future success, six articles are offered. First, we'll take a peek inside the recently completed survey on broadcast equipment purchases. Stations are not hunkered down as many would have us believe. Rather, many stations are planning aggressive purchases for 1993, which may signal the long-awaited turnaround. See "Perspective: An Industry in Transition" for details.

"New Technology for Broadcasters" examines some of the late-breaking ideas that soon may be implemented in production equipment. From miniaturized cameras to solid-state storage systems, exciting new hardware is just around the corner.

TV stations and cable systems could have a new source of revenue — if they're smart enough to jump on the bandwagon early. "Interactive TV: Tomorrow's Opportunity" explains how interactive services operate and how the broadcaster or cablecaster can participate. It appears to be an inexpensive technology to implement, and holds the promise of profits with little risk.

For those who enjoy an even more futuristic and potentially profitable venture, there is satellite and cable radio. Don't say these systems won't happen. Where there's a dollar to be made, someone will try to profit. "Satellite and Cable Radio: The Next Frontier" explains two technologies that could affect all radio broadcasters. Don't be left in the dark, learn how these systems work and if they hold potential for your station.

Protecting your turf has been a common theme for the past five years. Layoffs and automation often went hand-in-hand. That isn't necessarily the case now, as articles in this magazine will show. Even so, changes in staffing will continue. As facilities seek further productivity improvements, how will your facility respond? "Staffing Issues for the '90s" offers some hints to help protect your staff while recognizing the need for efficiency.

We end this month's feature lineup with an introduction to next year's coverage of HDTV or ADTV, as some are now calling it. "Building for a High-Definition Future" outlines how *BE* will bring readers a 12-part series on high-definition technology. The coverage will provide important information on the technology of HDTV and how your facility can plan for it now. From transmission to production, the hardware needed to implement HDTV will be covered. Don't miss this coverage in the "Strictly TV" column each month.

Brad Dick

Brad Dick,
editor

WHAT THE CARIBOU OF NORTHERN ALASKA TAUGHT US ABOUT HI-8 VIDEOTAPE.

"Northern Alaska, is a harsh, unforgiving country," says Frank Bello. "Make a mistake and you pay for it. That's why it's critical I carry in only the most durable equipment. And why I choose to use Sony Professional Hi-8 Videotape."

Unless you enjoy sub-zero temperatures, ice, and blinding snowstorms, we suggest you take Frank's word on the reliability of Sony Hi-8. He's the President of the Association of Visual Communicators. To produce his latest video documentary, he had to go well above the Arctic Circle, following Caribou herds to areas that could only be reached by seaplane, raft or on foot.

If something went wrong, Frank was out of luck. The nearest repair shop was over four hundred miles away, across frozen Tundra. Thankfully, Sony Professional Hi-8 Videotape performed admirably and Frank got his footage on the first try. Time and time again. With a sharpness and clarity he found nothing short of astounding.

The new Hi-8 HMPX and HMEX videocassettes and exclusive Sony album case.

"It's smaller, lighter and much more rugged than 35mm," he notes.

Producers like Frank Bello inspire us to continually improve our Professional Series Hi-8 HMEX tape. They are a new generation of evaporated metal tapes that produce high density recordings of unrivaled quality and unprecedented signal-to-noise ratios.

And the improvements don't stop there. For editing and cart machines, we've also made a more resilient professional metal particle tape.

And our new HMPX Series sets industry standards for greater durability and lower dropout rate.

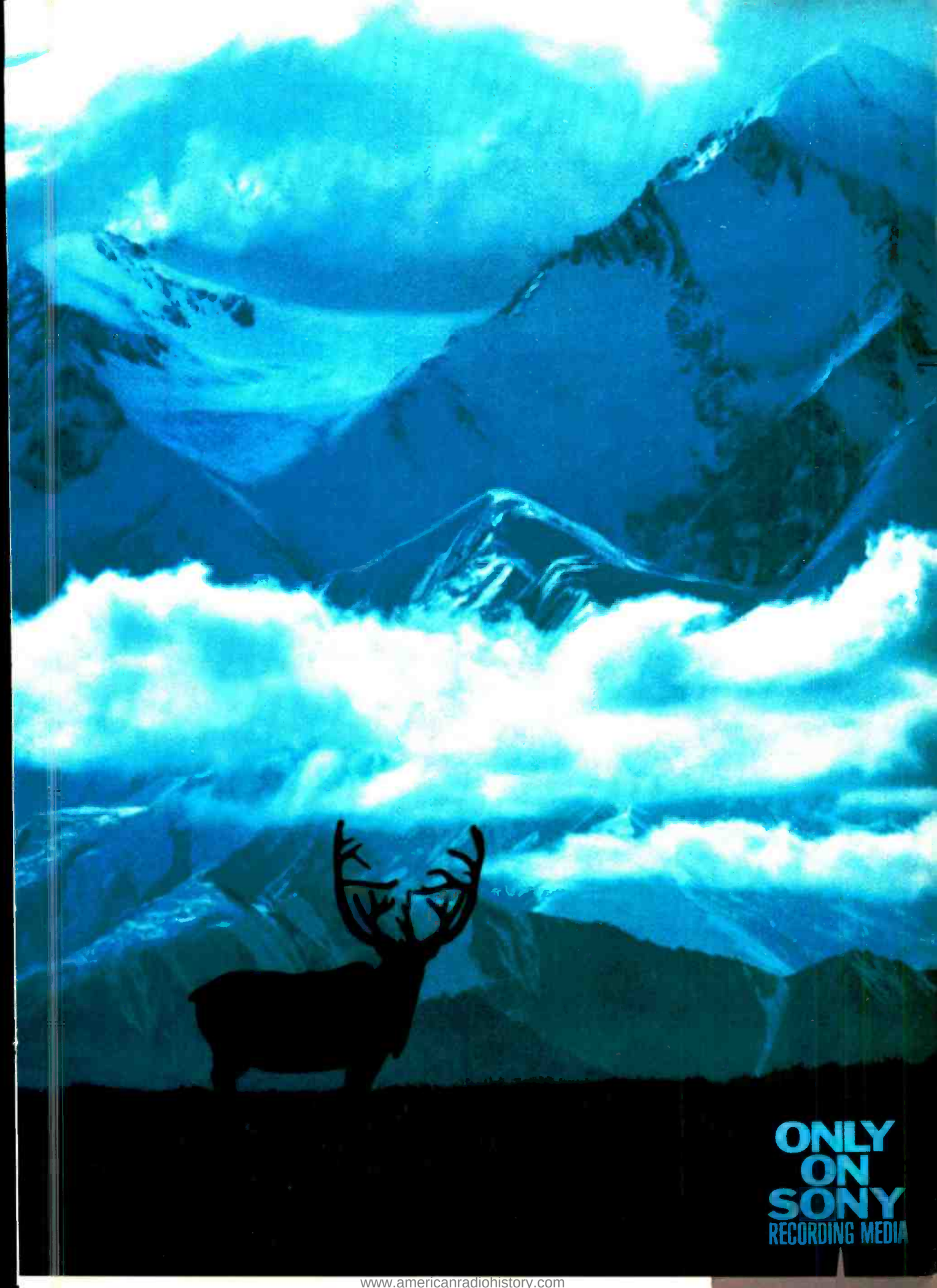
At Sony, we take the needs of people like Frank into account when we design the shells and packaging for our tapes too. Our shells are equipped with an anti-static lid, to further guard against dust and debris, and come with a unique professional album case.

Improvements that come in handy in Northern Alaska, where the climate can quickly change from rain to ice. And where below freezing temperatures, dew and moisture create real problems for once-in-a-lifetime footage.

As Frank Bello has discovered, it truly is an unforgiving country. But with a tape as rugged as Sony Hi-8, you'll never have to make any apologies.

SONY

SONY RECORDING MEDIA



will provide readers with a detailed look at the equipment broadcasters are planning to purchase.

Survey overview

Table 1 gives a summary of the planned spending trends. The results are shown for radio and television, broken down by market size, for the 1992 actual expenditures vs. 1993 planned equipment spending plans.

For TV stations, the 1993 equipment budgets are 14% higher than the amount spent in 1992. In the below top 100 markets, planned spending is slightly lower but still 13% higher than last year. Remember that the financial data is being reported as averages, which is different from the median values used for some of the other data in this report.

The predicted growth in equipment spending for next year is far ahead of anything we've seen recently.

Radio spending varies widely based on market size. The top 50 radio markets plan to spend 47% more in 1993 than they spent in 1992. That is perhaps the best news we've heard in a while. Stations in the 51-100 markets plan on spending a healthy 14% more in 1993 than they did last year.

The below top 100 market radio stations plan on spending 12% less than they did in 1992, confirming the delicate nature of stations in the smaller markets. This is not surprising, considering their fiscal constraints and limited budgets.

Nonetheless, the overall market trend is up. Measured across all radio and TV stations markets, planned equipment spending for 1993 is 14% higher than actual expenditures for 1992. This is exciting news for stations as well as equipment manufacturers.

Consultants and contract engineers

The technical community has expressed serious concern about the use of consultant and contract engineering personnel at radio and TV stations. Many have perceived that the use of consultants had increased. The survey highlights some trends in this area.

In 1991, 31% of TV stations reported using an engineering consulting service. This number was fairly uniform across all markets. Not surprising, the smaller the market, the higher the use of consulting engineering services. This year, that figure was down only slightly to 30%. A com-

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ShibaSoku's Auto Setup system provides acute accuracy and longer-term color temperature stability with impeccable chromaticity reproduction, to +0.002 points on the CIE x y scale — as accurate as the best color analyzer. Unlike other systems, the Optical Sensor and CPU circuitry reduce measurement errors from compensation adjustments and eliminate optical filters in the probe. Auto Setup operation is executed with an internal CAL signal generator. Five Color temperature memories store Contrast and Brightness data, the R,G,B, Gain and Bias levels. Manual Front panel controls have Preset/UNCAL switches for two separate settings without using Auto Setup. High Voltage Beam current detection circuitry ensures better Luminance stability plus higher luminance performance (to 881L).

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Many facilities are buying the latest in technology to leap-frog their competitors. Shown here are before and after photographs of a new post-production suite at Realtime Video.

parison by markets shows similar usage of this talent as in last year. Overall, less than one-third of TV stations reported using consulting engineers.

However, that was not the case for radio stations. A steady increase in the use of consulting and contract engineering personnel was seen. Measured over all radio respondents, 44% reported using consulting engineers in 1991. This year, that number increased to 46%. Looking at this data by market size shows a different picture.

Top 50 market stations increased their use of consulting engineers to 55%, up from 47%. The 51-100 market stations increased their use of consulting engineers from 33% to 45%. The small market stations, below top 100, increased their use of consulting engineers from 36% to 44%.

This year's survey also asked about the use of contract engineers. Interestingly, TV stations use them less than radio stations. Use of contract engineers in TV stations ranged from 18% in the below top 100 markets to 26% in the top 50 markets.

Twice as many contract engineers are used in radio stations located in the below top 100 markets as in the same-sized market TV stations. These smaller stations represent the largest users of contract engineering personnel. A full 37% of these stations report using contract engineering personnel. In the other two markets, approximately 29% of the stations use contract persnnnel.

When looking closer at how contract work plays a role in station operation, consider the following. Contract work accounts for approximately 13% of the work done in TV stations. When asked what percent of their station's technical maintenance is performed by contract engineering personnel, the smaller below 100 market stations reported 53%. This means that more than half of the technical work is being done by non-staff personnel. However, even the top 50 market stations use such workers. These stations say that 33% of their technical work is handled by contractors.

For TV stations, the 1993 budgets for equipment are 14% higher than the amount spent in 1992.

Looking at the entire radio station market, 51% of the technical work is handled by contract personnel. These figures point to a gold mine of opportunity for those *BE* readers who would like to own a business.

In addition, respondents were asked about staff sizes. For television, you can take the below top 100 station staff size of six and double it each time you increase in market size. Measured over all markets, an average of 15 people work on the TV engineering staff.

Radio stations continue to have small technical staffs. Measured over all markets, two people are employed on each station's staff. The top 50 market stations have an

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Base = all respondants.	Weighted Grand Total by Market Rank	Weighted TV Subtotal by Market Rank	TV Top 50	TV Top 51 to 100	TV Below Top 100	Weighted Radio Subtotal by Market Rank	Radio Top 50	Radio Top 51 to 100	Radio Below Top 100
1992 Actual	$57,607	$267,631	$397,735	$258,057	$120,450	$25,674	$46,540	$24,388	$19,404
1993 Forecast	$65,476	$304,431	$452,942	$293,208	$136,667	$29,144	$68,627	$27,895	$17,074
% Increase 1992 Actual vs. 1993 Forecast	14%	14%	14%	14%	13%	14%	47%	14%	<12%>

Table 1. Summary of budget trends.

average of three, and the 51-100 market stations have an average of two. The smallest stations report an average of one person on the engineering staff. Respondents also say that few changes in staff size have occurred in the past year.

Convention attendance

Although station technical staffs may want to attend trade shows, fewer may be able to do so in 1993. A large drop in the percentage of respondents that plan to attend industry trade shows has occurred.

In 1992, 61% of TV station respondents planned to attend conventions and shows. This year, that dropped to 53%. In 1992, 52% of the radio stations planned to attend industry trade shows. This year, that figure fell dramatically to 30%. That means that less than one-third of the radio stations plan to send their technical staffs to 1993 conventions.

Now, let's take a look at the shows that those still traveling will attend. The following figures are based on those respondents who said they were planning to attend conventions or trade shows in 1993. Those who answered no were not included. In 1992, 93% of those TV respondents planning to attend shows went to NAB. This year, that figure increased to 95%. Planned attendance at SMPTE dropped from 19% to 13%. Likewise, AES planned attendance dropped from 2% to 1% for TV stations.

The number of radio station respondents planning to attend shows fell across the board. Planned NAB attendance fell from 75% in 1992 to 72% for 1993. Attendance at AES fell from 8% to 6%. The NAB radio show attendance dropped from 15% in 1992 to 13% for 1993.

Despite these negative show attendance figures, the overall tone of the results is positive. With stations planning to increase equipment purchases, that means good news for everyone. The January issue of *BE* will continue its examination of the 1993 industry forecast. The article will detail the type of equipment planned for purchase in 1993. ■

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Now, every camera operator, from broadcast and teleproduction studios, electronic field production, ENG, and corporate and industrial television shooting environments, can access Panasonic EMMY-winning technology. From the highly advanced AQ-225 studio camera through the production-oriented AQ-20D EFP camera to the new value-packed WV-F500 dockable camera, Panasonic has firmly established its leadership in digital technology and camera design by being the first Company to apply the advantages of DSP to professional video cameras.

Panasonic's DSP technology overcomes analog's imprecision and need for constant adjustment. DSP maintains strict uniformity in RGB signals and ensures that phase and frequency characteristics remain stable regardless of normal temperature changes or aging. For assurance against signal degradation, some Panasonic DSP cameras feature digital outputs and fiber optic connection.

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erarchical approach to imaging standards. Simply, given a set of imaging hierarchical guidelines, it provides a migration path so that advances in technology do not necessarily mean the discarding of old products, as long as the products conform to the given set of guidelines.

At the intersection

For decades, the broadcast and video industries have endured the affair between the three sides of the triangle: acquisition, display and transmission. During the '80s, the bonds between the acquisition/production and the transmission/display components started to break. This was accomplished by the introduction of analog component video recording and processing, followed by digital component processing.

