BROADCAST ENGINEERING

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Testing coaxial lines p. 82

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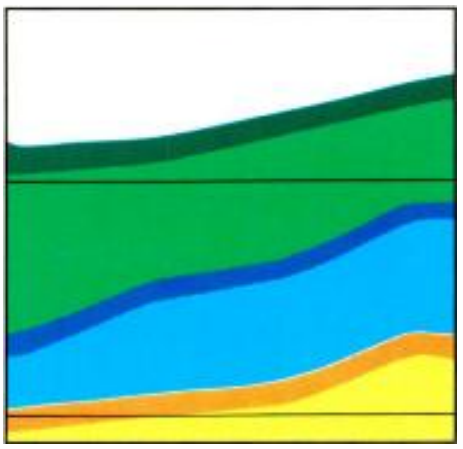

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PROFITABLE TECHNICAL MANAGEMENT:

The terms "profitable" and "technical" are no longer mutually exclusive. Today's technical managers are moving from the back room into the front office. They realize the importance of their facilities making money, and profit is no longer an ugly word. The managers who direct the use of technology and those who make use of it are now on the same team.

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ON THE COVER

Profitable operation today means more than the sales department. Even the engineering and technical staffs have become crucial elements in the profitability of a facility. The cover illustrates the intertwining of technical support for profitable facility operation. (Cover illustration by Kim Bracken, *BE* graphic designer.)

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News

By Dawn Hightower,
senior associate editor

Broadcasters announce AM radio campaign

At the Radio 1991 Convention Sept. 11, in San Francisco, a campaign to acquaint the public with new high-quality AM receivers was unveiled.

The campaign is designed to promote new radios that provide listeners the improved sound now being broadcast by AM stations.

Consumers will be able to distinguish the new radio receivers by the AMAX certification mark they carry.

The year-long campaign started Oct. 1 and more than 1,100 AM stations have pledged more than one million spots promoting AMAX-certified receivers. The radio spots have been produced in different formats for use by local AM stations nationwide. Kits, with ideas to tie in promotions with local retailers, were mailed to all participating stations in September.

To use the AMAX or AMAX stereo certification mark, receiver manufacturers must incorporate six technical standards into their radios:

1. Compliance with the NRSC voluntary bandwidth and distortion receiver standard IS-80. This calls for a minimum bandwidth of 7.5kHz on home radios and 6.5kHz on mobile radios for three years starting Sept. 30, 1991.
2. Manual or automatic bandwidth control.
3. The receiver must have an AM tuning capability. If the receiver is stereo, the certification mark becomes AMAX stereo.
4. AM noise blanking, a system that significantly reduces many kinds of static.
5. External antenna capability, so that a signal can be introduced into the receiver from an external antenna in situations where the AM signal is shielded by steel in buildings and other factors.
6. Expanded AM band capability so that the radio can receive the new 1605kHz to 1705kHz segment of the AM band.

Broadcasters test equipment to remove "ghosts"

In mid-September, field tests were begun as part of a process to select a voluntary standard that removes "ghosts" or multiple images from over-the-air and cable TV reception.

The National Association of Broadcasters (NAB), working with broadcast, cable and consumer electronic groups, will test and evaluate ghost-zapping proposals from five different groups. The tests will be performed with the assistance of three Washington, DC, TV stations: WRC-TV, Channel 4; WDCA-TV, Channel 20; and WFTY-TV, Channel 50. These TV stations were selected because they occupy the VHF, low UHF and high UHF airwaves.

Selecting a single standard will encourage broadcasters to incorporate the ghost-canceling technology in their TV transmissions and spur TV set makers to install the complementary technology.

NAB's partners include the Electronic Industries Association (EIA), the Association of Maximum Service Television (MSTV) and CableLabs. The NAB also will be sharing its results with the Advanced Television Systems Committee (ATSC).

The groups that have submitted proposed standards for field-testing are the Broadcast Technology Association of Japan (BTA) Samsung Electronics, AT&T/Zenith, Philips Laboratories and the David Sarnoff Research Center/Thomson Electronics.

FCC to reconsider pioneer preference

The NAB, concerned about the way the nation's airwaves might be carved up in the future, is asking the FCC to reconsider a recent decision that would automatically award a "pioneer preference" to innovators of new communications services seeking radio spectrum.

Granting a pioneer preference to developers of new broadcast technology should not be an automatic ticket to secure a federal license to use radio frequencies, NAB told the Federal Communications Commission (FCC) last week.

Such a rule would "dramatically and artificially increase the number of spectrum requests for new services," without first going through the traditional process of establishing a public need. This process is part of the FCC's statutory mandate, which places great weight on public interest needs before awarding any broadcast or communication license.

NAB also had other problems with the new rules, and feels they are too vague, will confuse applicants, and ultimately lead to lengthy legal action. Because spectrum is a valuable commodity, NAB said the FCC pioneer rules "may...work against (the) optimum public interest use of spectrum," and lead to "awarding spectrum to

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BROADCAST ENGINEERING

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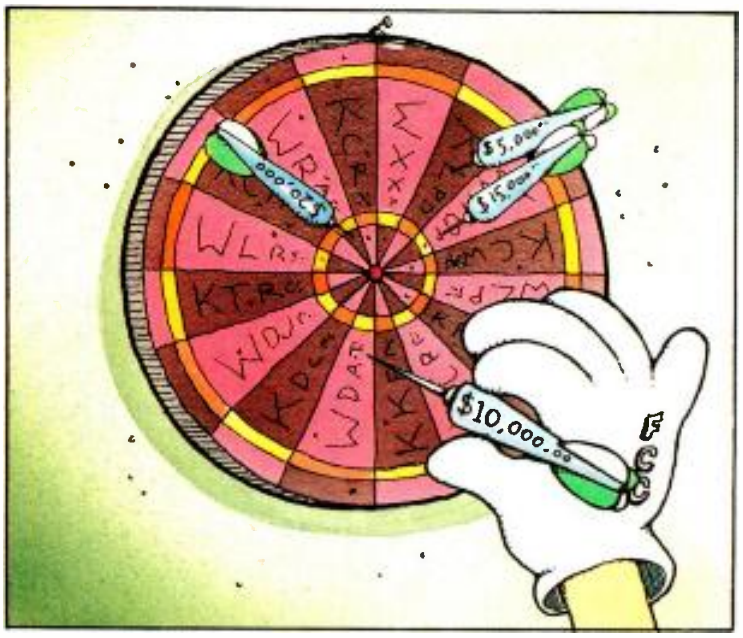
You could be next...

"The government is mainly an expensive organization to regulate evil-doers and tax those who behave; government does little for fairly respectable people except annoy them."
— Edgar Watson Howe

This quote may represent how the FCC's field offices enforcement of regulations is perceived. The days of lax or no regulation have come to a screeching halt, and may catch some broadcasters with their regulatory pants down.



The FCC recently conducted an experiment at nine stations in the Southern California area. The stations were sent a form with questions about their technical operations. The forms were to be completed by station personnel and returned to the commission. Although the questionnaire was called voluntary, would you have the courage to refuse to complete it? Furthermore, how honest would you be in telling the FCC that your station had technical problems or was violating any regulations?

It's been rumored that after the California test, the same idea might be applied on a national level. Say what?

Even my children won't admit they've done something wrong unless they think I already have proof or that it might be discovered. Let's be realistic.

Having stations conduct a self-test isn't going to cure any problems. Such a program will likely do only two things: First, it will cause people to lie. Second, we'll see the sprouting of consultant-type services that will help the stations complete the self-test — not fix the problems. These services could help dishonest stations complete the questionnaires in such a way that the facility appeared to be operating properly. The net result would be a fee paid to the service and no mail-order fine to the dishonest stations.

You could argue that conscientious stations would make the necessary improvements before completing the questionnaire. However, I'll bet that many more stations would opt for the paper approach and avoid dealing with the technical issues at all. So what's to be accomplished?

But wait, there's more. Consider this scenario: An FCC field officer is driving home one evening and passes an antenna farm. He notices that the second beacon on the third tower is out. The next day, he calls the FAA to see if the outage has been reported, and finds that it hasn't.

This same field officer drives home that evening (24 hours later), again noting the missing beacon light. At the office the following day, he fills out the paperwork to fine the owner of the tower $80,000 and each tenant $20,000. Sound like a nightmare? Well, wake up to reality. It could happen to you.

In a time of shrinking staffs and money, the commission is still faced with regulating this industry. Consider the advantages offered by the above practices: minimal time and effort required, coupled with maximum potential for fines (money). What more could a business want?

If you don't have a copy of the commission's publication 91-217-38213, you should purchase one immediately. It's the FCC's policy statement on standards for assessing forfeiture. In layman's terms, it's a *fine list*.

Few would argue for no regulation of this industry. Even so, isn't there some other way than through the use of phony self-examinations and unreasonable draconian-like financial penalties?

Brad Dick

Brad Dick, editor

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FCC sets forfeiture standards

By Harry C. Martin

The commission has adopted a policy statement establishing standards for assessing forfeitures. The standards set a base forfeiture amount for specific classes of forfeitures, as well as upward and downward adjustment criteria for each specific violation.

Forfeiture authority

In 1989, Congress substantially increased the amounts of FCC forfeiture authority. For each violation or each day of a continuing violation, the commission may assess forfeitures of up to $25,000 against broadcasters, cable operators or applicants for such facilities. In addition, there is a limit on forfeitures for continuing violations involving a single act or failure to act of $250,000.

Base forfeiture amounts

The base forfeiture amounts are based on a ranking of the relative gravity of the violation, and are computed as a percentage of the statutory maximum for the service involved. For example, failure to comply with prescribed tower lighting and marking requirements, which is considered a grave offense, has a base forfeiture amount of 80% of the relevant statutory maximum — $20,000 (80% of $25,000). In contrast, failure to provide required station identification is considered a minor offense and has a base forfeiture amount of 10% of the relevant statutory maximum, i.e., $2,500.

Adjustments

Once the relevant base forfeiture amount is determined, the next step is to apply the relevant upward and downward adjustment criteria. Each of the upward and downward adjustment criteria is assigned a specific percentage range, which is applied against the base forfeiture amount. The adjustment criteria were derived from the new law, which instructs the commission to "take into account the nature, circumstances, extent and gravity of the violation and, with respect to the violator, the degree of culpability, any history of prior offenses, ability to pay, and such other matters as justice may require." In establishing specific criteria to carry out its statutory mandate, the FCC also will take into account the economic benefit of the violation, the harm caused by the violation and the violator's financial condition.