The production and post communities within the broadcast and video worlds soon realized the benefits of this divorce. Producers, directors, engineers and artists discovered that fewer artifacts were introduced when layering video in vision mixers and DVE systems. The completed analog component program could often be encoded into the transmission medium with far better results than could be achieved with composite video acquisition and production equipment.

Following the momentum built up from the previous example, the next possible scenario is to separate the transmission and display systems for NTSC and digital ATV. Why? One short-term solution is to develop an interim acquisition standard to fill the digital ATV channels that the FCC may soon authorize. This would involve extending the existing CCIR-601 standards to a 16:9 aspect ratio. Should the broadcasters choose to do so, the existing broadcast channels would be filled by encoding a 4:3 aspect ratio subset of the image for transmission. The new digital ATV channel would carry a simulcast of the entire 16:9 aspect ratio image, which would be scan converted up to the transmission specifications selected by the commission.

Imagine the possibilities. Acquisition systems could evolve at a variety of price/performance points that would support increasing spatial and temporal resolution as you moved up the scale. Existing and new digital transmission standards would be positioned at different levels of the ladder. For instance, with the onset of bandwidth-limited transmission channels and new pay-per-view options, scalable video/image technology could evolve to keep pace with it. Even display standards would evolve. Also, consider single standard solutions offering a low-cost option for receiving a single transmission standard, while scalable intelligent solutions would offer the end-user the ability to display a variety of formats and resolutions.

As the broadcast and video industries move forward toward a North American DATV standard, many benefits likely will be gained. DATV will bring us higher-quality pictures with greater flexibility than today's analog television. Furthermore, it will enable easier and cheaper transcoding among the different display formats. For the end-user, it will provide a greater degree of control or customization of programming.

Technology advances: bridging the gap

Another area that has and will impact our livelihood is the digital revolution. As broadcasters make the transition to a new era, careful planning, budgeting and resource management will ensure a safe and profitable journey.

In the days of the ENIAC computer, a person could stand in a room the size of an average closet full of glowing vacuum tubes that represented one bit of information. Back then, you might have been

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Welcome news for all of us concerned with both an environment and a rising cost of electricity. AYDIN's new high voltage power supply and custom installation service provides long awaited relief from skyrocketing electricity bills. You can upgrade UHF transmitters with a new high efficiency UHF Power Klystron with an output power ranging from 30 to 60 kW. The power supply is designed to fit in an existing AYDIN supplied tank reusing the same core steel and rectifiers or be packaged in a new tank smaller in size than the original.

Continued Back Page

Station Manager Reports: $11,000.00 a Month Saved After Installation of AYDIN Transmitter Upgrade

Sutro Tower of San Francisco is the Latest Example of The Trend to Utilize The High Efficiency Tube to Promote Energy Conservatiion Effort.

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

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

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

Worse, every layer you create overwrites the previous one. So if your clients change their minds about a particular move in layer 15, for example, and you've already laid down layer 18, you have to start over again... from layer 1.

Starting where the disk stops.

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

The result is the Ampex DCT 700d Tape Drive. It can hold 3 *hours* of program material. Which means in multilayering applications every layer you create can be saved intact. So if your clients want to make a change in layer 15, you can do it effortlessly—typically in less than a minute.

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

In fact, the DCT 700d has been optimized in every detail to meet the demands of post production. It is simply the best digital editing tape drive in the world.

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

The DCT 700d is built for demanding professionals. It is the most advanced tape transport mechanism ever designed. It is precision engineered to maintain ultratight tolerances through the rigors of post production, edit after edit, day after day, year after year.

Yet for all this rugged precision, the DCT 700d is also the *gentlest* drive in the world, floating the tape on frictionless air-lubricated guides and eliminating the pinch roller used on less sophisticated machines. This allows the high performance ballistics to accelerate the tape to 60X play speed in less than one second—without risk to your valuable masters!

If you're used to working in post production, you're used to working fast, and there's no tape drive faster—or more versatile—than the DCT 700d.

Not just a new product, a new perspective.

The DCT 700d, however, is only part of the story.

DCT from Ampex is actually a *system*. A system conceived and optimized for post production in the digital component environment. A system that removes the problems of multigenerational image degradation found in the analog world.

And while each device in the system offers unparalleled performance on its own, when taken together, they offer a post-production solution with a level of precision integration and efficiency never before achieved in this industry.

The Ampex DCT System is also the first complete digital component system available from one manufacturer. In addition to the DCT 700d drive, it includes new tape cartridges, a new production switcher, new computerized edit controllers, ADO® digital special effects, and interconnect equipment.

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

Finally, the switcher you want in a size you can use.

Most switchers used in post production today are actually relics from the days of live television, when you needed lots of inputs to handle all the sources.

Digital post-production environments, however, typically require only a few inputs. And you really don't need more than that.

So we looked at how a post-production switcher *should* work in a digital environment and developed the Ampex DCT 700s Production Switcher. It may well be the first sensible digital post-production switcher you've ever seen. Yet you can do as much with it as you can with even the biggest panels.

Why? Because the Ampex DCT 700s has been optimized for post production, and offers you unprecedented transparency with a full 4:2:2 digital component signal system. With two key layer processors, you get unmatched performance, flexibility, and versatility.

The DCT 700s gives you big-switcher performance in a small package. It gives you the freedom to be more creative... and the power to be more competitive.

Tape is tape unless it's this tape.

Some people don't think much about tape. They should.

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declared insane and escorted to the nearest mental institution had you discussed the possibility of a computer on a chip. Now, thanks to computer chips, we have digital storage technologies that are capable of storing a terabyte (10^{12} bytes) of information in the same amount of closet space. Indeed, analog technologies have given way to the ever-evolving digital frontier, and astute manufacturing companies have taken advantage of this trend. What's to come? Consider a technology capable of producing a *quaternary* (as opposed to binary) state. Rather than 0 and 1 states, coding will use four states — 0, 1, 2 and 3.

The transition to digital

For most facilities, changing from an analog or hybrid facility to an all-digital environment is a time-consuming and expensive proposition. A well-planned transition program will allow for the best use of current and future hardware. Areas of concern include performance level, flexibility, expansion, routing and distribution, interface and timing. Fortunately, technology is available to help make the leap without too much discomfort and drain on our pocketbooks.

The terms videographer, desktop publication and integrated production system are less than a decade old, but a variety of new markets have been spawned as a result of the digital revolution. What once was hallowed ground to the broadcaster and selected associates is now a global playground for many, with a winner-take-all attitude. The trick is to recognize the situation and start stacking the deck in your favor. A tactic unearthed is a tactic rendered harmless.

Babes in Toyland

First, face the fact that the digital revolution is upon us. Next, try to understand — whether you're a small station in the remotest part of the state or a major network — that a multiplicity of digital hardware is available to suit your application needs. These technologies offer higher performance and features not usually found in their analog counterparts, at a cost-effective price point. Take, for example, an entrepreneurial news videographer team using a camcorder that has digital electronics. In order to conform the edits and add some pizzazz to this production, it may be necessary to purchase a low-cost editing and DVE package for less than $5,000. Additionally, many music industry companies offer a wide variety of digitally based sound equipment to complement the visuals. These devices can be in the form of MIDI music instruments, samplers, effects devices, sequencers and multimedia systems. The added benefit is that music and sound effects libraries are now on disk, and CD-ROM makes importing sounds much easier. Again, costs are reasonable and competitive, so finding a deal shouldn't be a problem. The alternative — using analog equipment — would severely impact production time and expense.

Consider a technology capable of producing a quaternary (as opposed to binary) state.

Assume that the video team is getting serious. It decides to conform audio to video, and wants to throw away the razor blades and trade up to a digital audio workstation. No problem. More than 80 companies are making digital audio workstations in one form or another. It's even better if the team happens to have a PC, MAC or Amiga computer. Many companies offer suitable software and hardware plug-ins for computers, with prices rang-

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Interactive TV: tomorrow's opportunity

Forward-thinking stations should plan now for interactive TV. It may be a chance to increase profits — at little cost.

EXPLORING NEW TECHNOLOGIES

By Gil Dinkins

The Bottom Line

Now is the time for broadcast and cable facilities to look toward innovative investments and new technology in the near future. One opportunity that stations will be able to take advantage of is interactive television. Although the technology is just around the corner, stations should plan now to participate. This emerging technology will give broadcasters and cablecasters a unique way of generating profits. It also will be up to individual facilities as to how much or how little they wish to invest. Make sure your station is on the right track to take advantage of interactive television.

Dinkins is vice president of engineering for TV Answer, Reston, VA.

After years of promises and undelivered promise, interactive television is on the verge of becoming a viable player in the broadcast industry. As the Federal Communications Commission (FCC), private industry and the marketplace pave the way for this exciting technology to emerge, TV station and cable company leaders, engineers and marketers are studying ways to fit this innovative service into their programming mix. Broadcast and cable companies also must determine what equipment and skills they will need to take advantage of it.

The establishment of interactive video and data service (IVDS) will offer many broadcast stations and cable companies a 2-way TV system that can boost ratings and generate revenue, while allowing them to remain flexible about the amount of investment and involvement required.

The premise/promise of interactive TV

Two-way television is built on a simple premise: turning television from a 1-way information and entertainment vehicle into a 2-way communications tool. Under Part 95 of the commission's rules, IVDS is a point-to-multipoint radio service that will provide 2-way interaction with commercial, educational, and informational programs and data services. These programs and services may be delivered by broadcast television, cable television, wireless cable and direct broadcast satellite (DBS). This technology will change TV viewing from a passive past-time into an active and interactive event.

Viewers will be able to use their televisions to respond to what they are watching in real time. For example, wireless interactive television will let consumers respond instantly to game shows, play along with sports events, react to interactive advertising, participate in long-distance educational courses, and voice their vote in local or national opinion polls. Viewers may also be able to save some time by doing their banking, shopping and bill paying interactively.

Two-way television is built on a simple premise: turning television from a 1-way information and entertainment vehicle into a 2-way communications tool.

If broadcast stations and cable companies incorporate this 2-way interactive application into their programming, opportunities to generate revenue can increase. Stations and cable systems can promote

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special interactive programming and opinion polls, incorporate interactive advertising into their marketing packages, create cross promotions for advertisers or allow charities to use television interactively in their fund-raising public service announcements and programs.

The opportunities to incorporate interactive television into the programming/marketing/public service mix of stations and cable companies is limited only by the imagination of the companies and individuals involved.

Creating the technology

One company, TV Answer, has been exploring the feasibility of this interactive technology since 1985. During that time, the company has been creating the technology and support service network to promote interactive television.

TV Answer's equipment includes a home unit, called an interactive TV appliance (ITA), which has a 2-way capability and a joystick. The unit is manufactured by Hewlett-Packard and contains the software and technology needed to process, encrypt and transmit/receive the data that appears on consumers' TV screens. The joystick is wand-shaped and contains only two moving parts: a lever and a trigger. The lever allows the consumer to move a cursor across the TV screen to an icon. Once the icon is selected, the consumer squeezes the trigger to indicate a selection. The information is transmitted to the home unit via infrared radio signals.

Viewers will be able to use their televisions to respond to what they are watching in real time.

The home unit processes the data, encrypts it, then transmits it to a local cell site. The data will be combined with data from other units and uplinked via a 1.8m send/receive dish to a Hughes satellite and then downlinked to the hub site in Reston, VA. Here, the data is routed through TV Answer's National Information Center to various service/product providers. (See Figure 1.) The minimum rate of data transmission is 5,100 bits/s from the unit to the cell site.

The entire processing time is only a few seconds. However, the speed of transmission will depend on the length of the transmissions (amount of data per transmission). For example, a response could be sent from Los Angeles, received in Reston, VA, and returned to Los Angeles in approximately six seconds.

Putting IVDS into place

On January 16 of this year, the FCC launched the IVDS industry by designating one megahertz (218-219MHz) of spectrum for use by companies wishing to offer interactive TV services to consumers.

The FCC ruled that the service areas to be licensed will be identical to the Metropolitan Statistical Areas (MSAs) used for cellular telephone service. The MSAs are centered in areas with large populations. This divides the nation into 734 areas, each of which will receive two IVDS licenses. The licenses will be awarded by lottery, in a sequential order, ranging from the largest MSAs to Rural Service Areas (RSAs), which are centered in less-populated areas.

The FCC has already started the licens-

ing process for nine of the top 10 MSAs: New York; Los Angeles; Chicago; Philadelphia; Boston; Washington, DC; San Francisco; Dallas and Houston. The only top 10 MSA not represented is Detroit, which is being delayed because of potential conflicts with Canadian radio traffic. The FCC hopes to issue the first license by the end of this year.

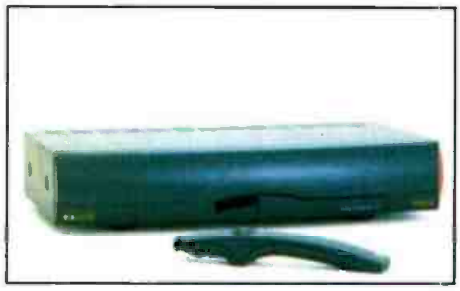
If so, license holders will have to react quickly to meet the FCC's build out requirements. To minimize the potential for speculation, licensees will have to build their interactive TV system to cover 10% of their market within the first year and 50% of their market by the end of five years.

This means that licensees will be anxiously looking for technology and services to firmly establish their operations within the first year. It is possible that IVDS will take a strong foothold early and grow into the first interactive technology nationwide because of the impetus created by the FCC's rulings.

Wireless vs. wires

Two types of technology are available to implement interactive television: wireless and wire-based.

A wireless system has two advantages over a wired system — geographic reach and transmission capacity. Because a wireless system is based on satellite technology, it is not bound by a limited coverage area. Wireless transmissions do not require



The interactive TV appliance (ITA), has 2-way capability. It contains the technology to process, encrypt and transmit/receive data that appears on the TV screen.

that cable be layed in order to reach consumers, so the service can reach rural areas where no cable service exists.

In some cases, the transmission is totally wireless, using RF to transmit data to and from a consumer's home. In others, a portion of the in-home transmission path is wireless, but the receiver unit is connected to the telephone line in order to transmit data. Other wireless systems use the vertical blanking interval (VBI) to send data to the home.

The total user capacity of wire-based systems may be limited because telephone transmission technology is designed to handle up to approximately 3% capacity of the total telephone users within the service coverage area (local or national). This technology is not capable of handling a blast volume of responses that could occur if an interactive opportunity were offered during a limited-time national event. As a result, the technological barrier could frustrate users because they might get a busy signal.

One example of the potential for system overload was President Bush's 1992 State-of-the-Union Address. CBS followed Bush's speech with a promotion that let viewers call an 800 telephone number to express their opinions on several questions. The viewers responded by pressing buttons on their telephones to answer recorded questions. In the hour following the presidential address, approximately 315,000 callers voiced their opinions. This is only a small portion of the 24.6 million calls that were placed. The rest of the callers could not get through because the lines were busy. Wireless interactive TV technology could have processed the entire call load in ap-

If broadcast stations and cable companies incorporate this 2-way interactive application into their programming, opportunities to generate revenue can increase.

proximately 3.5 minutes.

The wire-based segment of interactive television, however, is undergoing a tremendous amount of activity. Court decisions and federal regulations opened the door for the seven Regional Bell Operating Companies (RBOCs) to offer video dial tone services. Some manufacturers, such as Hewlett-Packard, Philips, Sony, IBM and GTE, have given the interactive arena a new look — and a sense of urgency that was shared by only a few farsighted companies not long ago.

Although several systems now employ coax or fiber to offer near-video-on-demand and videotex in their systems, they are primarily experimental (GTE's Main Street program, which is broadcast in conjunction with cable systems in Cerritos, CA, and Needham, MA), provide regional coverage (Time Warner's 150-channel experiment in Queens, NY) or are 1-way interactive in that they allow viewers to select from alternate channels but not respond to programming (ACTV's Select-A-View service in Springfield, MA).

TV Answer's main control room in Reston, VA.

The future of wire-based interactive television may rest on the ability of the industry to transform the existing network from copper to fiber-optic cables. The increased channel capacity (up to 160 channels in many cases) of fiber-optic cable will give cable companies the luxury of dedicating channels to 1-way transmission, and allow them to accommodate the volume of responses needed to make interactive service more efficient, cost-effective and consumer-friendly.

The home unit processes the data, encrypts it, then transmits it to a local cell site.

However, replacing America's millions of miles of copper with fiber will be an expensive and time-consuming process. Because of this, wireless interactive television may be entrenched in the marketplace by the time a national, fiber-based system is complete.

Where the broadcaster fits in

Broadcasters can receive the data in either raw or processed form via a terres-

trial or satellite link. A very small aperture terminal (VSAT) or modem will provide the gateway to a front-end processor or file server. The specific equipment and software configuration can be tailored to the station's needs.

The initial cost to broadcasters or cable companies will depend on how involved they want to get in the collection/compilation process of the received signals. The investment can be as little as $1,000 for on-site equipment if the facility wants to receive only the processed net results. The cost could range as high as $20,000 if on-site processing of the raw data is desired.

On January 16 of this year, the FCC launched the IVDS industry by designating 218-219MHz of spectrum for use by companies wishing to offer interactive TV services to consumers.

Getting established

In order to gear up for IVDS, TV Answer has been building a national network of marketers who will use interactive television to offer their products and services to consumers. It currently has contracts with a pizza delivery service, a major department store and several 800 companies. The company has also signed contracts with service companies to offer bank-at-home and national bill-paying services.

In addition, TV Answer has a contract with a sports network known for its national sports play-along game. Viewers will be able to play along for fun and prizes with NFL televised games beginning with the 1993-94 season.

Although consumers may also welcome the convenience of banking, bill paying, grocery buying and catalog shopping via television, the ability to interact with the programming is likely to be 2-way television's most popular consumer feature.

Another innovative area of video programming is distance learning. Viewers who use interactive television will be able to attend classes from the convenience of their living rooms. Likewise, students will be able to respond to exams on a real time basis. The instructors will have the ability to instantly receive and tabulate responses from students throughout the viewing area. Because sponsors might be

found to underwrite educational series or the school could establish some type of marketing agreement, stations may be able to create new sources of revenue and increase the station's visibility within the community.

An interactive future?

A study by Frost & Sullivan, "The U.S. Market for Interactive Television," predicts that interactive television will be "the key to...future growth [for a] huge confluence of industries." According to the report, television's annual revenues are expected to increase from $681 million in 1991 to $1.64 billion by 1996, and the home interactive terminal market will grow from $210,000 in 1991 to $225 million by 1995. But the real explosion will be in the cable TV arena. Frost & Sullivan estimates that revenues from cable TV-related services will jump from zero in 1991 to $32 million by 1996. Estimates are that interactive television could be available in 20 million consumer homes by the end of the decade.

So where does this interactive technology leave the station or cable company? Although the technology is not yet here, it's not too early to begin planning to participate. First, make sure your management is aware of this future opportunity. In future issues of *BE* you will be able to follow the technological developments and learn more about how the systems operate as they are designed.

Second, your station could profit from this new technology so keep an open mind toward this opportunity. No broadcaster or cablecaster can afford to ignore a new idea just because it looks out of the ordinary. Interactive television could become a new and significant source of revenue at your station — at what appears to be little cost.

The three current IVDS proponents, TV Answer, Interactive Network and Radio Telecom & Technology (RTT), are all offering innovative ideas and plans. They will be looking toward working with forward-thinking stations and cable systems in mutually beneficial ways. Be sure your facility is ready to take advantage of the opportunities that are sure to develop. ■

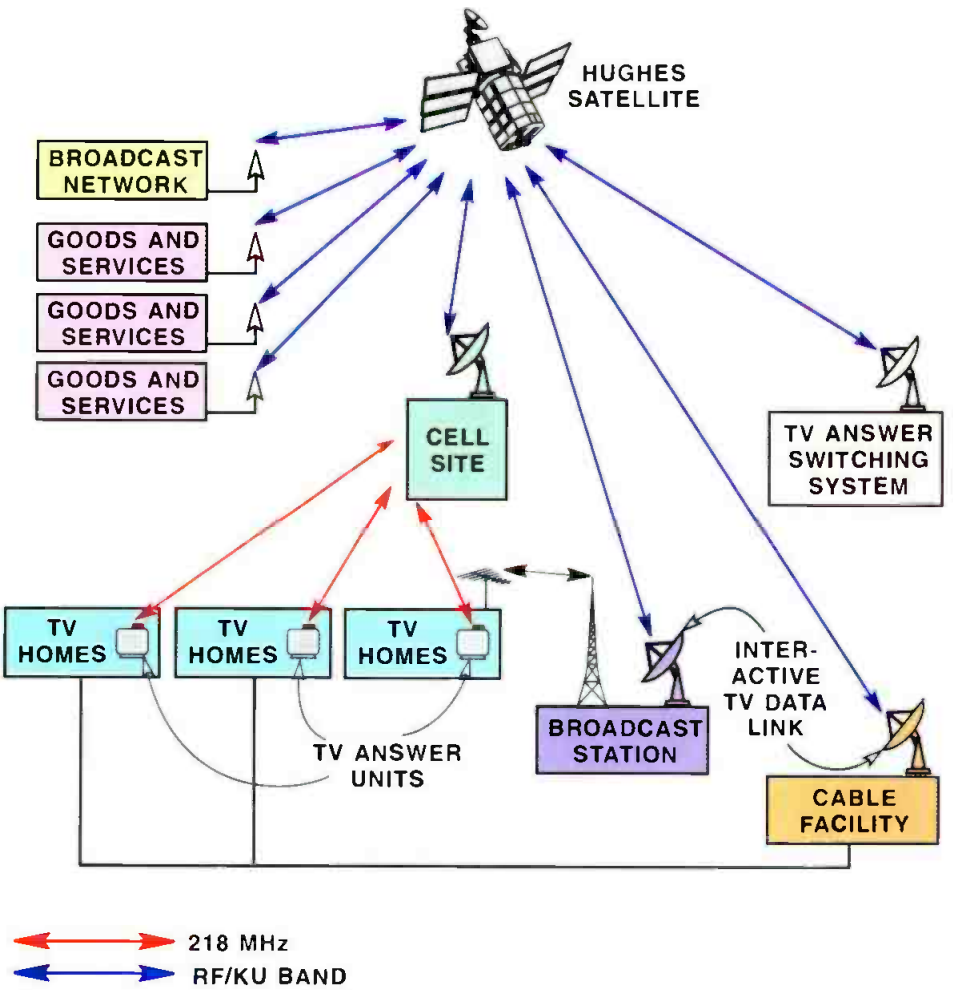


Figure 1. A block diagram of TV Answer's 2-way wireless interactive communications path.

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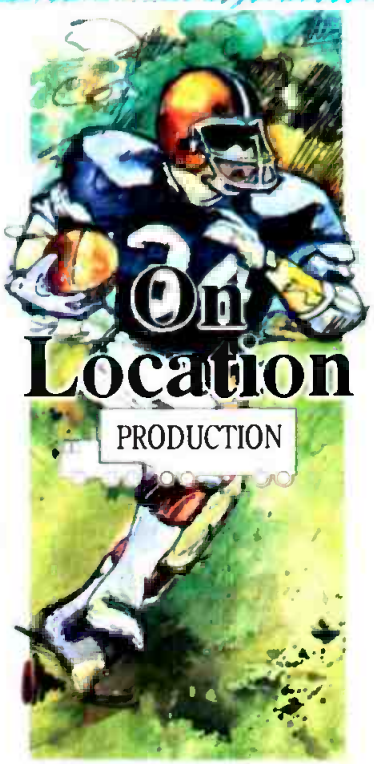

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Satellite and cable radio: the next frontier

Are these emerging delivery systems the next wave, or just a flash in the pan?

EXPLORING NEW TECHNOLOGIES

By Skip Pizzi, technical editor

The Bottom Line

Many broadcasters perceive cable and direct broadcast satellite (DBS) radio as competition. However, they also may present new opportunities. In either case, lessons can be learned from these systems' successes and from their failures. As elsewhere, digital transmission techniques make these alternate pathways possible. Such technologies will continue to reshape the broadcast industry for some time. Keeping up with these developments is a prerequisite for survival in the new communications world.

Not long ago, the words *cable radio* brought a smile to most broadcasters' faces. It seemed to be an oxymoron: Tethering the mobile medium of radio to a cable TV drop made as much sense as driving a car while it was plugged into an AC outlet.

Today, those smiles are giving way to raised eyebrows and over-the-shoulder glances. The new kids on the pedestal are making some noise, and finding success in several markets.

Suppliers of these services stress that they are not directly competing with radio, citing that they are subscription-based rather than advertiser-supported, and currently have no local content. Furthermore, their need for cable hookup eliminates the use of these services on clock radios, boomboxes and personal headphone receivers, where much home radio listening now occurs.

Nevertheless, time spent listening to cable audio services is time not spent listening to over-the-air broadcasts. Although not as convenient or widely available as broadcast radio, early studies show that desirable program offerings have sufficiently motivated many consumers to use (and pay $7 to $12 per month for) cable audio services. Therefore, they bear observation and study by those in the cable and broadcast worlds.

How cable radio works

Two national cable audio services are now in operation: Digital Cable Radio (DCR) of Hatboro, PA, and Digital Music Express (DMX) of Los Angeles. A third, Digital Planet, closed its doors earlier this year. Both use similar techniques in the delivery of their product, as shown in Figure 1. Rate-reduced digital audio is distributed to cable head-ends via satellite, using time-division multiplexing to combine multiple digital audio channels into a single wideband signal. At the head-end, the channels are demultiplexed (but not decoded), encrypted and remodulated onto the cable system.

Incoming cable to the home is split between the standard cable TV tuner/decoder and a new cable radio tuner/decoder. The latter selects one of the approximately 30 audio channels that each of these (incompatible) systems currently offer, converts it back to analog audio, and feeds the customer's existing audio system with standard consumer levels (nominally −10dBV) on RCA phono connectors. In some cases, an S/PDIF digital audio output is provided. An option available on the DMX receiver provides a wireless remote control with an alphanumeric LCD display of associated data, such as title and artist now playing.

Because channel space is not as scarce in the spectrum of cable distribution as it is in the broadcast world, bit-rate reduction (or data compression) ratios used by cable audio are not as high as those typically encountered in on-air transmission

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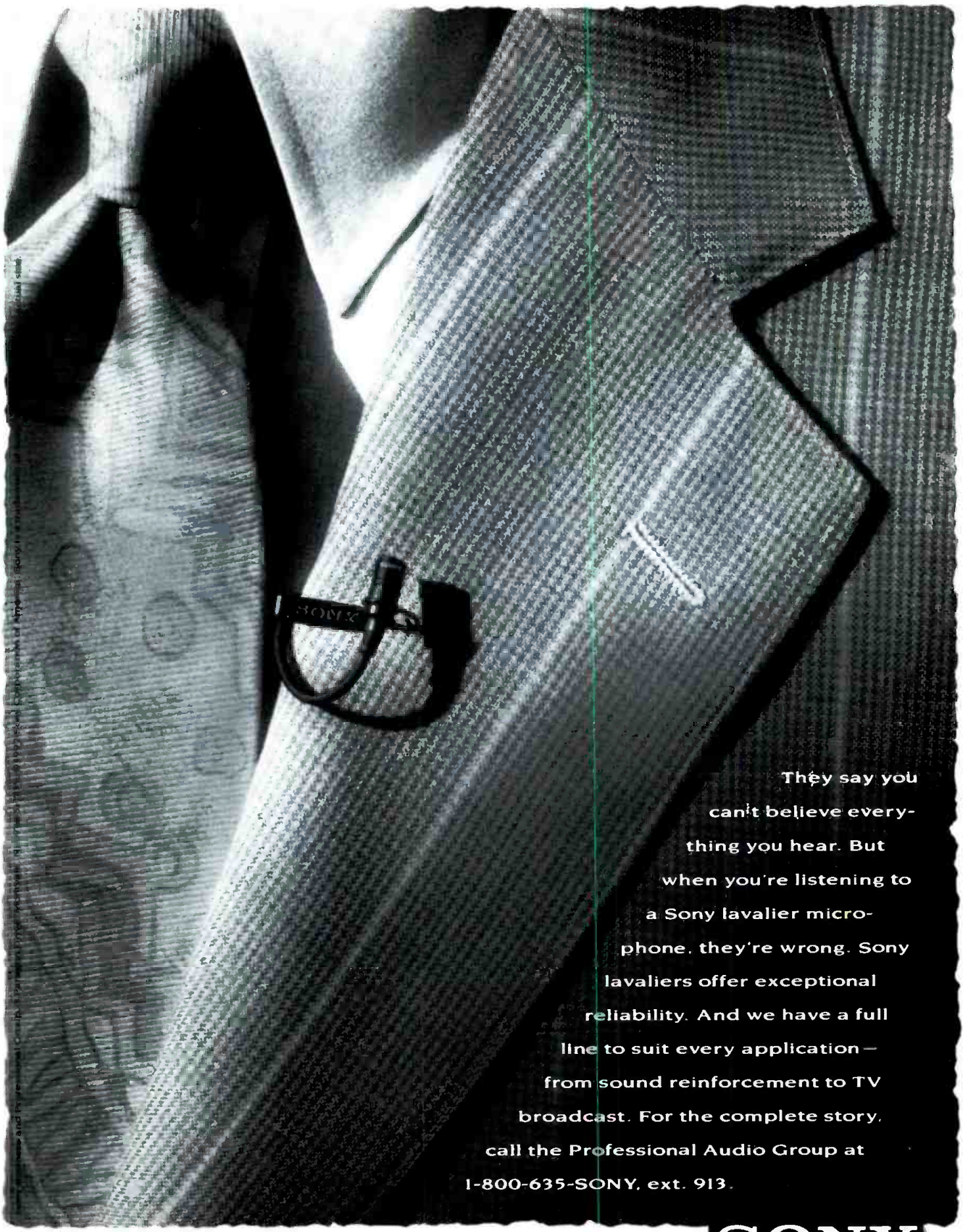

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systems. Here, the two systems deviate in their approaches.

DCR uses the Dolby AC-1 algorithm, an adaptive delta-modulation system that codes 20kHz stereo audio into a 512kbit/s datastream (approximately a 3:1 rate reduction). The use of AC-1 keeps decoder prices low — around $100, manufactured cost. As with cable TV decoders, cable audio hardware devices usually are leased to customers by cable operators. Each DCR audio signal (or stereo pair) is transmitted on a discrete carrier, generally at about 15dB below video carrier levels.

DMX uses the Scientific Atlanta cd-x system, providing minimal bit-rate reduction that results in a 1.13Mbit/s data rate per stereo audio channel. Unlike DCR's discrete method, DMX uses quadrature partial response (QPR) modulation to transmit multiplexed blocks of five stereo signals each (5.6Mbit/s block data rate) in 3MHz-wide channels on the cable. DMX claims that its system allows closer alignment to video and other signals without interference, and recommends a −10dB level relative to video carriers.