Any of the following upward percentage adjustments will be applied to the base forfeiture amount when warranted:

- Egregious misconduct 50-90%
- Ability to pay/relative disincentive 50-90%
- Intentional violation 50-90%
- Substantial harm 40-70%
- Prior violations of same or other requirements 40-70%
- Substantial economic gain . . 20-50%
- Repeated or continuous violation . . . . . variable

Any of the following downward percentage adjustments may also be applied:

- Minor violation 50-90%
- Good faith or voluntary disclosure 30-60%
- History of overall compliance 20-50%
- Inability to pay . . . . . variable

Example: In adopting its new standards, the FCC gave the following scenario: For a licensee who uses unauthorized equipment for one day, a base forfeiture amount of $10,000 is established. If the relevant upward adjustment criteria were determined to be a 70% increase for intentional violation and a 40% increase for substantial harm, each of which is within the range established in the standards, increases of $7,000 (70% of $10,000) and $4,000 (40% of $10,000) would be added to the base forfeiture, for an adjusted forfeiture of $21,000. If it were also determined that there should be a 30% downward adjustment for a history of overall compliance by the licensee, which is also within the established range, the forfeiture would be reduced by $3,000 (30% of 10,000) to $18,000. If the broadcaster made a specific showing that an $18,000 forfeiture would cause substantial economic hardship, the forfeiture would be further reduced.

Facsimile signatures rejected

The commission has affirmed the dismissal of four applications for new FM stations because they were submitted with facsimile, rather than original, handwritten signatures. The applications were considered defective under the FM "hard look" processing procedures.

In adopting its "hard look" approach, the commission put potential applicants on notice that certain portions of FM applications are crucial for tenderability and that applicants without such information at the close of the filing window would be dismissed without an opportunity to amend. The agency identified a signature as one of the items crucial to tenderability of commercial FM applications.

Although the "hard look" criteria pertain only to commercial FM applications, the original signature requirement applies to all broadcast applications.

Failure to comply with prescribed lighting and marking	$20,000
Failure to permit inspection	$18,750
Failure to respond to commission communications	$17,500
Exceeding power limits	$12,500
Unauthorized emissions	$12,500
EBS equipment not installed or operational	$12,500
Unauthorized discontinuance of service	$10,000
Use of unauthorized equipment	$10,000
Violation of main studio rule	$10,000
Construction or operation at unauthorized location	$10,000
Failure to make required measurements or conduct required monitoring	$2,500
Failure to maintain required records	$2,500

Table 1. *Some base amounts of forfeitures applicable to broadcasters and cable TV operators.*

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

"What I Like About the Odetics Cart Machine."

"When I joined WTVH two years ago, the existing cart handling equipment was more than 15 years old. There was a real need for a new, more reliable cart machine. I took a serious look at the machines out there, then settled on the Odetics TCS2000.

Since we installed the TCS2000, everyone here has come to share my appreciation of its capabilities. We've especially liked the computer-based playlist. We had been manually checking play information against a paper log. Now we download the information directly from our traffic computer, and the TCS2000 generates a playlist. With the human-error factor eliminated, on-air discrepancies have become practically non-existent.

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At WTVH we run 2-1/2 hours of local news every day, so last-minute changes are routine. Using the Odetics keyboard, we can insert new material up to 30 seconds before going on air. Deletions need only two seconds lead time.

One of the most useful aspects of the machine's software is the reports it generates. For example, I can pull a report any time showing what spots are needed that are not already in the machine. In the past, we might not know we were missing a spot until just before air time.

This machine has certainly made my own job a lot easier. That's what I like most of all. I don't hear any more comments at staff meetings about spots being lost on-air, and it's a pleasure to see those blank discrepancy reports.

If you're considering installing a new cart machine, give me a call at (315) 425-5555. I'll be glad to talk with you firsthand about the advantages the Odetics TCS2000 has brought to WTVH."

Jim Bernier, Director of Engineering
WTVH Syracuse

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Circle (7) on Reply Card

Part 1

Strictly TV

PCs for TV

PC-based ID box

By Rick Lehtinen, technical editor

The humble personal computer (PC) is taking an expanded role in TV production and operations. This has not necessarily come about because the PC is well-suited for TV work, but because PCs are so plentiful. Broadcast equipment manufacturers have discovered that PCs are powerful, yet inexpensive.

A natural application for PCs is system control. More and more, the control panel on any piece of equipment is merely a microcontroller. Push buttons and indicator lamps provide the human interface. An RS-232 or RS-422 interface connects to the equipment. (See "Circuits," October 1990 through August 1991, for information on using microcontrollers.)

PC ID

It only takes a little imagination, plus an awareness of PC products on the market now or soon to come, to think up many additional applications for PC-based video tools. For example, a PC could be fashioned into a low-priced, 1-piece station ID box. Such a device could free a channel on a still-store (or a slide projector and telecine) and an audio cart machine.

It takes only a little imagination, plus an awareness of PC products on the market now or soon to come, to think up many additional applications for PC-based video tools.

The basic platform for such a machine need not be one of the latest high-speed screamers. AT-type systems are now available for a few hundred dollars. For this application, they have enough horsepower.

The computer should be capable of supporting at least a VGA-type output. This provides 640×480 pixel resolution, which is enough to be aesthetically pleasing. It can also produce up to 256 colors on the screen. This is an 8-bit image. (The VGA card cannot create as many colors as true video frame buffer cards. These can produce 16- and 24-bit images — 32,000 and 16 million colors — but VGA cards are usually less expensive.)

Acknowledgment: The author wishes to thank Henry Mistrot, Video Associates, Austin, TX, for help in the creation of this article.

A PC could be fashioned into a low-priced, 1-piece station ID box. Such a device could free a channel on a still-store (or a slide projector and telecine) and an audio cart machine.

The VGA display signal must be converted into video. Some new VGA cards have video output hardware built in. The more advanced systems even include a provision for gen-locking the video to house sync, and have a provision for system timing. Note that VGA-to-video circuitry varies widely in quality. Examine the output waveform carefully.

You mustn't forget audio. The computer could easily drive a CD player. However, new devices exist that use data to produce good quality audio in the PC. One new VGA card includes audio reproduction circuitry. This means that the PC can provide video and audio output. Alternatively, the computer could play back high-quality audio backgrounds from a CD player or CD-ROM. It could then mix in PC-generated voice-overs and tag lines using data from the hard disk.

Caveats

There is no free lunch. Anytime you attempt to translate a signal from one media to another, there will probably be hurdles. One of the first obstacles is that the VGA resolution of 640 × 480 matches neither the NTSC nor PAL screen size. Stretching and transforming is required to overcome this problem, which is called *overscan* in computer parlance.

Another problem concerns disk storage. Audio and video files use a lot of memory. One solution is to use a large optical drive for bulk data storage. Data to be used immediately can then be buffered in a *cache*.

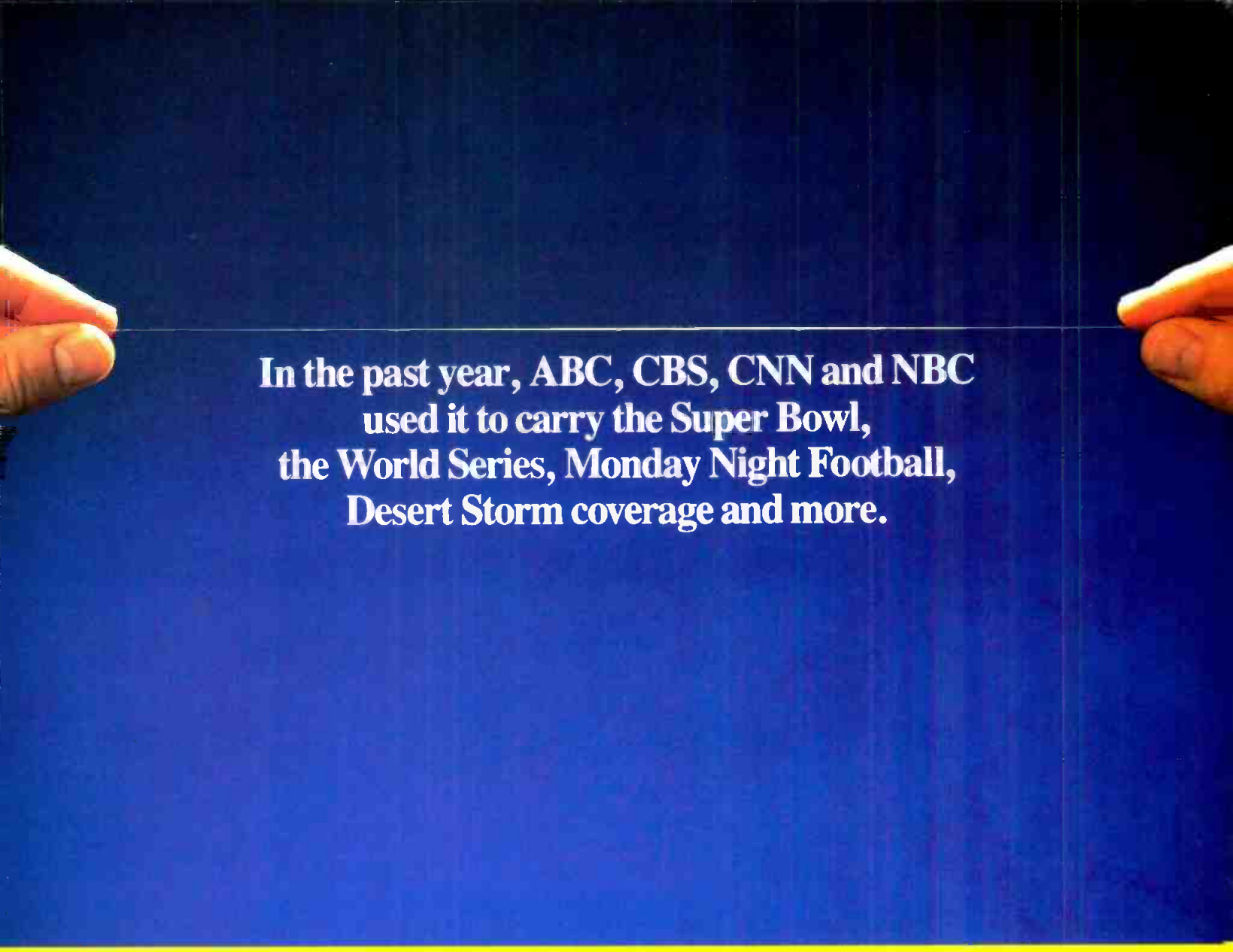
A third problem is nomenclature. Computer people are concerned with data rates and data bandwidth. Broadcasters care more about frequency bandwidth. This can cause confusion. Roughly speaking, a 32kHz audio sample rate translates to 16kHz response (response ≈ sample rate/2). Audio sample size (12 bits or 16 bits) determines effective signal-to-noise. Video sample size (8-, 16- or 24-bit) gets back to the number of displayable colors.