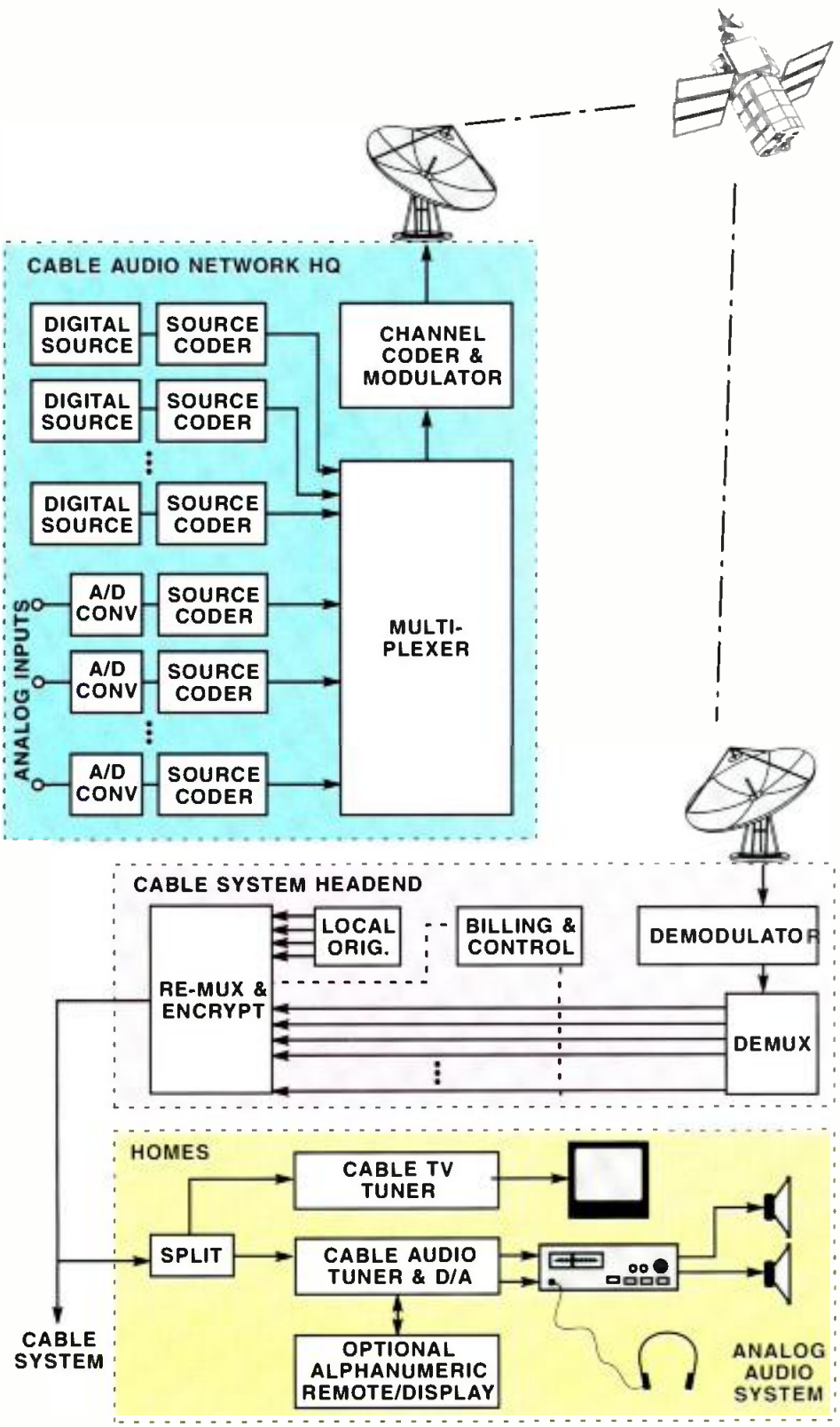

Figure 1. A general block diagram for digital cable audio systems.

As noted in Figure 1, these systems permit locally originated audio services to be incorporated into a cable operator's package. Although not yet widely used, this function could allow selected local radio stations' signals to be included. Alternatively, a radio station might provide a separate service — or a commercial-free derivative of its on-air service — specifically for the cable audio system. (Today's multi-output automation systems could generate these alternate streams without much difficulty or expense.) Larger stations might consider alignments with multiple cable operators on a national or regional basis, and uplink their service as a radio "superstation."

Future growth in cable radio will undeniably include more audio channel offerings, but may involve unwired elements. MMDS (wireless cable) variants also have been developed. These services are already in place outside the United States. In addition, cable audio network operators are poised to move into direct broadcast satellite radio (DBS-R) distribution when it becomes viable, perhaps allowing them to tap the car radio market they currently miss.

DBS-R delivery

Although cable radio systems are real and growing, DBS-R is a more speculative future issue. Nevertheless, it could have even more dramatic impact on the broadcast radio business if and when it does arrive. Presently, two major proponents are involved in U.S. DBS-R: Satellite CD Radio (SCDR) and RadioSat Corporation (RSC). A third, Afrispace, targets the African market and may begin its service within the next year or two. The U.S. government also is involved in DBS-R development through the U.S. Information Agency (USIA, parent of the Voice of America [VOA]) and NASA.

DBS-R already exists in Japan. There, the St. GIGA service is operated by the Satellite Digital Audio Broadcasting Company, using the Japanese Yuri-3a satellite. The service offers multiple CD-quality digital audio channels for a monthly subscription fee equivalent to approximately $5. Several American companies are reportedly involved as investors in the operation.

For domestic service, the U.S. position at WARC-92 allocated S-band frequencies (2,310-2,360MHz) for DBS-R, which is referred to in WARC deliberations as *Broadcast Satellite Service, Sound* (BSS [Sound]). A recently issued FCC Notice of Proposed Rulemaking (NPRM) suggests that alloca-

on of frequencies for such services may begin soon.

Thus far, SCDR is the only proponent for U.S. S-band delivery. RadioSat preferred an earlier Mobile Satellite Service (MSS) allocation in L-band (1,544-1,559MHz), using the high-powered MSAT satellites of the American Mobile Satellite Consortium (AMSC). However, this allocation and RadioSat's role within the consortium have been the subject of protracted litigation. Therefore, minimal action toward establishment of service has occurred. Meanwhile, Afrispace will likely use the standard BSS (Sound) L-band allocation (1,452-1,492MHz) available in all African nations.

An important notion in most of these proposals is the inclusion of mobile reception possibilities, an element not normally found in satellite transmission systems. The power levels and coding gains used are designed to allow extremely small receive dishes that do not require critical alignment, thereby accommodating automotive and possibly hand-held receivers.

The primary difficulty with DBS-R is line-of-sight requirement for proper reception. Building shadows in "urban canyons" and certain terrain features might preclude this, especially for mobile reception. System designers have proposed the use of low-power terrestrial repeaters called *gap-fillers*. The digital formats used by these systems typically allow gap fillers to operate on the same frequency as the satellite signals without interference. The receiver switches to the stronger signal automatically in this, the so-called hybrid model. However, the need for such a terrestrial network of gap fillers adds significant expense to the development of this system, in addition to the high price of satellite operations.

One way to counteract this problem is to use a multiplexed service. With such a service, a single terrestrial transmitter or small network of transmitters repeats all satellite channels for a market while adding several local, terrestrial-only channels. A single receiver would pick up satellite and terrestrially originated signals in this so-called mixed system. This approach is currently favored for L-band application in Canada, in which existing AM and FM services are to be replaced by the terrestrial channels, with national channels (or perhaps regional services, using spot beams) added by satellite transmission.

In the United States, the recent FCC NPRM favors the hybrid model. Terrestrial origination would be used for gap-filling of satellite signals only, with no provision for purely terrestrial S-band services. Given this environment, domestic DBS-R services are not likely in the United States until the late 1990s or beyond.

What the future holds

Cable audio services seem destined to continue their penetration, with a stated goal of reaching at least 10% of homes already served by cable television. This appears possible, because the two remaining cable audio services have among their principal partners the largest cable multiple-system operators (MSOs) in the country.

Keep an eye on activities at the FCC and at the Electronic Industries Association (EIA), where digital radio formats are being considered for U.S. standardization. NASA/VOA is one of the 11 format proponents involved in the EIA process, as are General Instrument (the principal force behind DCR) and Digital Planet.

As the curtains part on radio's next act, no one knows how the story will end. You can bet that cable audio and DBS-R will be among the cast of characters. ■

Staffing issues for the '90s

Technology is placing greater and different demands on today's engineering staffs.

EXPLORING NEW TECHNOLOGIES

By Marvin Born

The Bottom Line

In today's business climate, profitability is paramount. It's the good news/bad news syndrome. The good news is that much of the personnel cuts of yesterday are over. The bad news is that unless you're prepared for tomorrow's technology, you could be next. Fortunately, technical managers can be effective in helping improve profits, while protecting those with the skills needed to operate the facilities of today — and tomorrow.

Born is vice president, WBNS-TV, Columbus, OH.

Look around. How many people have left your production or broadcast facility in the past 10 years? How have you managed to stay employed?

The answer to the first question depends upon the facility. The answer to the second question is universal — the employee's value to the company. If you aren't valuable to your company, you probably would be terminated. This article examines how technology has changed the way broadcasters use technology to improve their job performance.

Out with the old

In the days of traditional broadcast television, numerous people had to perform different jobs just to get a commercial on the air. For example, one person had to pull the spot from the tape library, while another person loaded it on a tape machine. At the correct time, the master control operator played the spot on the air. When it was finished, another person unloaded it, and someone else replaced it in the library. This time-consuming process required as many as four people to run one commercial.

Today's automation systems complete most of these tasks without human intervention. Once the commercial is loaded, it is pulled from storage, played and restocked — all without an operator. Granted, someone must place the spot in the machine and someone must oversee master control, but that can be the same person. Facilities can operate for hours without human interaction. As the technology changes, we must keep up with the changes to be personally and professionally successful.

Technology — a moving target

Today, fewer people are needed to operate facilities. However, the level of skill and training required to be one of these remaining people is rising. Through constant personal training, broadcast and production engineers can keep their job skills current.

Today's automation systems can complete most (on-air) tasks without human intervention.

Not long ago, engineers learned about tubes and were prepared for almost any position in the industry. But technology does not stand still. Since the days of tubes, perhaps six generations of semiconductor technologies have been implemented. The complexity of these devices has increased to the point where millions of transistors now reside on one chip. The days of easy maintenance (where failures were solved simply by looking for a tube without a

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glowing filament and then replacing it) are gone forever.

Despite the tremendous increase in the complexity of production hardware, engineers are still expected to be able to quickly repair systems. The skills needed to perform this maintenance are a far cry from what was required a few years ago. Engineers' abilities must remain current with the equipment they service and operate.

Reducing the people cost

Personnel costs are typically the most expensive part of an operation. Twenty years ago, a station could hire four or more people at $5 per hour to maintain normal on-air operations. Today, a person in a middle-market station earns $18 to $20 per hour. In raw dollars, that's as much as four people cost 20 years ago. Add to this higher hourly wage the increased social security, health insurance and retirement costs, and the net cost for one person is probably much higher than it was for the four people combined.

This has forced many companies to view staff reduction as a priority when it comes to cost control. The next objective is to make those remaining people more efficient. Many companies look for ways to get more work from fewer people. In broadcast, this usually means installing automated equipment, such as cart machines, robotic camera systems and facility automation.

The company advantage

With the proper equipment and a good physical layout, one person can operate an on-air TV master control. Let's examine how an efficient on-air facility might be designed.

First, the commercial cart machine should be located in or near the master control room. The operator won't have time to walk any great distance to load or retrieve tapes from the system. Next, the transmitter remote control should be part of the switcher console so that readings and adjustments are easy to make. Several stand-alone tape machines should be located near the operator for program playback. Make sure the programs are loaded and cued well in advance of air time. The program segments can even be preprogrammed into the system so that the machines will fast forward and automatically recue while the commercials are running.

Although the operator in such a facility will be busy, this concept is becoming more common, especially in smaller markets or at independent stations. Experience shows that these operations can be extremely reliable. In addition, operator errors are kept to a minimum with trained personnel.

Don't be misled. A down side to this approach does exist. When something goes wrong, only one person is present to handle the problem. The station could end up sitting on a slide while the problem is resolved. However, many problems can be fixed during a commercial break, thereby making the trouble slide a rare occurrence. Reliability is sufficient, and many stations believe the cost savings is worth the gamble and occasional problem.

Jack of all trades

Another trend of the '90s involves cross-departmental exchange of employees. For stations not bound by collective bargaining agreements, cross-training and cooperative exchange of staff members can increase the work output without increasing staff size.

Cross-training the production and engineering departments can permit a production assistant to fill in for a sick tape or master control operator. On the surface, this looks like more work for the same money. Perhaps it is, but moving a person from a task that can wait to one that can't (on-air operation) makes sense when you

don't have the people or can't afford the overtime.

Using news editors as directors for the pre-production of news material is another example of effective cross-training. Typically, a period exists between shifts (such as early afternoon) when the staff is smaller than normal. Using a news editor as a director saves having a higher-cost director on duty just to repeat to the engineering crew what the news tape editor wants.

The engineering department can assist in this process by taking the theory one step further. With little additional equipment, a combination editor, switcher and special effects device can be added to a news edit suite, along with a small character generator and an extra tape machine. Now, the news editor can complete the whole pre-production process — without additional staff time and cost. The production crew could then be assigned to commercials or promotional spots. The staff might not be needed at all, thereby resulting in additional savings.

These are only a few of the options available to save money through more efficient use of staff. In the aforementioned scenarios, the librarian and tape operator positions were eliminated. The cross-training of production and engineering personnel resulted in position savings and perhaps a reduction in overtime charges.

The drawbacks

Serious drawbacks to such staff reductions do exist, and they should be considered carefully. The basic knowledge of a station's operation resides in the minds of the employees, not in any machine. As the number of employees is reduced, so is the pool of knowledge available to your company. Depending on the department involved, an employee reduction can severely handicap a company in the long run.

Sales and engineering are two examples of where staff knowledge is critical to a facility's operation. Sales people often have unique personal relationships that are crucial to effective selling. Instead of eliminating sales positions, many companies opt to place them completely on commission: no work, no pay. Although this may work with sales staffs, it doesn't work for engineers.

Engineering and operations is an expense department. As such, it is a favorite target of budget cutters. However, the learning curve for operation and maintenance of electronic equipment is long. It is not easy to replace knowledgeable staff with part-time personnel, especially if they have little experience. Improper staff reductions also can leave the company without enough people for on-time projects and without the knowledge necessary to operate the facility.

Loyalty is another important issue. After working for a company for several years, employees often develop a strong sense of loyalty. Employees expect that same type of loyalty from the company. Any staff reduction breaks this confidence, which can take years to rebuild.

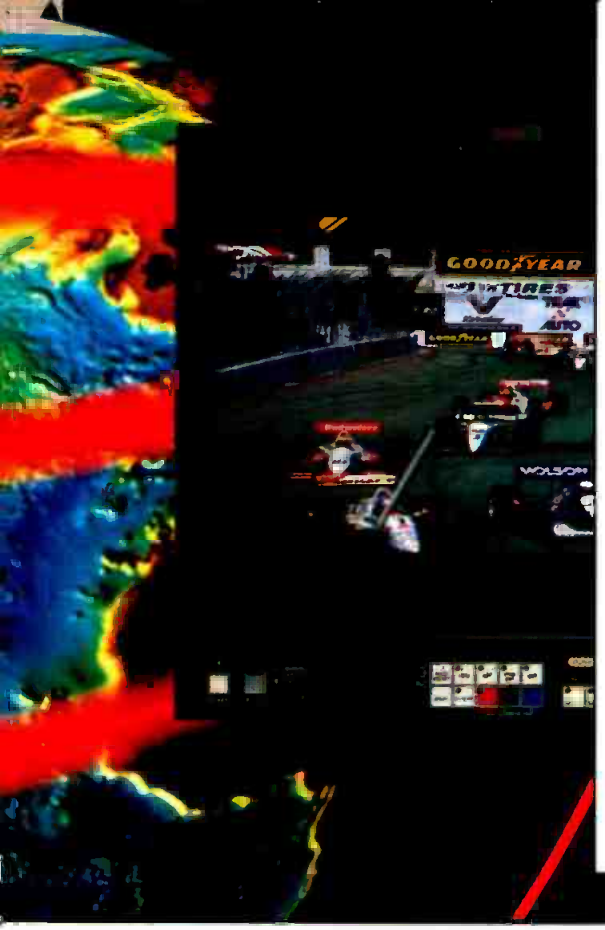
Furthermore, remember that part-time employees may be doing great work for you today, but tomorrow they could be at your competitor's site. A savvy and possibly less-than-honorable employee may offer certain business knowledge to the highest bidder.

Even if part-time employees don't violate any ethics standards or disclose business secrets, their basic industry knowledge is enhanced by each temporary position for which they are trained. The investment you make in training part-time employees is not being entirely realized by your company. In addition, the training you provide may be used to your disadvantage, because it could help them obtain other employment.

The self-employed engineer

Service contract work has its advantages. Today's radio manager wants to stay

Continued on page 71



Building for a high-definition future

Don't let the tidal wave of HDTV drown you. Prepare now for the transition period.

EXPLORING NEW TECHNOLOGIES

By Curtis Chan

The Bottom Line

The HDTV/DATV era is sitting on our doorstep. Burying your head in the sand won't stop its implementation. Now is the time to arm yourself with the proper ammunition to help your station make a smooth transition. To remain competitive, stations need to anticipate costs and what types of new equipment in which to invest. The transition to HDTV will impact the future of the broadcast industry, so gear up now for the change, and go with the flow.

Chan is a principal of Chan & Associates, Fullerton, CA.

Earlier this year at the Digital TV Conference sponsored by MIT's Media Lab, FCC chairman Al Sikes announced the onset of a new era. "While the decades-old acronym HDTV is still used by most persons, we are in fact now dealing with digital advanced television (DATV). The importance and implication of this transition cannot be overstated. DATV will be higher quality and enable higher capacity, while at the same time using the radio spectrum more efficiently," said Sikes. "It will be far more flexible than today's analog television, and it will enable easier and cheaper transcoding among different display formats. From a consumer perspective, DATV will increase choice. It will provide viewers greater control over what, when and how they watch television — ultimately leading to personalized and customized television in addition to the mass media television we know today."

Out with the old

As the FCC HDTV/DATV standard selection deadline approaches, TV stations are not concerned with *will* it happen, but when and how their station will deal with two program origination formats during the transition period. What are the risks and opportunities of procuring new equipment for recording, camera systems, editing, image and audio manipulation, switching/routing, playback equipment and RF transmission components?

Other major considerations include cost and how to maintain profitability. Although HDTV may be a great idea for improved programming, one underlying concern is how to attract a revenue stream that will ultimately convince stations to invest in HDTV. For advertisers, the opportunity to reach an upscale audience is attractive, because HDTV will fragment the market. But will the industry respond to the fragmentation with a new fee structure? What should current facilities do to make their program quality and equipment complement more HDTV-friendly?

The purpose of this introduction and a 12-part HDTV series in the "Strictly TV" column is to offer viewpoints from various manufacturers, organizations and other industry figures. Beginning in the January 1993 issue, each of the "Strictly TV" columns will spotlight a relevant topic or emerging technology, and will provide you with more ammunition to make rational decisions for the transition to the HDTV era. Featured topics will include tape formats, camera issues, switching and routing needs, RF systems and timely news regarding standards progress. Remember, the HDTV tidal wave is coming, and there's no place to hide. If you think smart and plan now, you can ride the crest of the wave to future profitability.

At the crossroads

A recent study on the implementation of HDTV portrayed costs that varied by a wide margin. According to the report, an estimated $1.5 million will be needed to just pass a signal. Up to $12 million will result in a fully functional station. Several proposals have been spawned over the months to make the advent of HDTV as fair as possible. One proposal is the sub-

mission of an appeal requesting the FCC to pair specific HDTV and NTSC channels with current transmitter sites, based on the principles of replication, interference prevention and coverage maximization, instead of proposing a table of allotments and allowing broadcasters to negotiate for the best pairings. However, a draft was approved for a table of allotments that likely would place all HDTV channels in the UHF spectrum, which again drew various comments.

The draft noted that 17 of the 1,716 commercial and non-commercial HDTV channels would be allowed to operate in VHF. The agency admitted that shoehorning HDTV into the existing spectrum was most difficult in the crowded northeast section of the country. Nine VHF assignments are in that area, and five are in California, two of which are in Los Angeles. The FCC suggested that stations receiving VHF HDTV assignments be given special consideration in making the transition, and then be given one of the vacated UHF channels after everyone has made the switch.

To provide sufficient channels, the FCC draft suggests co-location or reduced spacings between adjacent channels in some instances. The assignments of many of the HDTV channels to UHF depend on the ability to eliminate UHF taboo channels that have been off-limits for years. The FCC noted that the early draft allotments may change significantly.

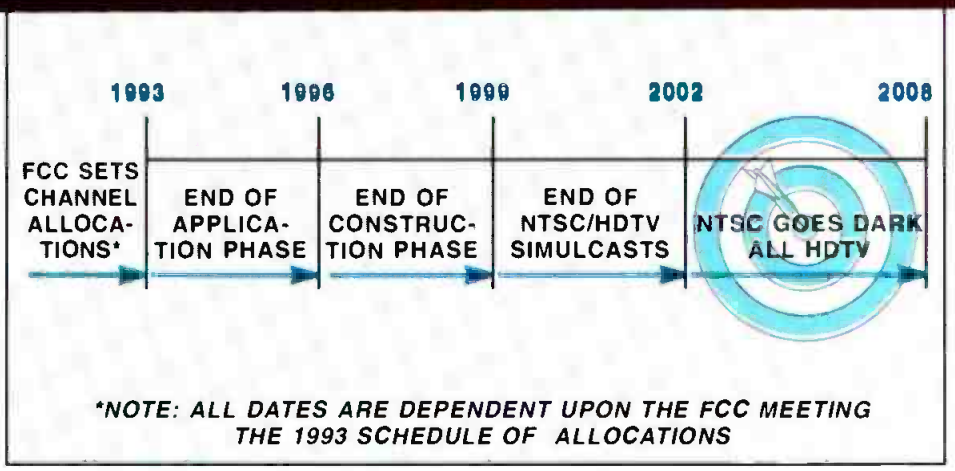
The proposed conversion schedule has been greeted with criticism — three years from the release of the allotment list to apply for an HDTV channel, three more years to construct the new channel, three additional years to have 100% simulcasting, and 15 years for a total conversion from NTSC to HDTV. The alternative to this schedule is to go dark. The Association of Maximum Service Television may voice the complaints best: "The FCC's deadlines are driven by an effort to speed the implementation of HDTV by bypassing normal marketplace forces and imposing on broadcasters an inequitable and dangerous share of the risk and financial burden involved in bringing this new, and to some extent largely unknown, technology to fruition."

The National Cable Television Association (NCTA) took an opposite stance on the schedule issue. It believes the delay in requiring simulcasting would cause the cable industry problems, because stations would be expected to carry two signals each for a multitude of channels. In addition, the NCTA committed resources to the development of a broadcast-compatible HDTV standard based on the understanding that the transition from NTSC to HDTV would be smooth and expeditious. In its filing, the National Telecommunications and Information Administration (NTIA) disagreed with the proposal to require NTSC transmission to go dark after 15 or 16 years. Broadcasters should have the choice, NTIA said, to surrender whichever channel they choose. More on this subject later.

Industry forecasts

What is the outlook for HDTV? Assuming court involvements are avoided, the reality is that the fates of HDTV and NTSC now seem dependent upon public response. As with all the formats that came before it, HDTV needs public acceptance to gain a firm footing before profitability can be considered. Earlier this year, the FCC Advisory Committee Working Party charged with forecasting the public's reaction developed its analysis. The study stated that perceived value and price are the principle variables.

The report indicates that large screen sets account for 5% of the NTSC receiver market. This market is growing, and receiver manufacturers are confident that a



*NOTE: ALL DATES ARE DEPENDENT UPON THE FCC MEETING THE 1993 SCHEDULE OF ALLOCATIONS

fair share will make the transition to high definition. The initial sets are projected to cost approximately $3,700.

Assuming that HDTV will find its way into high-end graphics and animation, medical and other niche markets, the real issue is that without programming, HDTV will remain a curiosity for technical trade shows. As is often the case, if it wasn't for programming, television would be dead.

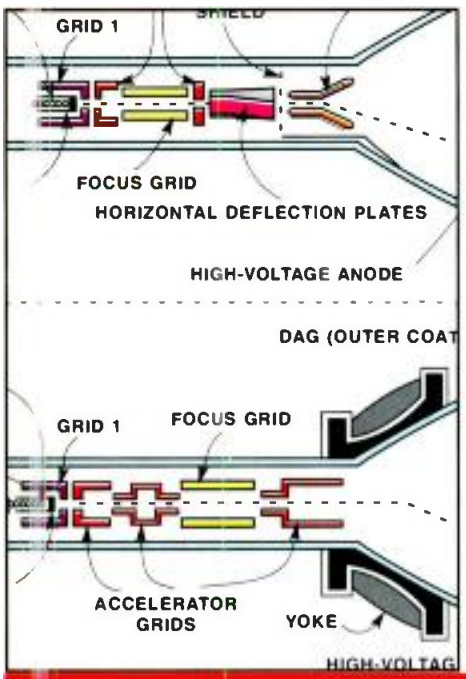
One WP-5 report stated that when color was introduced, six years elapsed with little market penetration, even though set costs fell significantly. When the networks implemented full-color prime time programming in 1966, sales increased explosively. Similarly, VCR sales were relatively insignificant until the introduction of videocassette rental stores.

Cable is expected to be an early provider of HDTV programming. One unique advantage of cable is its ability to offer hundreds of channels of programming. As to the origination source, it was cited that more than 70% of prime time programming is already produced on 35mm film — a medium easily translatable to HDTV. The remaining NTSC-based programs could be economically upconverted during the start-up period. Using the proposed FCC time frame and assuming a cost between $1 million and $2 million to build a station that can pass network HD programming with inserted local commercials, WP-5 estimates that 150 stations in the top 100 markets will have converted by year five, thereby serving 83% of the TV households.

HDTV's impact will significantly change our future thinking and livelihood. What is at stake reaches far beyond broadcasting and professional video production. As we move forward, consider the implications of a new infrastructure for personal and business communications, narrowcasting and broadcasting. The full impact will affect us in many ways. Video, as we know it, has brought entertainment and information into our everyday lives, but has been limited to essentially a 1-way affair. HDTV and its derivative audio-video medium and technology will play an important role in the new communications plan, making it possible to live in a fully interactive world.

For the broadcaster, the clock is ticking. Progress waits for no one. However, decisions should not be made without knowledge. To help you gain relevant, timely and crucial information to survive the HDTV onslaught, read "Strictly TV" each month in 1993. ■

Maintaining video monitors: focusing on CRTs



Understanding common monitor problems can save you time and money.

By Hulon Forrester

The Bottom Line

How many video monitors are in your facility? What would it cost to replace them at today's prices? What would it cost to replace all of the CRTs? Purchasing all new monitors and CRTs would represent a substantial investment at a significant cost. In the next few years, with the impending investments suggested for the onslaught of high-definition and digital television, now is the time to start cutting some of the current costs to prepare for future capital expenditures. You may be able to trim some costs with a better understanding of monitor problems. If the picture tube is at fault, consider rebuilt CRTs as a fix for ailing monitors. $

Forrester is a freelance writer for AD Ideas Inc., an agency serving Video Display Corporation, Tucker, GA.

Maintaining image quality requires a critical evaluation of the video signal from three viewpoints. First, waveform monitors illustrate timing and amplitude characteristics primarily of the luminance signal. Second, vectorscopes show saturation and phase of color. Third, even when all of the amplitudes, timing, phases and saturations appear correct, few facilities would consider distributing or transmitting the signal without seeing how the picture appears on a picture monitor. A precision picture monitor can be the most important of the three in assessing overall image quality. Seeing the actual picture reassures us that the grass is not red, the sky is not green and people are not blue.

CRT prognosis

The cathode ray tube (CRT) is the most expensive component in the monitor. Depending upon the condition of an older monitor, the price of a new CRT could make a difference between repairing or replacing the unit. For some tube types, an alternative may exist — a rebuilt CRT.

Monitors may perform poorly for a number of reasons. Most of the reasons involve signal processing, sensing and driving circuits. Only a few reasons for poor performance directly involve the CRT. Most of the monitor problems that may relate to the CRT are listed below with a probable cause and cure.

- **Fading picture.**

Over a period of time, the picture seems to fade. Essentially, there is no brightness control. The image may go negative. Ballooning of the picture is possible.

Probable cause: Low cathode emission. In a color tube, the cathode of one gun may occur before the other two. If that happens, there is an uncorrectable imbalance in the color.

Cure: Replace the picture tube.

- **Phosphor burn.**

After the power has been turned off, an image remains visible on the screen. Often, graphics and letters on an operating monitor are no longer sharp and clear.

Probable cause: This problem usually occurs with monitors that must remain on for long periods of time. It is made worse by high contrast and brightness settings.

Cure: Replace the CRT. Once the unit has been replaced, avoid excessive brightness and contrast, particularly on monitors that do not need to be observed constantly.

- **No picture.**

Several conditions are possible.

Probable cause: No power applied. As obvious as this may seem, many picture failures are the result of a power cord that is faulty or not attached. A fuse in the monitor also could be at fault.

Cure: Replace or repair the power cord. Make sure that both ends of the cable are properly seated. Check and replace the fuse if it is defective.

Probable cause: Open filament. An open filament in the CRT means that the cathode cannot be heated to operating temperature. No reddish glow will be visible in the neck of the tube. No beam current

is created. Because the filaments of a color are usually a series circuit, not parallel, if one filament goes, so does the entire picture.
Cure: Replace the CRT.
Probable cause: Gassy tube. The vacuum has been corrupted by gas molecules. A blue glow may be visible inside the neck of the tube, the result of ions being excited by the high-voltage levels inside the tube. The gassy condition first shows on the screen as a lack of focus and may eventually become sufficient to short out the high voltage applied to the anode.
Cure: Replace the CRT.
Probable cause: No high voltage. Components in the high-voltage section may have failed. Lack of high voltage can be observed with a high-voltage meter. If no meter is available, an insulated screwdriver can be used to "draw an arc" from the anode connection of the CRT. In order to avoid shock, take extreme caution when using this approach. (You should put your left hand in your back pocket and use your right hand to work on the equipment. If you do receive a shock, the current is not as likely to affect your heart.)
Cure: If high voltage is present, consider replacing the CRT. If high voltage is absent, troubleshoot the HV oscillator and flyback system or horizontal drive circuits.