Putting a product on a PC may either strain or waste the computer's capability. However, it is extremely cost-effective, particularly in OEM quantities. For this reason, expect to see more PCs in television.

PC in every pot?

Finally, there is a concern that the PC may not be the most effective tool for every situation. What if a microcontroller can provide all the necessary processing power? Is it a waste of resources to throw a whole PC at a problem that could be solved with a few chips and a little code? Frankly, yes. Putting a product on a PC may either strain or waste the computer's capability. However, it is extremely cost-effective, particularly in OEM quantities. For this reason, expect to see more PCs in television.

Next month's column will continue to discuss the emergence of PCs in television, this time from a multimedia standpoint. |:-)))|



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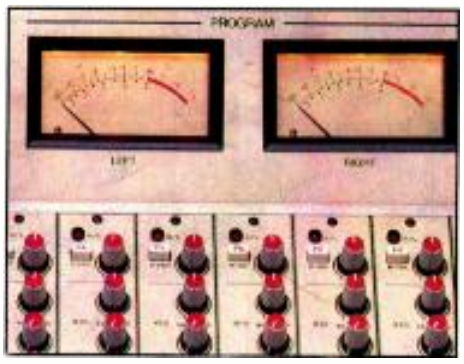
Part 1

re: Radio

Antenna systems

Reviewing our roots



By John Battison, P.E.

Broadcasting owes a tremendous debt of gratitude to James Clerk-Maxwell, and before him, Faraday and Ampere, for their pioneering work in electromagnetic research. Lesser-known is the Biot-Savart law, which tells us how to project the behavior of a conductor, and it also eases our development work. Although radio would probably have still developed without this law, it certainly helped it along its path.

Briefly, the Biot-Savart law says that in a long straight wire carrying a current (I), the magnetic field intensity (H) at any radial distance (r) from the conductor is given by:

$$H = 2I/r$$

When the idea of radio transmission, or *transmission sans fils* (TSF) — "transmission without wires," as the French call it — was first developed, the transmitting antenna was almost always insulated and isolated above ground.

In a spark coil transmitter, the spark coil "hot" side was connected to one end of a piece of wire elevated in the air; whatever tuning was used also occurred in this wire. Similarly, the arc transmitter had its "hot" arc element connected to the antenna high in the air. A carbon microphone element in this lead modulated the "carrier."

Alexanderson's alternator was also connected to an antenna that was not grounded. When tubes replaced "mechanical" oscillators, the antenna was still connected to the "hot" terminal so that the signal could "slide right off the end of the antenna wire" and be propagated.

Back then, many engineers apparently felt that only by insulating the antenna could a radio wave be transmitted; any connection to ground would "ground" the signal and lose it. Thus began the development of tall towers supporting long horizontal wires. As a matter of interest, for some years after World War II, WOR in New York on the 770kHz frequency still used its two towers with a T-antenna suspended between them. The center downlead went directly to the transmitter building.

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

Early antennas

As radio transmission techniques developed, it was found that horizontal antennas tended to be directional — radiation was generally a maximum at right angles to the length of the wire.

Vertical antennas, it was soon found, exhibited non-directional characteristics, so they were preferred for general entertainment transmissions. An additional positive feature was the lack of horizontal ground area required. But this was somewhat contravened by the need for an extensive ground system. And thus the standard series-fed vertical quarter-wave antenna was developed.

When the entertainment side of radio began to receive attention, initial inclinations were to get a signal out as far as possible, generally in all directions. This naturally led to the use of vertical antennas with circular radiation patterns. As stations proliferated, it was found that signals overlapped, causing interference. To overcome this problem, *directional antennas* were developed.

By this time, the series-fed vertical antenna was practically an industry standard. The FCC's rules and regulations of the 1930s included only data on such antennas. Horizontal antennas were practically unknown in the broadcast field — except for the WOR antenna — and they didn't lend themselves to complicated directional work.

Antenna problems

As the broadcasting industry matured, a new need developed. STLs, RPUs, FM, TV and mobile communications antennas all required access to tall towers. What better place than the AM towers?

There was a problem, however. The AM towers were above ground with a hefty base insulator (and, of course, insulated guy wires). The question was how to bypass the insulated base. Direct connection across the insulator was not possible. Tower lighting circuits employed one of two methods. An Austin transformer consisting of two interlaced, but not touching, coils could be used to get AC across the insulator. Or lighting chokes in the three AC lines going up the tower could be included in the ATU design. This bypass system worked quite well, although a number of fires could be traced to faults in these chokes.

Passing the signal circuit across the base requires either an isocoupler or a quarter-wave stub. The former consists basically of a coil of coax carrying the auxiliary signal and forming an RF choke across the base with a high impedance at the broadcast operating frequency. Or it can be a single turn of the auxiliary coax with a tuning capacitor to tune for a high impedance.

A quarter-wave stub is formed by insulating the coax up the tower for a quarter-wavelength at carrier frequency and grounding it at that point for the rest of the run. Final adjustment is made by means of a shorting bar moved up and down the insulated portion until the desired base impedance is reached.

A third method of isolation is a variation. In this system, the auxiliary line is bonded to the tower at its base, and a quarter-wave section is insulated from ground on its horizontal run. This is not too feasible in many cases, and besides, all of these methods cost money.

Next month's column will consider the solutions that were developed to solve this predicament.

Meanwhile, another problem that was with us all along, but which had not received a great deal of remedial investigation, was that of lightning strikes. All of the antennas hung on the tower were susceptible to lightning damage, and the main transmitter frequently received hits that knocked it off the air for unacceptably long periods.

Considering the isolation and lightning problems, attention was turned to the possibility of *grounding* the transmitting tower. I don't know who developed or placed the first grounded AM tower into use. (Perhaps one of our readers does?) However, the late Dr. George Brown of RCA Labs published a number of papers in the *Proceedings of the IRE* during the 1930s, detailing his work with ground effects and antennas. J.H. Morrison and P.H. Smith published an excellent paper, "Shunt-Excited Antennas," in 1937. About this time, the term *shunt-fed* began to be used.

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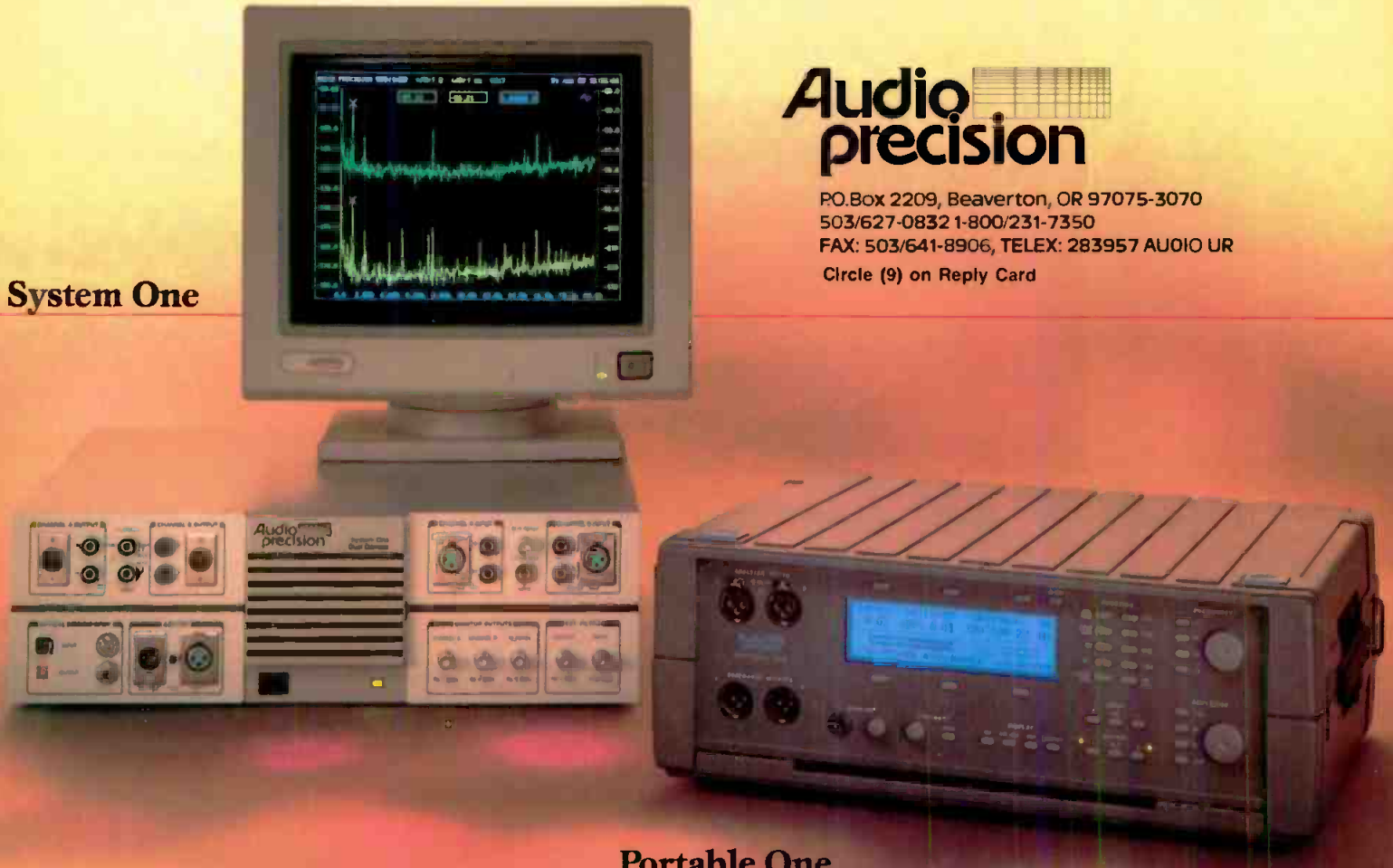

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Bylaw revisions under consideration

By Bob Van Buhler

Seven referenda proposing to amend the Society of Broadcast Engineers' bylaws were presented to the membership for consideration in the annual election.

The first referendum changes the wording of the purpose of the society. Section D is altered to include management groups as a target for exchange of ideas. It also refers to all elements of the broadcasting and communications industry, not just to broadcasting. This is to address the rapidly changing nature of information and entertainment technology, where the line between satellites, fiber, broadcast, telephone and cable is already blurred.