- **Airy tube.**

Air has leaked into the tube. Typically, arcing will be visible inside the neck of the tube. In general, high voltage will not arc in a vacuum.
Cure: Replace the CRT.

- **No brightness control.**

The screen raster appears bright without visible information.
Probable cause: A short exists between grid 1 (G1) and the cathode of the CRT. Normally, a potential difference exists between the grid and cathode; video is applied to the cathode and the brightness adjustment controls G1. As a result, no picture information appears.
Cure: Replace the CRT.

- **Sweep failure.**

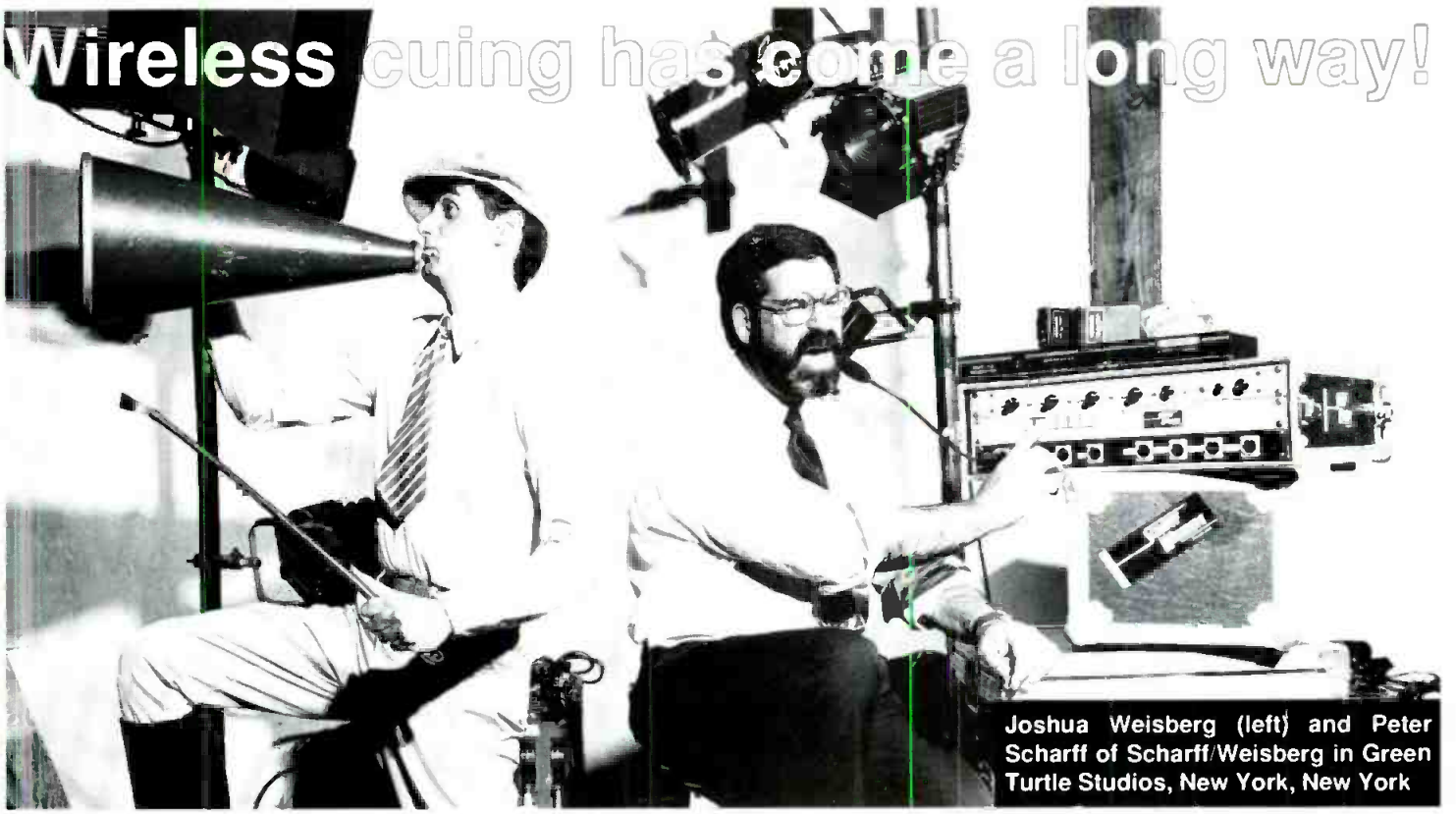
The only light on the screen is a horizontal line.
Probable cause: The vertical sweep circuits are malfunctioning. Turn the brightness control knob until the line is just visible in order to avoid burning the phosphor layer while you are troubleshooting.
Cure: Check the sweep circuitry, drives and yoke. The CRT is not the cause.

- **Keystoning.**

The picture raster is distorted into a trapezoidal shape.
Probable cause: A winding in the yoke is shorted.
Cure: Replace the yoke. The CRT is not the cause.

- **Curving of sides and images.**

Several possible conditions may occur:
1. The picture appears to have an S curve that runs from top to bottom. The curvature may move slowly upward across the picture.
Probable cause: 60Hz AC power is getting into the vertical sweep circuit. It may be coming from a faulty filter in the power supply.
Cure: Troubleshoot the power supply. An oscilloscope will be useful in looking for excessive 60Hz ripple.
2. The picture has light and dark horizontal bars with some curving along vertical lines. The bars may be nearly invisible to intense black and white. Some side-to-side movement may be visible as the bars move upward across the screen.
Probable cause: The power supply filter is faulty, or a filament-cathode short has occurred in the CRT.
Cure: Troubleshoot the power supply. An oscilloscope will be useful in looking for excessive 60Hz ripple. If no significant ripple exists, the CRT may be at fault.
3. Irregular curves along picture edges can be caused by magnets on the yoke. These are convergence problems.
Cure: The magnets can be moved to al-



Joshua Weisberg (left) and Peter Scharff of Scharff/Weisberg in Green Turtle Studios, New York, New York

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leviate the irregularities, but convergence of the picture may result. The problem generally is not the CRT.

A few words of caution

Few technicians like to change picture tubes. The process is not difficult, but it does take time and involves some risk. Because CRTs involve a hard vacuum, mishandling could result in a crack in the glass envelop. Although a crack might permit air to leak into the tube slowly, the sudden inrush of air has been known to cause CRTs to disintegrate with explosive force. Always wear safety goggles when replacing CRTs, in case the glass becomes cracked and the CRT implodes.

In order to operate, most picture tubes require a high voltage applied to their cathode. This voltage may vary from 10kV to 35kV, depending upon the type of tube. The anode inside the bell portion of the CRT behaves like a large capacitor and retains a high-voltage charge. Although that charge should be dissipated soon after the power is removed from the monitor, the possibility does exist that some charge will be retained in the cathode. Be certain to short-circuit the anode connection to chassis ground before trying to work around the CRT.

Rebuilt vs. new

Most CRT failures are gun related. If a new gun assembly is installed, the tube can often provide a few years of service. For a successful rebuild, the phosphor and mask of a color picture tube must not have been damaged and the manufacturer must be able to provide a new gun assembly.

To rebuild the tube, a cut is made in the glass around the neck to remove the old gun assembly. The new gun with appropri-

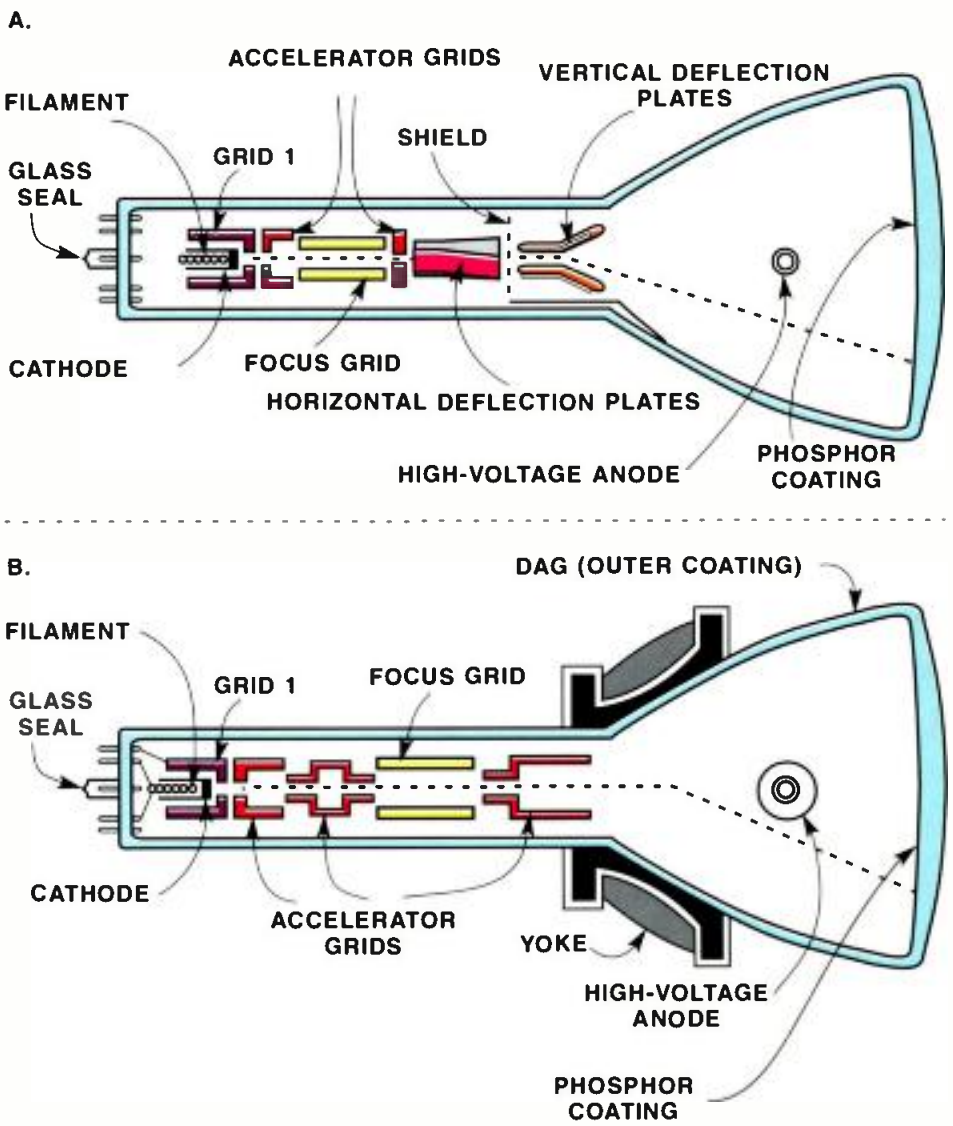


Figure 1. The diagrams compare electrostatic (ES) (see A) and electromagnetic (EM) (see B) cathode ray tubes. Although some of their construction features are similar, the deflection sections are significantly different.

Electron guns and phosphors

Today, four primary types of color CRTs are in use. The most established is the delta dot system, shown in Figure 1. The three sources of electrons are in a triangular array and, after passing through a dot mask, strike triads of phosphor dots that also are arranged triangularly. The in-line dot tube (see Figure 2) places the three sources in a linear array. The dots excited by a beam from these guns are a horizontal linear triple, after the beams pass through a dot mask. Figure 3 shows the in-line slot type tube. The linear array of three guns forms beams that must converge through slots in a mask before they strike phosphor stripes on the faceplate. The fourth type (not illustrated) is the Trinitron, which has three separate cathode and grid 1 elements, but uses common focus and accelerator grids.

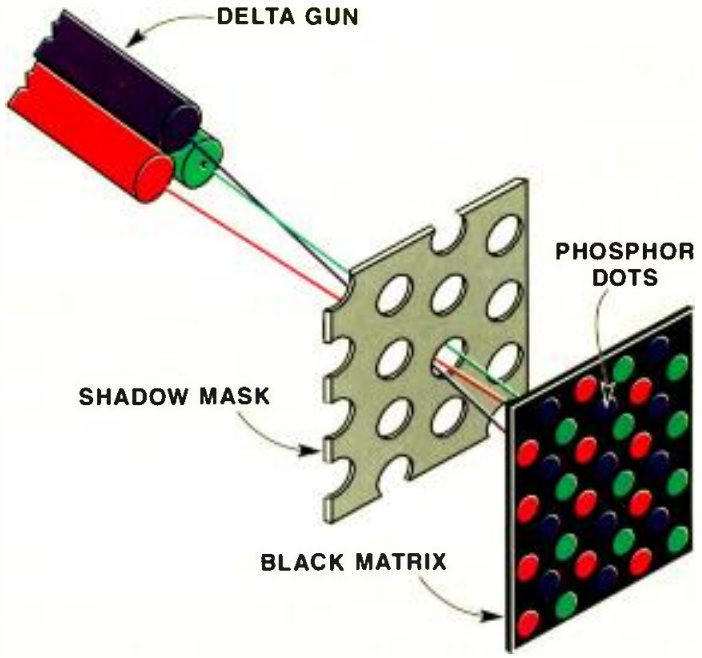


Figure 1. A delta dot system.

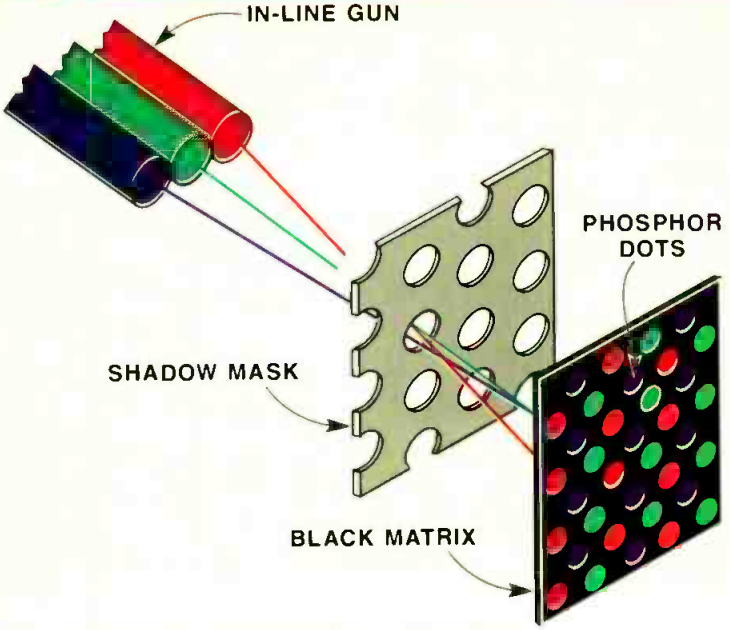


Figure 2. The in-line dot tube of a hybrid configuration.