The second referendum concerns article 2 provisions on membership. The wording of section 1 clarifies the reasons for geographical grouping of chapters, i.e. to alleviate attendee hardships in participation because of location, and also to authorize the establishment of student chapters.

Section 2 deals with who may be elected a Fellow. Previously, a member rendering "signal service" to the society would be considered for Fellowship, according to the last portion of the criteria for selection. This clause was redundant to the first listed, "A member who has rendered conspicuous service."

Requirements for Senior Member have increased from three to five years of consecutive active membership with 15 years minimum in broadcasting.

Member requirements have been changed to less cumbersome wording, with the change reflected in the subsection's reference to the "communications field," rather than "broadcasting and related industries." The previous wording of the bylaws also inserted broadcast marketing personnel as an afterthought. The revision includes "design and marketing of broadcast-related products," as professions enumerated in the main description.

The Life Member category has also been inserted into the bylaws. A Member or Fellow who has been a member for 10 years or more and who retires may, upon request, become a Lifetime Member. A plaque and membership card has been dictated by the revision.

The third referendum seeks to include the immediate past president as a member of the board of directors. The immediate past president was not previously recognized as an official board member, but attended at the request of the new president and board.

This referendum also reverses a previous bylaws change voted in by the membership in 1987, which increased the term of directors to three years, and the limitation of directors to two terms was removed. The results of the 1987 change have not been favorable. The bylaws committee felt that the society would be better served by limiting the term of directors and officers to two terms each. Furthermore, the 2-year turnover has proved to foster more ideas and energy, and better grassroots contact. Some directors elected or appointed to fill vacancies on 3-year terms have been absent from board meetings for a year or more.

Section 8 is revised to include proxy votes by absent directors by telephone, and also allows the president to cast a tie breaking vote. The other officers and immediate past president may join directors in a vote, but the president may not.

The revised bylaws would no longer require board approval for filling vacancies on the board. The replacements would be selected by the executive committee, and the new board member would serve for the entire unexpired term of the predecessor.

The fourth referendum bars any officer from returning to service as an officer or director for at least two years. This provision may inadvertently or deliberately preclude a vice president from ascending to the presidency, or a secretary from becoming vice president or president.

Section 7 is modified to provide chapter chairmen with summaries of board meeting minutes. Also, financial reports would be sent once a year by written request.

Previous bylaws allowed for the removal of an officer who failed to attend two or more consecutive meetings for which due notice had been given. The referendum also includes directors who are absent for two or more consecutive meetings as eligible for removal by a two-thirds vote of approval by the board.

The fifth referendum changes suspension of membership from four months arrears on dues to six months. Reinstatement of suspended members is left to board policy-making. This referendum also exempts Life Members from paying dues.

The sixth referendum grants expanded power to the executive committee. The referendum requires a full vote of the board of directors to overrule the actions of the executive committee, and empowers it to act on the board's behalf "between meetings."

Section 2 has been altered to require all committees to be chaired by a current member of the board of directors. Previously, the president had the authority to appoint any member as a committee chairman.

Referendum 7 is important because it changes the way the bylaws are amended. Previously, every change in the bylaws, no matter how minor, had to be submitted to the entire membership. Such a practice is rare in professional organizations.

Under the proposed change, a petition from at least 25 members would be submitted to the board of directors for action. The board would then examine the proposal and take action to adopt or reject it, based on a two-thirds vote.

The bylaws committee is chaired by immediate past president Jack McKain, with the assistance of SBE counsel Christopher Imlay. The committee's work was submitted too late to allow extensive debate on its provisions before the annual election.

New certification fees

A new certification fee schedule has been adopted. Broadcast Technologist fees are $35, Broadcast Engineer is $50, Senior Broadcast Engineer is $75 and SBE Professional Broadcast Engineer is $100. Fees increased after the last round of examinations at the old prices, at the SBE National Convention in Houston this month.

Van Buhler is manager of engineering at KNIX-FM/KCWW-AM, Phoenix.

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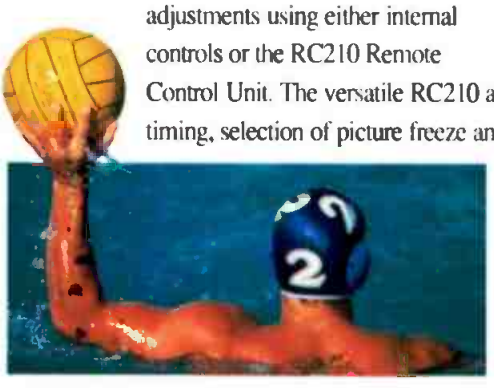

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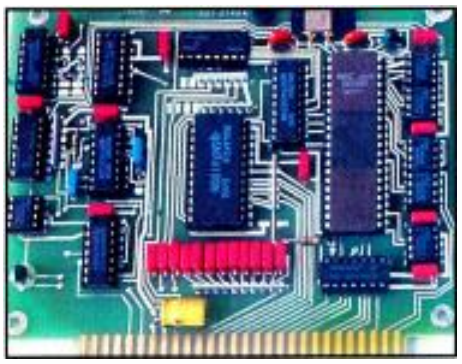
Part 2

Circuits



An in-depth look at analog ATR circuits

Record equalization circuits

By Gerry Kaufhold II

Last month, we began a 6-part series about the circuits used in analog tape recorders (ATRs). The September column presented high-frequency biasing. For the next two months, we will take a look at equalization.

Doing it with frequency

The tape moves past the record and playback heads at constant linear velocity. This means that each frequency recorded is imprinted onto a finite length of tape. For example, at a recording speed of 15ips (inches per second), a 10,000Hz tone has an imprinted wavelength of 0.0015 inches.

The gap between the poles of the record and playback heads must be less than half the wavelength of the highest frequency. A gap of 0.0005 inches in the recording and playback heads sets an upper limit on frequency response of approximately 15,000Hz (at 15ips).

A frequency of 100Hz has an imprinted wavelength of 0.15 inches. Low-frequency tones spread a small magnetic field across a large portion of tape. This attenuates the amount of signal that gets recorded.

Without compensation, the analog tape recorder exhibits approximately 6dB-10dB of attenuation at frequencies below 160Hz. Frequency response in the mid-range shows an increasing sensitivity of approximately +6dB/octave between 160Hz and 3,200Hz. Above 3,200Hz, it drops 3dB-6dB per octave.

Circuits save the day

Figure 1 shows a typical recorder equalization circuit. Power for the circuit, V_{cc}, comes through the record switch. This makes the equalizer active only when the bias and erase circuits are operating.

The 10kΩ potentiometer provides the correct signal level to the equalizer input. A capacitor provides AC coupling between the input signal and the base of transistor Q-1. A pair of resistors provide proper DC bias. The collector has a load resistor connected to V_{cc}. The emitter of Q-1 has a 4.7kΩ resistor that fixes the DC voltage gain of the amplifier.

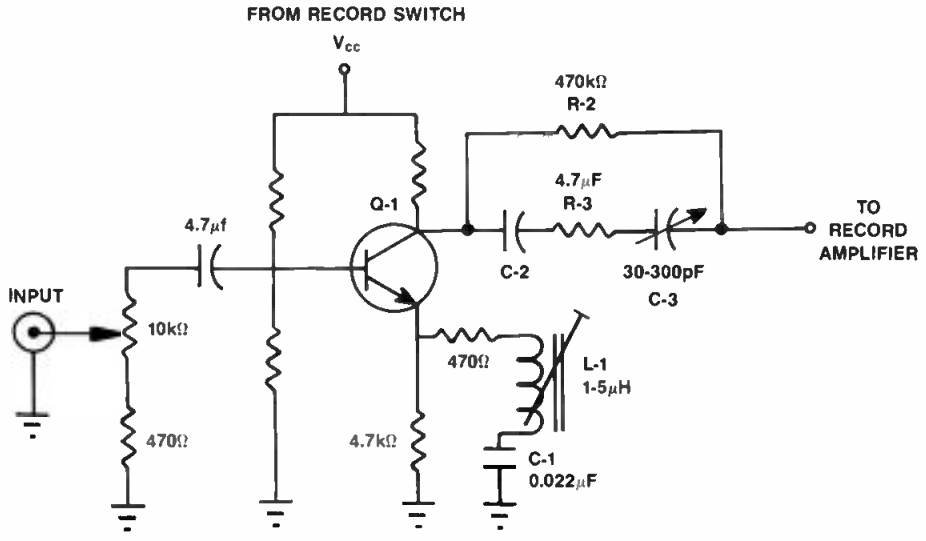


Figure 1. *A typical circuit for record equalization. Tuned circuits shape and amplify the incoming signal to counteract for frequency effects inherent in the record process.*

Toning down the mid-range

A 470Ω resistor connects in series to L-1, a 5μH tunable inductor, and to C-1, a 0.022μF capacitor. The inductor is adjusted during initial setup to provide a degree of flatness through the middle frequencies.

Low frequencies are amplified by the DC gain of the transistor. The small value of capacitor C-1 blocks low frequencies from passing through the low impedance presented by L-1. High frequencies are also amplified by the DC gain of the transistor, because the inductance of L-1 blocks the low impedance presented by C-1.

Tweaking the high range

Resistor R-2 provides a path for the amplified low frequencies to pass unattenuated to the following stage. The 4.7μF capacitor C-2 provides AC coupling for the mid-range and high frequencies. The series circuit made up of resistor R-3 and variable capacitor C-3 acts as a high-pass filter. This attenuates the mid-range, and adds a sharper peak to high frequencies above 10kHz.

The final step

The circuit must be swept with frequencies from 10Hz through the highest expected frequency. Any anamolies in the response curve must be rectified by fine-tuning the adjustments. Figure 2 shows a typical response curve of a properly adjusted equalizer for the record section.

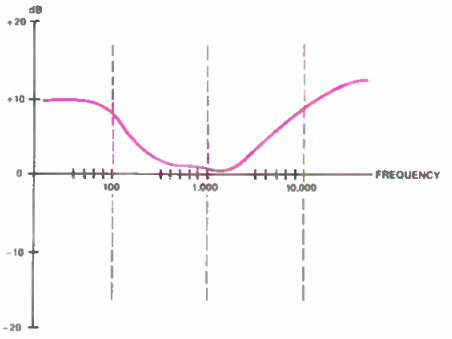


Figure 2. *A recorder equalization curve shows how much gain at what frequency the equalizer must provide.*

After leaving the record equalizer circuit, the signal passes to the record amplifier, which provides a constant-current output to the record head. The bias circuit discussed last month helps to further improve the recording quality of high-frequency signals.

Next month, we will look at the circuits used for providing playback equalization.