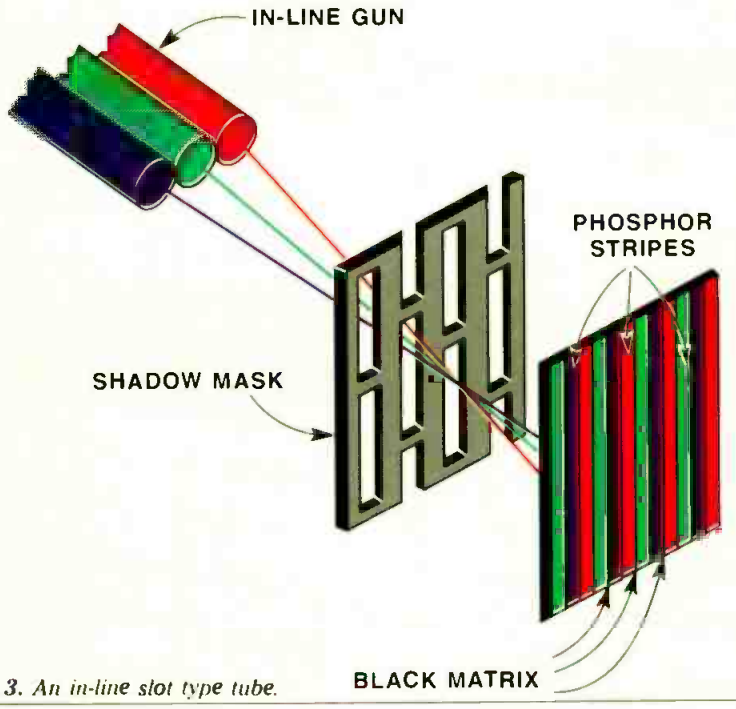


Figure 3. An in-line slot type tube.

ate glass is fitted into place and the glass is "rewelded." A vacuum pump is used to evacuate the glass bulb, after which the tube is sealed.

Rebuilt tubes normally have a shorter warranty than new tubes, but their cost is from one-half to one-third the cost of a new tube. As electronic devices go, a rebuilt tube could outlast several new ones.

Most of the time, tube rebuilders will deal primarily with popular tube types. Some may be willing to work on a less common device, if they can get the replacement gun.

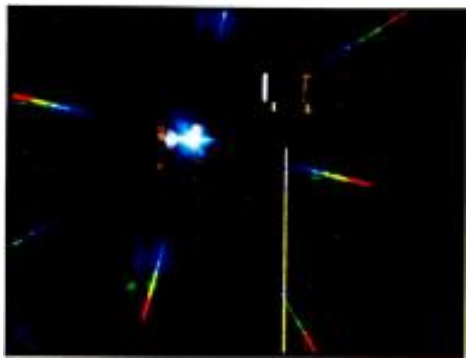
Cutting costs

Most facilities have a large number of monitors scattered through one or more control rooms, edit suites and viewing rooms. Unless the monitors are old, replacement tubes should be available. Except for certain "master" monitors, rebuilt picture tubes could serve the purposes quite well instead of new tubes. The cost differential is worth considering.

Becoming acquainted with CRTs and their operation will permit you to troubleshoot many of your monitor failures and determine quickly if the CRT is at fault or some other component is the culprit. With a better understanding of CRTs, you should feel more comfortable about filling out a purchase order to get a replacement.

➡ *For more information on video monitors, circle Reader Service Number 301.* ■

Applied Technology



Solid State Logic Scenaria

By Mark Yonge

Editor's note: The following article looks at some of the new technology developed for the Scenaria workstation, a major element in Solid State Logic's series of integrated post-production equipment. Because of space limitations, the original article apears in condensed form.

Producing sound for film or television is perhaps the greatest challenge for digital workstations. These projects impose a more formal structure than pure audio work.

Random-access audio editing expands the editor's palette in film and video production. Instead of working to the nearest frame, as in many conventional setups, the editor can make choices as fine as 1/100th of a frame. With multiple tracks available for editing simultaneously, and the ability to move any sound in time relative to the picture, the editor is able to choose and position material in context. This would be difficult for more than a few tracks at a time in film, and extremely awkward for multitrack tape. Similarly, the release from a rigid time framework allows easy implementation of time compression and expansion.

Although valuable, random-access techniques have not been without some operational cost.

System challenges

Although valuable, random-access techniques have not been without some operational cost. For example, it's still impractical to record original production audio on random-access media. Therefore, it is necessary to transfer linearly recorded material onto a random-access storage device, typically by real time dubbing to hard disk. After editing is completed, the finished audio again must be transferred back to a master videotape. Regular back-up of the computer disks also is required, which can add to the unproductive time involved.

Yonge is manager, digital products, for Solid State Logic, Oxford, England.

At present, hard disks are the only practical random-access medium for this application. Imagine an alternative that could provide the same random-access capability, but avoid the upload/download necessity. Magneto-optical disks suggest what could be done with a physically removable random-access medium. However, their comparatively low speed and limited capacity per disk renders them unsatisfactory as yet for many applications.

Consequently, hard disks will likely carry the bulk of high-performance digital editing for awhile. Used intelligently, they can perform well in terms of sophistication and cost-effectiveness.

A multi-user network

Avoid the upload/download problem by installing random-access editing stations on a computer network. This breaks the dependence of individual users upon isolated storage disks, so that a central resource of audio storage can be available to all users. Whole projects can be moved between users without leaving the digital domain, and without repeated loading.

A network approach also allows each workstation to have multiple jobs in progress during the work day. Assuming sufficient disk capacity exists at the central server, the operator can switch quickly between sets of stored files, as dictated by production needs and clients' schedules. With such an arrangement, a current project need not be completed before starting on the next one.

Furthermore, a single complex job could be broken into smaller components across several workstations, with each sharing necessary common audio and video elements. After the components' completion, the full project can be synchronously reassembled at the master workstation.

The system

Scenaria is such a master workstation. It combines a 38-channel, fully automated digital mixer with a 24-track random-access digital recorder/player. It also incorporates full audio editing facilities and

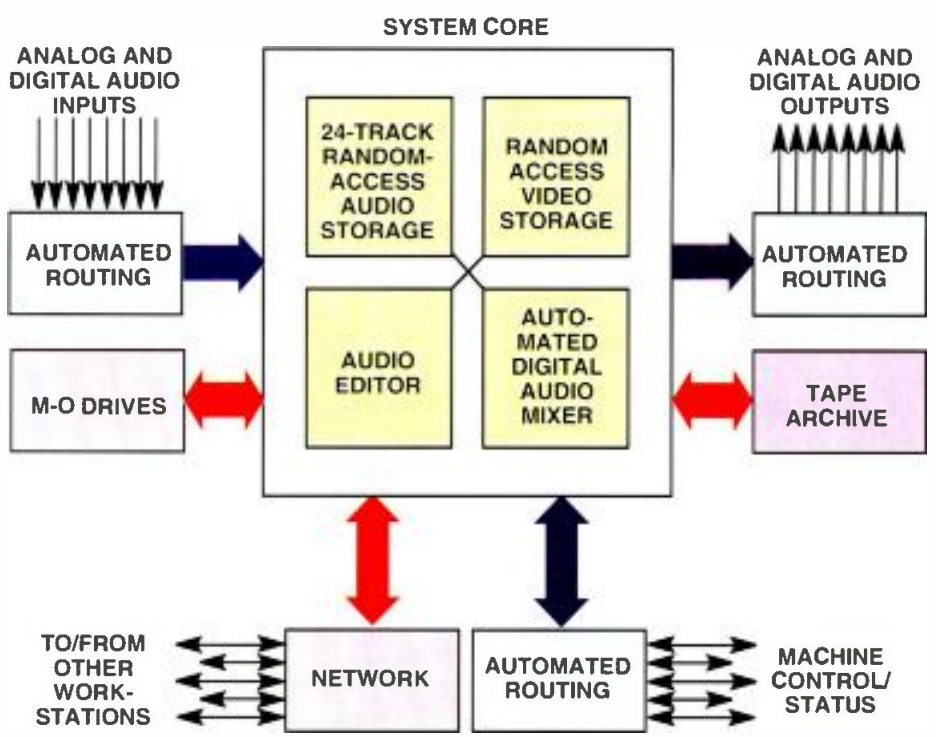


Figure 1. Conceptual block diagram of the Scenaria system.

machine control for conventional VTRs. It contains a unique random-access video storage system, and an expandable, computer-controlled routing system for audio (analog or digital) or serial control signals. (See Figure 1.)

This device operates on a high-speed network by which it can communicate with other similar units or with another earlier workstation from the same manufacturer (ScreenSound). Previously edited and stored material can be instantly recalled via the network to appear on the system's faders.

The network can handle up to seven users, providing up to 56 channels of digital audio simultaneously. This represents a sustained data rate of more than 4.3Mbit/s without any interference or service waits. The network file server currently supports up to 48 hours of central storage, with off-line data backups and a central magneto-optical disk library incorporating database search and retrieve support.

The following provides a more detailed look at this system's operation:

• *Mixing.* Motorized faders and tactile controls allow simple operation and continually show the user what's happening. Faders can be grouped together in single or multiple layers. Faders, parametric EQ, pans, channel delay, auxiliary sends and full dynamics in each channel are dynamically automated to reproduce a complex mix precisely and repeatably. Automation can operate in a snapshot or dynamic (time-code-based) fashion, or in a combination of both.

Avoid upload/download problems by installing random-access editing stations on a computer network.

• *Integrated editing.* In the process of mixing, the system still allows direct access to its integrated editing system. More important, when returning to mixing after such editing, the automation information previously stored is altered to match the new edits. There is no need to remix from scratch whenever a few lines of dialogue are changed or a scene is removed. The preparation of alternate versions for different markets also becomes straightforward and fast.

• *Instant pictures.* When using conventional VTRs to provide video reference to a random-access audio system, the limitations of the linear video transport become apparent. Although the audio system jumps to a new part of the soundtrack instantly, the videotape has to catch up and lock in sync. Waiting for sound and picture sync to be re-established continually interrupts the editing process and erodes concentration. This system solves the problem by integrating a hard disk video recorder that provides a visual reference with the same instant access that the sound has. The video reference automatically follows the audio in sync at any speed, and cues quickly to any new point.

The Scenaria system installed in a typical application, with ScreenSound prelay workstation in foreground.

• *External routing.* The system has analog or digital inputs and outputs for interfacing external sources and special processing. It also includes an automated patchbay with a bidirectional, balanced switching matrix under computer control. The multilayer switcher handles analog audio, AES/EBU digital audio and serial machine control data. Patch setups can be stored and recalled any time.

Scenaria provides a highly integrated environment for audio post-production and solves some of the problems encountered in earlier non-linear production styles. Furthermore, it builds upon the installed base of earlier products from its manufacturer (ScreenSound, SoundNet and PatchBay), extending the value of previous investments rather than obsoleting them. This approach exemplifies the quality, speed, organizational benefits and value offered by integrated digital production systems.

➡ *For more information on the SSL Scenaria, circle Reader Service Number 303.* ■

Continued from page 61

on the air with good sound and minimum cost. In many markets, it's possible to make a good living by servicing several radio stations as a contract engineer.

Television is moving in the same direction as radio has over the past 15 years. Some stations rely on part-time employees for master control, studio cameras, news vans and to act as reporters. The benefits and traps discussed for radio also apply to television.

One major difference exists between radio and TV contract work. People working part-time in television often are employed in another industry, such as cable or a production facility, as opposed to another TV station. TV stations are usually more careful about multiple station relationships. They also tend to require their part-time workers to have a higher skill level.

Today's stations need fewer employees to operate.

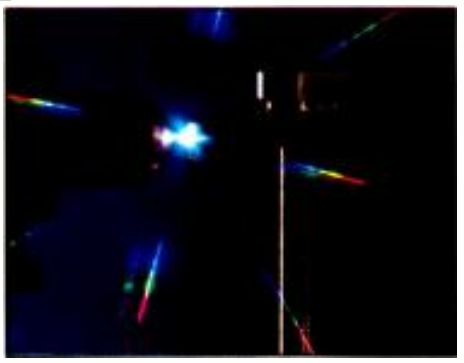
Self-employed engineers should make sure they provide their own health insurance and retirement plan. They must also protect themselves with business insurance and use contracts for all their clients. Furthermore, there must be a written understanding as to which station gets first service during problem periods. It's also important to have a backup contract engineer who can cover for you when you are unavailable.

You must keep your job skills current.

Use the technique of maximizing profit. Find the maximum amount that a station will pay for contract service and then charge that amount. If you don't charge enough, you'll probably end up with too much work and too little money. If you charge too much, you'll have less work and even less money.

Set two hourly fees. One fee should be for use as part of your retainer. The other should be a much higher fee that is charged for on-call service. The goal is to have a well-priced retainer plus the highest hourly fee the market will bear. One savvy technique to pricing information is to ask around locally. Being your own boss is no panacea, but it can work. The key is to have good business sense and be willing to work hard. ■

Panasonic Multi-Station II system



By Mark Mifflin

In the future, multiple TV stations will be run from a single facility. Panasonic has worked with Providence Journal Broadcasting to prepare for this trend and develop an innovative automation system that combines a library automation system with station automation software.

In June 1992, Providence Journal began controlling two stations from one control room in Tucson, AZ, using such a system. Providence Journal, which owns Fox affiliate KMSB, purchased the studios and associated equipment from independent KTTU, and entered into a local management agreement to program and sell KTTU's air time. The purchase did not include the station's license, transmitter or tower. The two stations merged, with personnel from KMSB moving to the newer and larger KTTU facility.

One control room

Panasonic's Multi-Station II system offers users a range of options for automating the playback of commercials and programming for more than one station. With this system software, a TV operation can simultaneously air two or more channels of completely different commercial and program material from the same control room, using minimum manpower.

The system consists of the M.A.R.C. library, its control console computer, two output channels, a record system, the automation system host computer, a central database and two cassette dub stations. (See Figure 1.) These subsystems are linked via a local area network (LAN) and other control cables. The LAN is used for transmission of data and files between computers. RS-422 serial control cables are used for critical real time controls, such as event-cuing data, start, stop and recue.

Library and compiler

The purpose of the M.A.R.C. library and compiler in this system is to prepare spot breaks for the two separate stations from a single spot library. (The library contains the playback VCRs and all the spot material for both stations. Many of the spots run on both stations.) Each station's spot breaks are pre-assembled from the material in the library and recorded on an external VCR.

The library's console computer manages the playlists and database, while the library plays the breaks to be compiled onto the external recorder. After the compiling process, the console computer provides the *as compiled* information to the automation system's host computer.

The compiled spots and time code are recorded on 90-minute cassettes. For a day's operation, each station's commercials and promos typically fit on three cassettes.

Figure 1. *Basic block diagram of a 2-station automation system.*

Output channels

Each output channel consists of a device-control computer, break players, program players, 10×1 routing switchers, bar code readers and user interfaces.

The device-control computers control the commercial break players and program players as well as the 10×1 routing switchers. These computers allow a station to use its existing broadcast VTRs, including MII, 1-inch, 3/4-inch and other video formats. Currently, seven players may be connected, and the operator can select any one to play programs or compile spot cassettes. Each of these players is assigned a bar code number for identification.

Figure 2. *A horizontal split-screen on the automation computer terminal displays two different stations' schedule data simultaneously.*

The operator uses the bar code reader to read the player's bar code number and the cassette bar code number as cassettes are loaded, thereby minimizing the possibility of error. Without this precaution in a hectic, dual-purpose control room, an operator could reverse a pair of cassettes.

The 10×1 switchers place the appropriate spot or program player on the output bus at the correct time.

Record system

Because the device controllers are configurable, they also can control recording. The record system at KMSB/KTTU records incoming satellite feeds. The system can handle up to eight simultaneous recordings. Just as the playback channels follow daily playlists, the record system accepts a record list for the day's satellite feeds.

The start command for these record events can be generated by clock time or by a manual trigger. The manual event may be started by the operator pressing a button or by a cue tone, if one was provided by the satellite transmission.

Dubbing and screening process

The system's 2 cassette-dubbing stations assist the operator in dubbing the commercial spots and screening programming material for each station. These stations each consist of a computer, a source player, a recorder, a bar code reader and a 10×1 routing switcher. The dub stations are on-line with a database in order to add new cassette data or access existing information about specific cassettes. The operator uses one station to dub commercial and promo material to the library format, and to create the database records.