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

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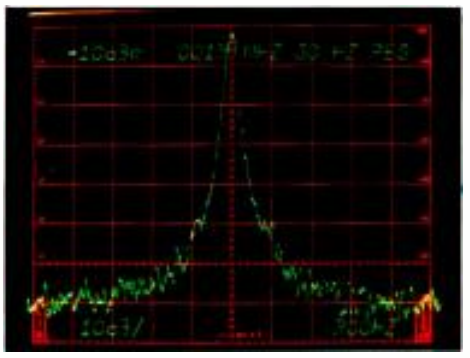
Part 2

Troubleshooting



Optimizing 2-track analog ATRs

Equalization

By M. Raymond Jason

Troubleshooting recorder equalization (EQ) problems is easier when you understand why EQ is used, and what else may affect frequency response. EQ in analog magnetic recording is necessary compensation for two playback-head effects. The first, known generically as the *velocity effect*, produces a constant 6dB/octave rise from low to high frequencies. All playback amplifiers, therefore, incorporate a fixed 6dB/octave cut. The second effect, *thickness loss*, applies only to short wavelengths. Playback head frequency response departs from the 6dB/octave rise as a function of domain-to-gap distance:

1. Loss in dB = $20\log(e^{-2\pi d/\lambda}) \approx 55(d/\lambda)$ where:
d = domain-to-gap distance
λ = wavelength of interest

Considering the tape's *entire* oxide layer, not just the magnetic domains at one depth, the relation is:

2. Output loss in dB = $20\log[(2\pi T/\lambda)/(1 - e^{-2\pi T/\lambda})]$ where:
T = oxide thickness

For tape with a 0.5mil oxide layer (not the generally quoted *overall* tape thickness), thickness loss becomes significant at approximately 3kHz for 15ips and at about 1.5kHz for 7.5ips.

Standard emphasis curves

Standard reproducer equalization is specified (by NAB in the United States and by IEC/CCIR in Europe) in terms of *time constants*, using microsecond units. Translate time constant T (in seconds) to corner frequency f_c using the relation $f_c = (2\pi T)^{-1}$. For example, the NAB 50μs time constant produces an f_c of $[(2\pi)(50\times10^{-6})]^{-1}$ = 3,183Hz. (See Table 1.)

Although the IEC specifies a 7.5ips f_c one octave below its 15ips f_c (note that λ, not f, appears in equation 2), the NAB f_c is *the same* for both speeds, and it is one that compensates more appropriately for the thickness effect at 15ips. Consequently, 15ips NAB recording, all other things being equal, has a flatter response above 1kHz than 7.5ips NAB.

The NAB curve's 3,180μs EQ is a low-frequency pre- and de-emphasis intended to reduce playback hum, but is often used to partially correct for "head-bumps" (*contour effect*).

With such standardized *playback* EQ established, record equalization is set to complement its response when using a particular tape stock on a particular recorder (including bias effects). Some recorders use two or more record-EQ poles to allow flatter overall performance.

Jason is an electronic engineer at National Public Radio, Washington, DC.

		7.5ips		15ips	
		LF CORNER	HF CORNER	LF CORNER	HF CORNER
NAB	TC	3,180μs	50μs	3,180μs	50μs
	FREQ	50Hz	3,183Hz	50Hz	3,183Hz
IEC	TC	—	70μs	—	35μs
	FREQ	—	2,274Hz	—	4,547Hz

Table 1. *Standard playback equalization curves for two common tape speeds, showing time constants (TC) and corner frequencies.*

Mechanical errors

Deviations from optimum tape-to-head interface degrade frequency response. Azimuth is critical, but so are wrap, zenith, penetration, height, play-mode tension and head wear.

You can discover wrap, penetration, low-tension and some wear problems by playing a 10kHz tone at 7.5ips (20kHz at 15ips). Increase supply-reel tension by applying drag to the reel or by adjustment. If playback level increases, mechanical alignment is required. The same test, in sync playback, exposes record-head alignment problems.

Scrape flutter modulates medium-to-high frequencies, and can be perceived as distortion or as an EQ problem. Find scrape flutter with a wide-bandwidth flutter meter. Check for misaligned or tape-grooved guides, or severely worn heads, as sources of scrape flutter.

Equation 1 explains the problem with dirty heads: tape/head separation of one wavelength produces loss at that frequency of 55dB. At 7.5ips, a single fiber from a cotton swab will knock 10kHz down approximately 6dB. When the sound is dull, reach first for a bright flashlight.

The NAB/IEC equalization option can be a trap. Most NAB/IEC switches are rarely used. If your machines use mechanical switching, EQ errors might be caused by a dirty switch. (Suspect this whenever significant EQ differences appear between channels.) Avoid this problem by exercising these switches every time you align.

Changing tape speeds involves rerouting audio as well as changing capstan velocity. Check mechanical and solid-state components of EQ-speed switching as potential failure sites. Switching components are more likely to fail than the EQ circuitry proper.

Electronic failures are best distinguished from tape/head interface problems by using a flux loop. Vertically wind small-gauge magnet wire *once* around a 1/2-inch wooden cube or something similar. Connect this wire, via a 22Ω, 1W resistor, to a low-Z-output oscillator feeding at +10dBu. Protect the head with adhesive tape, then put the loop directly against the play head, positioning it for maximum signal level at 10kHz in repro cal mode. Metering across the recorder's output, obtain a 1kHz reference level, then try to align the play electronics for 10kHz = +10dB and 100Hz = −1.4dB (relative to 1kHz), *in NAB mode*. Verify 20kHz = +15.7dB and 20Hz = −9dB. If you can achieve this alignment, the head windings, cabling and reproduce equalizers are functioning correctly; any play-mode EQ problem must therefore be caused by poor tape/head interface, head wear or a bad alignment tape.

Given a choice in alignment between a small dip and a bump, psychoacoustics says you'll generally fare better down the road with the dip. Fast-swept tone alignment tapes provide a real time display on an oscilloscope of the mid-to-high frequency playback response spectrum, facilitating optimum alignment.

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Part 1

Management for engineers

Working smarter

Managing meetings

By Judith E. A. Perkinson

For the next 12 months "Management for Engineers" will focus on "working smarter." This column will be devoted to helping you learn how to work more intelligently. There was such a positive reaction to the time management series that we will continue to focus on practical, useful information. The "year of working smarter" will begin with a 3-part series on meeting management.

If you asked the staff in any broadcast facility how they felt about meetings, they would probably say they're a waste of time. But, if you took the time and talent that's wasted in meaningless, unproductive, unnecessary meetings and converted it into productivity, your facility could profit from properly managed meetings.

What's wrong with meetings?

Meetings can be practical and productive, but in many instances they can be a waste of time. The following list describes some of the problems with meetings:

- Meetings don't accomplish anything.
- People repeat the same things.
- No one sticks to the subject.
- A few people talk so much that nothing gets done.
- Meetings that are scheduled for an hour usually take an hour and a half.
- The meeting doesn't have anything to do with your work or interests.
- Meetings don't start on time.
- It takes an hour to do what could be done in 15 minutes.
- You've heard it before.

These are common complaints, but they can all be avoided. Most unproductive meetings are the result of poor meeting management.

Why do we repeat the cycle?

Why do we continue to hold, attend and tolerate ineffective meetings? It's probably a combination of habit, ego and a lack of skill. Inevitably, certain meetings will be a waste of time. However, it is your responsibility to become a proactive meeting participant.

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

What is a proactive meeting participant?

Proactive meeting participants control the impact meetings have on their lives. These people hold productive meetings that start and end on time. Furthermore, proactive participants bring focus back into a meeting that has wandered off the topic. These people pick and choose which meetings they will attend, and they don't waste time.

How much control do you have?

Most of you probably feel that you have little or no control over the time wasted in meetings. This may be true. However, taking control over wasted meeting time begins by understanding when and what you can do to impact the problem. The meetings you attend should fall into three basic categories:

1. *Meetings you call and/or conduct.*

There is no excuse for time to be wasted in a meeting that you call or conduct. It is your responsibility to learn the skills necessary to conduct a productive, meaningful meeting. You're not working smart if you waste your time and the time of the people who attend your meeting.

2. *Meetings you must attend that are called and/or conducted by someone else.*

These are generally the types of meeting you can't avoid. However, there are ways to minimize wasted time. First, make sure you're not contributing to the waste of time. Many of the meeting management skills that will be discussed in Part 2 and 3 can be used as a meeting participant.

3. *Optional meetings.*

If a meeting is scheduled, many of you may feel obligated to attend. It may make you feel important to be invited to a meeting. Therefore, you attend even when it isn't necessary.

Working smart means you should routinely ask questions concerning every meeting. Based on the answers, you should then decide if you need to attend.

When should you attend a meeting?

When you are asked to attend a meeting, find out the answers to the following questions before you decide whether to attend:

1. *What is the purpose of the meeting?*

Meetings should have a purpose. Communicating information is usually not enough to justify attendance. When the purpose of the meeting is to disseminate information, ask if it can be put in a memo.

2. *How much time will the meeting take?*

Avoid meetings that do not have a time frame, because it probably means they are poorly planned and will last beyond the time it should take to accomplish the goal. One way to limit your liability is to indicate how much time you can spare. This way, you have the option of leaving if the meeting rambles on.

3. *Do I need to be there?*

Often, people who do not have to be at meetings are asked out of habit. Sometimes just asking if you need to be present is enough to make the meeting organizer stop and think. If you're not going to be a part of the main meeting activity but need to know the results, check written minutes or an informational memo after the meeting.

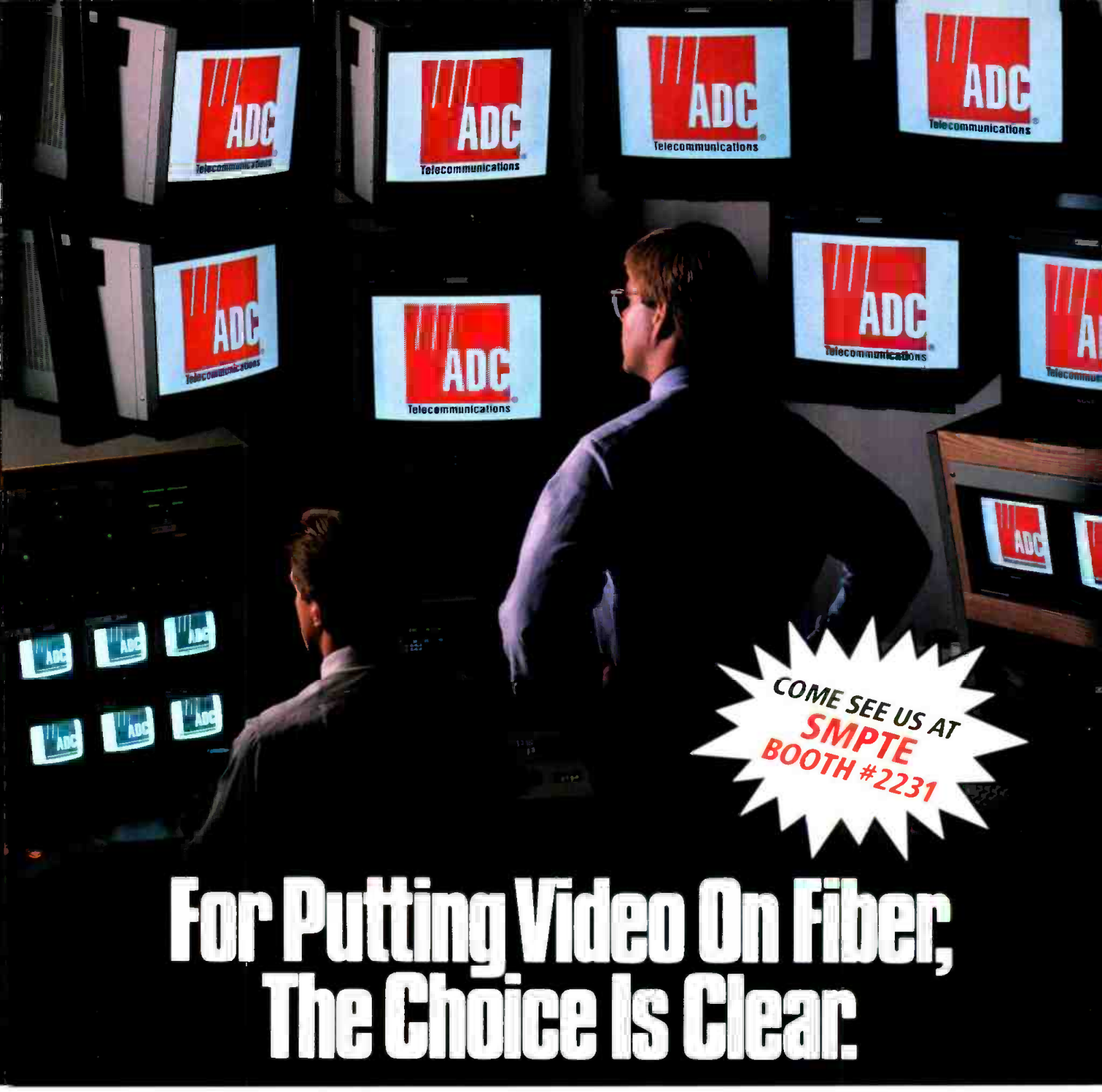
4. *Where is the meeting being held?*

Many times, the meeting location can have a profound affect on your ability and willingness to attend. If getting to and from the meeting is an investment in time and resources that exceed the value of the meeting, you need to question your attendance. Suggesting an alternative location for a meeting can assist not only you, but also the other participants.

Attitude is important

How you ask these questions is important. Ask your questions in a nonaggressive manner. Most people are reasonable, but your questions shouldn't sound like an attack on their judgment. If your questions sound like an attack, you can expect the people to become defensive and reduce the latitude they might otherwise be willing to give you.

Next month, I will discuss how to organize a meeting. This information should be learned and used each time you plan a meeting.



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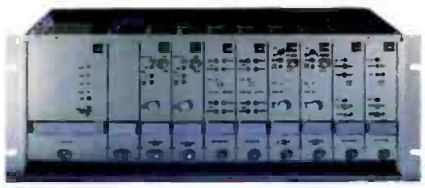

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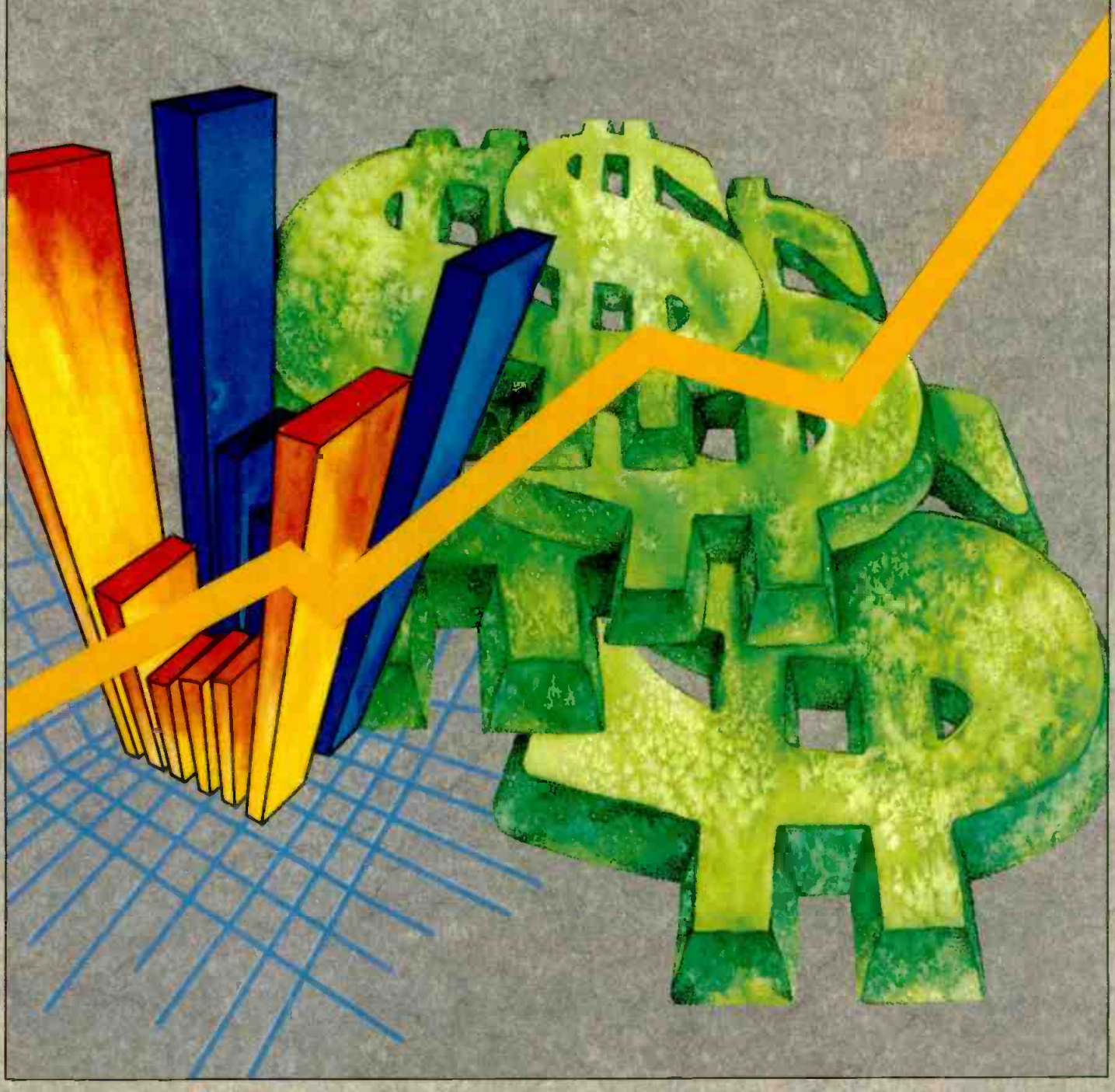


Engineering departments are making the move from the expense side to the income side of the business ledger.

At times it may not seem like it, but good engineering talent is in as much demand as ever. For the past 11 years, *Broadcast Engineering* magazine has provided an accurate gauge on the financial conditions and mood of the broadcast industry. One of the interesting elements discovered in this year's results was an increase in the number of comments about the need for high-quality technical expertise.

Despite the reductions in overall staffing, production facilities still require talented technical staff. After reading the survey comments, two related types of skills were revealed to be particularly valuable: the ability to manage and troubleshoot systems, and a knowledge of new digital technology.

The successful technology managers, and they go by a variety of names: chief engineer, director of engineering, director of operations and engineering, typically have high levels of skill in both areas. They don't waste their time with the microscopic issues, but instead concentrate on the overall system's performance. Also, because much of today's production and broadcast equipment relies on sophisticated digital hardware, maintenance is limited to board or module replacement. Such technology requires personnel who can diagnose the errant card or module and quickly effect the repairs. There is no time to become involved in component-level servicing. Repairs often rely on PC-software for system diagnoses. These techniques are a far cry from the VOM and soldering iron of yesteryear.

A related skill displayed by these successful engineering managers is the ability to target their efforts on helping their companies make money. These engineers have reversed their thinking from the expense side to the income side of the business ledger. Smart engineers recognize that staying in business means running their departments like a business — profitably. Today, purchasing decisions may be made on ROI as often as they are on performance or quality improvement. A successful engineer is able to recognize and balance these factors in the best interests of the station or facility.