The other station is used for screening recorded program material and marking time-code points for each program segment. The operator marks the time-code start and end points of each program segment with a simple keystroke. These time-code points are kept in the database, and are used by the device-control computer

Mifflin is senior product engineer for Panasonic Broadcast & Television Systems, Secaucus, NJ.

in cuing and playing the program segments.

Time-saving interfaces

While the operator is marking a program's start and end points, other points also can be marked for insertion of a station ID key during playback.

In addition, the system incorporates audio voice-over triggers, commonly used to start an audio cart at the end of a program. The station's log simply indicates an audio event, and the automation system's list makes the trigger part of the program event, backtiming it appropriately.

Host computer

The automation system's host computer allows the operator to supervise and control the entire system. This computer holds the day's playlist for each station, and allows the operator to edit and control each independently. If last-minute changes must be made, the operator makes them at the host computer.

The two stations' lists are displayed in a split-screen form, so the operator can view either easily. (See Figure 2.) The status of each controlled playback VCR is displayed on the right side of the screen. When the operator selects the list editor, all the details for that event are displayed.

In the future, multiple TV stations will be run from a single facility.

A day's operation

The step-by-step process for airing material is rather simple. (See Figure 3.) Traffic provides two logs, one for each station. These are then split into two listings, one with spots to be compiled and another containing each station's program events.

The programming department provides a daily list of already-in-house syndicated programs and movies to be timed, as well as programs to be recorded from satellite. The latter is loaded into the record system, and satellite feeds are recorded throughout the day according to that list.

The operator places newly recorded satellite feeds or in-house programs into the dub station for screening. Start, end and station ID key points are marked, and the cassettes are placed into available playback-channel VCRs.

The new program data flows to the database, and the host computer uses this data to complete the respective program event on the station's playlist.

Spot compiling

Spots that are not in the database are placed onto a *make list*. The operator uses this list at a dub station to record the commercials or promos, and then places the newly recorded cassettes into the library. The data for each of these cassettes is sent to the database.

Each station's spot-compile list is actually handled in three segments, because approximately one-third of the day's spot material can fit on a 90-minute cassette. The library plays the compile list, and the external VCR records the audio, video and time code on one of the three compile cassettes. After each compile cassette is recorded, the operator places it into an available player.

During this recording process, as-compiled information is automatically generated, noting the time-code location for each spot recorded on the cassette. This information is sent to the automation computer, and later is used to cue and play that compiled cassette.

The as-compiled information is merged with the program data by the computer, forming the two stations' complete automation lists, each containing spot and program information.

Program and spot playback

On each output channel, the spot or program events are rolled either manually or automatically. For example, the operator may roll the commercials and promos from the control panel during a live event.

During the afternoon movie, the programs and commercial breaks are rolled automatically, but the operator may alter the playback by rolling an event early or editing the duration.

With this system, a station can air two or more channels of different material from the same control room.

As each event is played, as-run data is sent back to the automation computer, where it is transferred into an as-run log for each station. The traffic department will use these logs for automatic reconciliation.

Occasionally, the operator must play something different than the events that have been compiled. To do this, the operator simply edits the list to play the desired event or compilation from a different player controlled by the system. The device control computer also can roll and switch directly to the library to execute a different playlist.

Other applications

At News Press & Gazette's three stations in South Dakota (KSFY-TV, Sioux Falls; KABY-TV, Aberdeen; and KPRY-TV, Pierre), a similar automation system enables the running of virtually the same programming for all three stations, while playing different commercial breaks for each.

These stations have used the system since September 1991. The hardware is located at KSFY, where it makes the commercial break reels for each station, feeding the remote stations via microwave links.

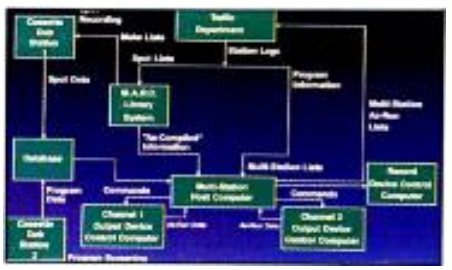


Figure 3. Information flow diagram for the Multi-Station system.

Future developments

The operational requirements of a broadcast facility are becoming more demanding in the 1990s. Although the need for playback flexibility and the volume of satellite recordings increases, staff size may remain fixed and the station's profitability must grow. Some broadcasters will add entirely separate channels through consolidations or ventures into alternative programming, while others add regional feeds or break-away cable TV links.

The operational requirements of a facility are becoming more demanding in the 1990s.

Panasonic has integrated two systems to form a cohesive whole that meets these stations' demands. The Multi-Station system provides the flexibility of today's library hardware with the capacity of comprehensive automation for broadcasters as they enter the era of multicasting.

➡ *For more information on Panasonic's Multi-Station software, circle Reader Service Number 302.* ■

Field Report

Wheatstone TV-600

By Bud O'Connor

Early in 1991, WUSA-TV began looking at control room audio consoles for its planned new facility. The consoles would be used for audio mixing of all news and production for air in two identical control rooms. Because the station generates five hours of local news each weekday, the new consoles had to work well on fast-paced news shows.

A few important criteria were set for the consoles:

- *Flexibility.* Versatile operation was required for dealing with a wide range of on-air situations and for accommodating the variety of operating personnel.
- *Simple multiple-mix capability.* Developing a mix had to be quick and easy.
- *Respectable audio performance.* Superior general performance was necessary, with an emphasis on microphone preamp quality and plenty of headroom.
- *Other concerns.* The console had to have good monitoring control, reliable operation, redundant power supplies and easy interface to a BTS switcher.

Installation and orientation

Wheatstone's TV-600 console met almost all of these criteria.

The consoles had arrived undamaged, thanks to proper packaging. The manufacturer also provided much of what was necessary for installation. Slide rails (optional) are highly recommended if the rear of the board is to be placed near a wall or window.

We only had about a week of actual hands-on rehearsal time for audio before operations were switched to the new building. Once on the air, the audio operators did exceptionally well, considering the chaos around them. While other systems failed, audio held firm. Furthermore, few problems could be blamed on the audio operators. This was partially because of the consoles' physical layout, which allows operation to be tailored to the user's needs.

Operational features

These consoles possess several elements that have proved their worth to WUSA:

- The mix system is elegant yet comprehensive, featuring two separate stereo mix buses, a separate mono bus and two dedicated mix-minus buses. All modules can participate in any or all buses. In addition, up to eight submasters (or four stereo pairs) and a variety of auxiliary send configurations are available. Any of these buses can be used for conventional mix-minus, or the unique *Bus-Minus* system can be employed. In the latter case, a selected mix bus's audio minus a particular input module's output is fed from that module back to the remote site. The backfeed's level is controlled by a mix-minus output pot on each module.
- The microphone pre-amps have performed admirably. Even without prelimiting, these amps have handled huge swings in level. They rarely exhibit audible distortion.
- Control of module input selection, usually not a hot topic, is superb. There is little problematic audio that the board can't re-route or otherwise accommodate.
- The meter bridge sits low, and it uses large analog VU meters that provide good visibility. At the station's request, the manufacturer added a cue-metering circuit that allows an operator to visually preview the audio level of an upcoming event.

Factory service

Service from the manufacturer has been excellent. Factory representatives have made two on-site visits — one to adjust gain structure on the mic pre-amps to the station's requirements, and the other to install a custom monitor-logic redesign.

Maintenance technicians appreciate the consoles' circuit-board extenders. They are actually extension cables for the edge connectors, which allow the malfunctioning module(s) to be laid on the board for testing and tweaking. Two sets of extenders were supplied with each console.

Documentation for the TV-600 was slow to arrive. The console was a new product, and the manufacturer originally supplied documentation for its predecessor, the TV-500. Subsequently, the proper documentation did arrive. So far, it appears to be clear and comprehensive.

Areas of concern

A few minor issues of potential difficulty are worth noting. First, the board runs warm. As yet, this has not been a problem. However, it is the station's first audio console that makes ambient cooling a consideration.

Next, the rear of the console connects with DB-25 for audio and control. In itself, this is not a problem. However, these DB-25s must be disconnected to remove a module. This requires rear access to the board so that a maintenance technician can undo the connectors, and then pull out the offending module. This is not ideal, especially for an on-air situation.

It is unfortunate that stereo line/mic modules weren't available when we purchased the console. These would have made the process of partitioning the console much easier. However, the new modules are available now.

Overall, the Wheatstone TV-600 is an excellent device. The two units at WUSA-TV have served the station well, especially from the operators' point of view. The consoles' design allows users to easily harness the full extent of their power. In a busy news control room, they are a welcome tool.

Performance at a glance:

- *Custom configurable audio mixing console, up to 52×8×2×2×1, plus a variety of auxiliary and mix-minus sends.*
- *Flexible operation, optimized for the TV environment.*
- *Frequently used controls located nearest to the operator.*
- *Signal path allows every input module to be discretely assigned to any mix bus.*
- *Digital quality audio performance.*

O'Connor is a maintenance engineer at WUSA-TV, Washington, DC.

Editor's note: Field reports are an exclusive *BE* feature for broadcasters. Each report is prepared by the staff of a broadcast station, production facility or consulting company.

In essence, these reports are prepared by the industry and for the industry. Manufacturer's support is limited to providing loan equipment and to aiding the author if requested.

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

➡ *For more information on Wheatstone's TV-600, circle Reader Service Number 304.* ■

New Products

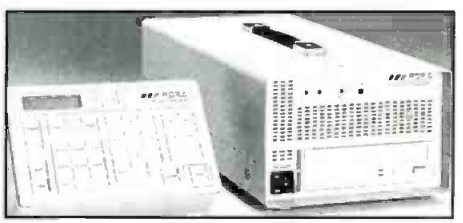
High density VDAs
By Grass Valley Group
• **8800 and 8801 series:** family of video distribution amplifiers; compatible with 8500 series, but contain two additional outputs and state-of-the-art surface-mount technology; 8800 VDA is for use in professional video systems and less demanding applications, such as monitor feeds; 8801 VDA includes loop-through inputs, six or eight output flexibility, delay-matched to previous generation 8501.

Circle (351) on Reply Card

NTSC signal generator
By Tektronix
• **Pathfinder TSG90:** features 16 video test signals, two channels of audio tone with 13 selectable frequencies, as well as video and audio channel ID; performs signal path checking and signal path verification; full alphanumeric keypad serves as keyboard; backlit LCD panel provides clear display in low-light conditions.

Circle (353) on Reply Card

Compact still-store
By FORA
• **CSS-200:** uses JPEG to provide approximately 200 TV frames on a single 50Mb removable cartridge; allows 0.6 second access of images; on-air preview and line output control; accepts composite (NTSC) and gen-lock signal inputs; available in three models: NTSC composite, NTSC component and PAL component.



Circle (355) on Reply Card

Demodulator
By Videotek
• **DM-141A:** new design with improved specifications and features; capable of tuning in 154 channels; channels tuned are 2-13, which are the same for the cable and antenna modes; 14-69 UHF in the antenna mode; and 14-99 in the cable mode.

Circle (369) on Reply Card

Radio console
By Wheatstone
• **A-6000:** built-in routing switching with individual alpha channel displays; features a bus-minus system, four mix-minus buses, logic-controlled program and mix-minus buses; user can relocate any module anywhere in the mainframe at any time; includes equalization option.

Circle (366) on Reply Card

"I compete with the giant studios, so my business image is very important."

–Stewart Tilger, Photographer, Seattle, WA

"That's why I replaced my old dot matrix with the HP LaserJet IIIP printer," says Stewart Tilger.

Now his proposals and invoices look every bit as good as anything his bigger competitors put out. Thanks to the scalable typefaces and HP's patented Resolution Enhancement technology, the print quality, Tilger notes, "is great. The type is so crisp and really smooth. You don't get any breakup in the letters."

The HP LaserJet IIIP printer comes with great customer support, too. There's a Customer Support Center to help Tilger get the most out of his printer. What's more, the IIIP is compatible with virtually all popular software packages. So he doesn't have to worry about whether his old software will work with his new printer.

To learn more about the most affordable HP LaserJet printers—the IIIP and IIP *plus*—dial **1-800-LASERJET (1-800-527-3753), Ext. 7016*** for our free video.

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Cart machine

By Odetics

• **Accu-Cart:** turnkey cart machine allows stations to automate on-air commercial and program playback without the need for other equipment or software programs; dual-size cassette storage; on-line storage of up to 150 carts; sophisticated auto-targeting and auto-loading capabilities; built-in database management; compatible with S-VHS, Beta SP with PVW and BVW, M2, D-2, D-3, D-5 and digital Betacam (when available).

Circle (357) on Reply Card

Editing system

By CMX/Chyron

• **Cinema:** non-linear, off-line editing system; uses digital video compression hardware and software to store and retrieve images; source material digitized from any composite source in real time; produces EDLs for video or cut lists for film conforming; displays source and master sequences as full-screen video; allows user to add or delete scenes as needed.

Circle (358) on Reply Card

Audio console

By Wheatstone

• **Audioarts engineering A-50:** gold contact switches for bus assignment and source selection; totally enclosed meterbridge housing protects Sifam VU meters from RF; burned-in and socketed ICs; includes machine control capability and individually programmable channel logic that is dip switch selectable; 110dB dynamic range; $\pm 1/4$dB (20Hz-20kHz) frequency response; 0.003% THD.

Circle (365) on Reply Card

Network system additions

By Solid State Logic

• **new SoundNet features:** print-a-directory allows directory of any device on the network to be printed on-screen or to a serial printer, including Sound Files and Desk Files stored on hard disk and MO disks; directories of up to 32 off-line MO disks can be stored in SoundNet database; permits back-up and restoration of individual Desk Files, Desk Files with audio sources or the entire working disk; tape directory can be viewed prior to restoring any or all of it.

Circle (367) on Reply Card

Editing system

By CMX/Chyron

• **OMNI 1000E:** enhanced version of the OMNI 1000; uses a multiprocessor architecture built around an MC68040 CPU; provides real lookahead, assembly and preview; offers simultaneous control of 10 VTRs.

Circle (361) on Reply Card

Program interface

By Computer Assisted Technologies and New York & Video Design Pro

• **BCAM and VidCAD:** programs share common databases of equipment and systems; changes made within BCAM or VidCAD are automatically reflected for both programs.

Circle (363) on Reply Card

Production-air console

By Wheatstone

• **SP-4:** offered in 2-, 4-, and 8-track formats; phone module can handle multiple callers; intercom module allows communication between other Wheatstone consoles and rack-mount locations within a facility; includes a studio control module, line preselectors, tape controllers and automatic timers; gold contact switches and I/O connectors.

Circle (364) on Reply Card

Software display package

By Chyron

• **CODI MATE:** software product controls logo, time and temperature display when using CODI text and graphics generator; includes screen interface and cursor-controlled, on-screen object movement.

Circle (359) on Reply Card

Video level meter

By Dorrough Electronics

• **CVLM-40:** includes a 40-segment LED bar graph; peak/average feature allows evaluation of lighting conditions, contrast, dropouts and general picture quality; weighs less than two pounds; can be read from a distance of 20 feet; may be rack-mounted or operated as stand-alone package; 25kΩ unterminated, 75Ω terminated input impedance; −32IRE to −50IRE sync range; 4IRE meter resolution; simultaneously displays three video levels: sync, average luminance and peak luminance.

Circle (368) on Reply Card

■

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