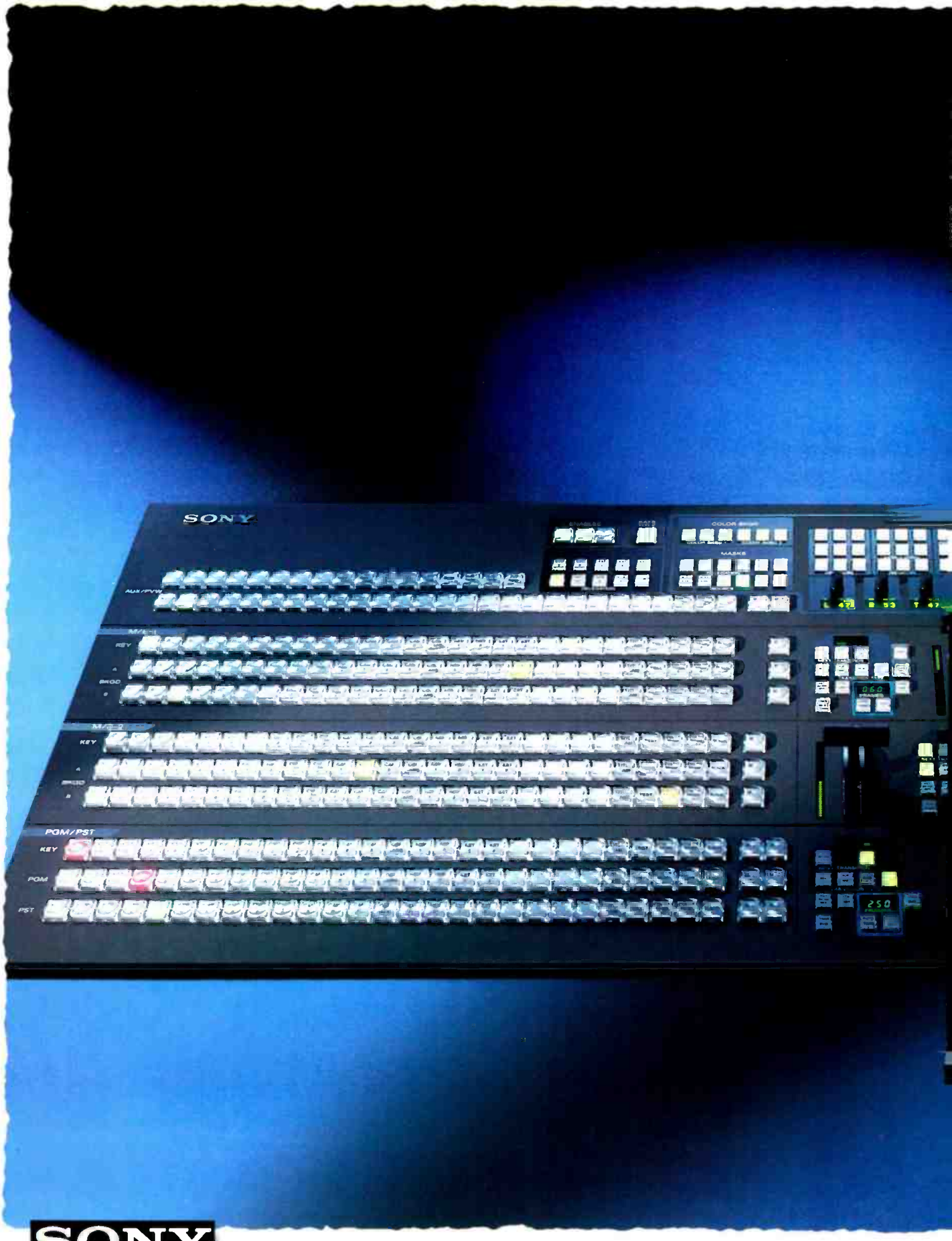
Take advantage of the increasing demand for top-quality technical skills by honing your abilities with this month's article lineup on profitable technical management.

- "The 1991 Salary Survey: The Complete Picture". . . . . page 26
- "Engineering Can Be a Profit Center". 52
- "Competing for Your Job". 64
- "Engineering Software for PCs". 70
- "Software Management". 78

Brad Dick

Brad Dick, editor

With Sony's digital switcher and effects, it's never been easier to switch.



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Once you do, you'll realize it really has never been easier to switch.

Business and Professional Group.

The 1991 salary survey: the complete picture

The latest word on the salary front.

By Brad Dick, editor

I can always tell when October is approaching by the number of calls we receive concerning the salary survey. By late summer, engineers and managers begin to look eagerly for the annual unveiling of the latest good and bad news on the salary front. Without further delay, let's see how things are faring for our fellow industry professionals.

The basics

The results are broken down into three general job title categories: management, engineering and operations. To use the tables, first determine into which category your job title falls. The management titles include president, owner, partner, vice president and general manger. The engineering titles should be obvious to most *BE* readers. Operation titles include operations manager, station manager and production and program managers. If your specific title isn't listed, choose the one that most closely resembles the type of work you do. Once you've determined which category to use, reading the results should be easy.

The survey results are summarized in Tables 1-7. If you want more details, see Tables 1-3. Almost everything you need to compare your financial situation with the industry at large is contained in these three tables. These tables allow you to compare specific portions of your compensation plan with those of your fellow professionals.

The dollar comparisons begin in Table 4 and continue through Table 7. These tables have been prepared to enable you to determine quickly how your salary compares to others based on history and market size. Several things must be kept in mind when reading the data.

First, and most important, the data is presented in *median* terms. The median value is quite different from the *average* value you may have seen in other surveys. The median accurately portrays the financial conditions within the industry.

The 1991 *BE* salary survey was conducted scientifically by the Intertec marketing research department. Questionnaires were mailed to 3,716 *BE* readers. As of July 15, 1,046 usable surveys were received, representing an overall response rate of 28.4%. The data in this report is based on those responses.

A slow train to nowhere

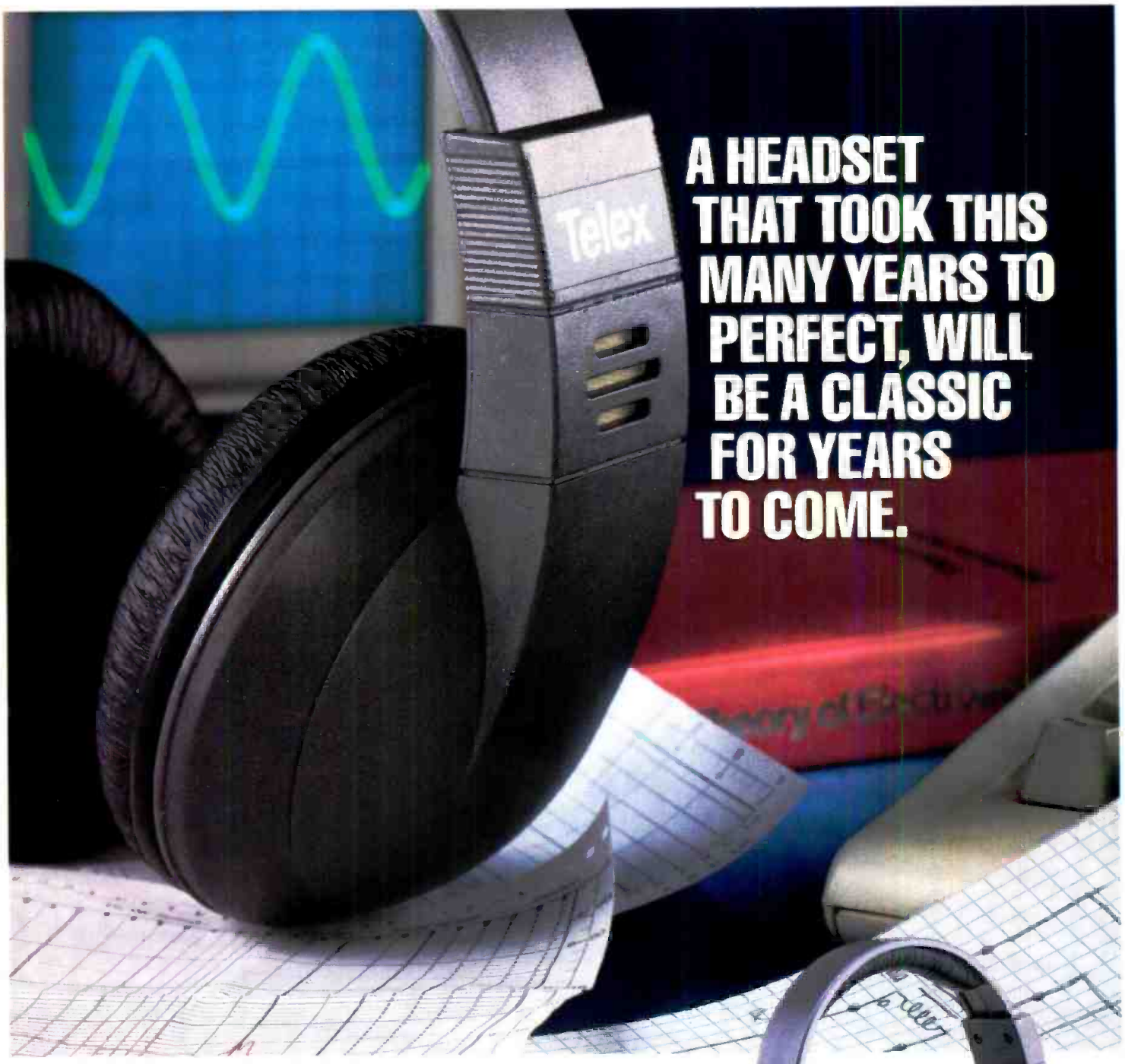
Don't look for dramatic changes in any of the salaries. A recession combined with gut-wrenching debt has clamped a stranglehold on large salary increases. Even so, not all the news is bad.

Let's look first at radio. Figure 1 charts the median salary for radio personnel from 1983 to 1991. The early years represent high inflation and corresponding significant increases in salaries. The last three years show a departure from that climb upward.

Managers have seen minimal improvement during the year. Radio corporate salaries increased from $35,000 to $35,500 during the past year. However the percentage growth rate is only half that of last year's survey.

Radio engineers continue to face a stagnant salary situation. From a high of $29,000 in 1989, salaries have fallen for two consecutive years. The 1991 median salary for a radio engineer was $28,600, which is roughly 1% lower than last year.

Radio operator salaries recovered a bit from last year's fall. The 1989 salary of $23,600 dropped to $22,750 in 1990, a loss of 4%. A 2% increase this year brought the salary up slightly to $23,190. That's not much, but we've got to look hard for the good points.



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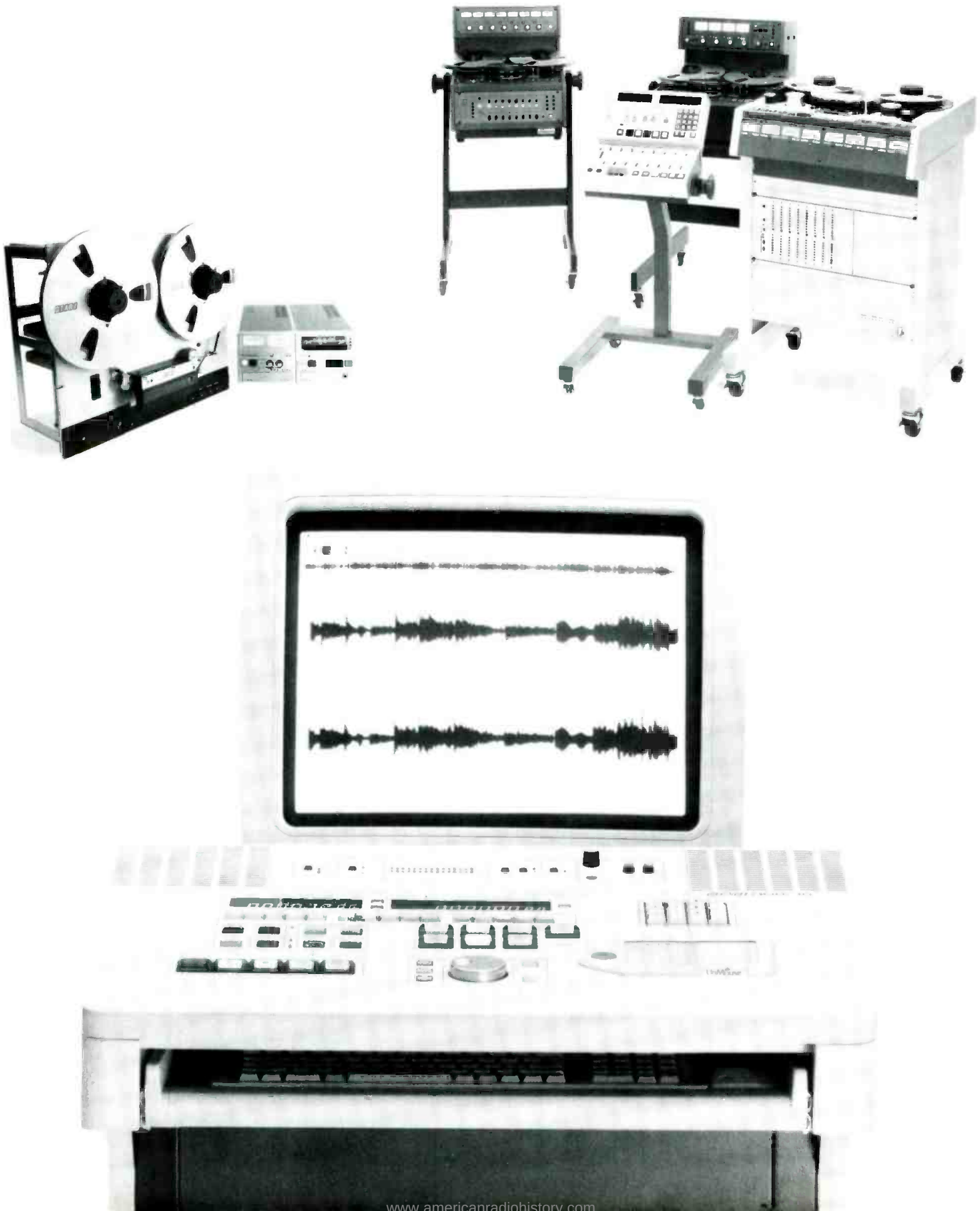

RADIO'S TOP TEN! OTARI GIVES YOU BETTER CHOICES.

Otari's new audio recorders for radio give you features to fit any application or budget. This means you're not forced to make compromises when choosing a recorder, so your station sounds better to listeners, and is more efficient. And, of course, Otari's legendary reliability means less down-time.

On the forefront, there's a line of digital disk recorders including the new 2-track DDR-10, and the ProDisk 164 with up to 64 tracks for multitrack production.

Then, Otari's famous "workhorse" 5050 BII machine, the choice of radio professionals the world over, has become the BIII – just as tough, and twice as easy to use. And it has all the things you asked for, like a Q speaker, independent left/right reel size select, dynamic breaking, and much more!

A new line of 2, 4 and 8-track machines, the 5050 MKIV Series, delivers state-of-the-art performance, plus features that will make your life easier, like a built-in autolocator with 3 one-touch, cue-point memories and return-to-zero.

Don't forget the MX-50II: a professional 2-track with a price that will astound you, and the MX-55 with all the features you'll ever need today, or tomorrow. (The "50II" and the "55" both offer a Voice Editing Module for normal pitch at twice play speed.)

Then there's our multi-tracks, from 32 tracks on down, at almost every price level – 8 machines, 12 different versions! And, of course, the CTM-10, a high performance cart machine we built for perfectionists, and an automated radio station reproducer.

Before you purchase *any* audio machine, look into Otari's line-up for the broadcaster. We think you'll find exactly what you need, at a price that fits your budget. Call Otari at (415) 341-5900 for more information.

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TABLE 1. — MANAGEMENT STAFF PROFILE*

Management	ALL MARKETS Total %	TELEVISION Total TV %	Top 50 %	Top 100 %	Below Top 100 %	Non-Comm. %	RADIO Total Radio %	Top 50 %	Top 100 %	Below Top 100 %	Non-Comm. %
Salary Level											
Less than $15,000	8.1	2.7	....	....	....	8.3	10.7	....	10.0	10.3	16.7
$15,000 to $24,999	9.0	1.4	....	....	....	4.2	12.8	....	....	17.2	11.1
$25,000 to $34,999	18.4	4.1	5.3	....	....	8.3	25.5	12.5	10.0	29.9	25.0
$35,000 to $49,999	21.1	13.5	5.3	....	20.0	16.7	24.8	6.3	40.0	26.4	25.0
$50,000 to $74,999	22.4	39.2	21.1	33.3	44.0	50.0	14.1	12.5	20.0	11.5	19.4
$75,000 or more	21.1	39.2	68.4	66.7	36.0	12.5	12.1	68.8	20.0	4.6	2.8
No response	....	....	....	....	....	....	....	....	....	....	....
Median =	$42,647	$66,666	$92,500	$100,000	$67,500	$53,750	$35,500	$90,000	$42,500	$32,692	$33,750
Received Salary Increase During Past Year											
Yes	42.6	64.9	73.7	66.7	60.0	62.5	31.5	43.8	40.0	10.3	75.0
No	54.7	33.8	21.1	33.3	40.0	37.5	65.1	56.3	50.0	86.2	22.2
No Response	2.7	1.4	5.3	....	....	....	3.4	....	10.0	3.4	2.8
Percentage of Increase											
Less than 3%	4.5	4.1	5.3	16.7	4.0	....	4.7	6.3	....	....	16.7
3% to 4%	7.6	10.8	10.5	16.7	8.0	12.5	6.0	....	....	2.3	19.4
5% to 9%	20.6	40.5	47.4	16.7	36.0	45.8	10.7	12.5	20.0	....	33.3
10% to 14%	4.9	5.4	....	16.7	8.0	4.2	4.7	12.5	10.0	2.3	5.6
15% or more	4.9	4.1	10.5	....	4.0	....	5.4	12.5	10.0	5.7	....
No Response	57.4	35.1	26.3	33.3	40.0	37.5	68.5	56.3	60.0	89.7	25.0
Median =	5.0	5.0	5.0	3.5	5.0	5.5	5.0	5.0	5.0	15.0	4.0
Fringe Benefits Received (Adds to more than 100% due to multiple answers)											
Medical insurance (paid)	80.3	87.8	84.2	100.0	84.0	91.7	76.5	93.8	80.0	70.1	83.3
Dental insurance (paid)	39.0	52.7	63.2	66.7	40.0	54.2	32.2	50.0	50.0	23.0	41.7
Life insurance (paid)	58.3	71.6	63.2	100.0	68.0	75.0	51.7	50.0	40.0	49.4	61.1
Sick leave	74.0	85.1	84.2	66.7	84.0	91.7	68.5	81.3	70.0	62.1	77.8
Vacation (paid)	84.3	91.9	84.2	100.0	96.0	91.7	80.5	75.0	80.0	81.6	80.6
Stock purchase plan	7.2	16.2	26.3	33.3	20.0	....	2.7	6.3	....	3.4	....
Profit sharing plan	13.0	17.6	36.8	16.7	20.0	....	10.7	18.8	20.0	12.6	....
Savings plan	8.1	12.2	21.1	....	8.0	12.5	6.0	6.3	....	5.7	8.3
Pension plan	27.4	43.2	36.8	16.7	28.0	70.8	19.5	31.3	....	5.7	52.8
401-K Plan	18.8	37.8	47.4	33.3	56.0	12.5	9.4	25.0	20.0	2.3	16.7
Bonus	27.8	36.5	36.8	50.0	64.0	4.2	23.5	37.5	20.0	27.6	8.3
Trade show/convention/ seminar expenses paid	61.0	71.6	63.2	83.3	92.0	54.2	55.7	56.3	50.0	55.2	58.3
Tuition refund plan	19.3	29.7	42.1	....	16.0	41.7	14.1	18.8	10.0	1.1	44.4
Automobile furnished	42.2	43.2	47.4	50.0	76.0	4.2	41.6	56.3	60.0	47.1	16.7
No benefits	4.9	2.7	....	....	....	8.3	6.0	....	....	6.9	8.3
Other	7.2	1.4	....	....	4.0	....	10.1	18.8	....	9.2	11.1
No response	1.3	1.4	5.3	....	....	....	1.3	....	....	1.1	2.8
Years In Present Job											
1 to 2	15.2	17.6	10.5	66.7	12.0	16.7	14.1	25.0	10.0	12.6	13.9
3 to 4	148	18.9	21.1	16.7	12.0	25.0	12.8	....	10.0	13.8	16.7
5 to 9	27.8	28.4	26.3	....	36.0	29.2	27.5	25.0	30.0	25.3	33.3
10 to 14	15.7	13.5	15.8	16.7	8.0	16.7	16.8	18.8	30.0	12.6	22.2
15 to 24	11.7	12.2	10.5	....	16.0	12.5	11.4	6.3	....	16.1	5.6
25 or more	9.0	6.8	5.3	....	16.0	....	10.1	18.8	10.0	9.2	8.3
No response	5.8	2.7	10.5	....	....	....	7.4	6.3	10.0	10.3	....
Median =	6.0	5.0	5.0	1.5	8.0	5.0	7.0	7.0	6.0	7.5	6.0
Years In Broadcast Industry											
Less than 5	2.7	2.7	....	16.7	....	4.2	2.7	6.3	....	3.4	....
5 to 9	7.6	6.8	5.3	....	4.0	12.5	8.1	....	20.0	4.6	16.7
10 to 14	8.5	9.5	5.3	16.7	12.0	8.3	8.1	....	10.0	5.7	16.7
15 to 24	30.0	27.0	15.8	50.0	20.0	37.5	31.5	31.3	10.0	29.9	41.7
25 or more	45.3	51.4	63.2	16.7	64.0	37.5	42.3	50.0	50.0	47.1	25.0
No response	5.8	2.7	10.5	....	....	....	7.4	12.5	10.0	9.2	....
Median =	23.0	25.5	29.0	16.0	27.0	20.0	22.5	25.5	20.0	25.0	16.5
Do Part-Time or Free-Lance Work											
Yes	30.0	25.7	31.6	16.7	28.0	20.8	32.2	31.3	30.0	34.5	27.8
No	69.5	74.3	68.4	83.3	72.0	79.2	67.1	68.8	70.0	64.4	72.2
No response	0.4	....	....	....	....	....	0.7	....	....	1.1	....
Education											
High school	5.8	....	....	....	....	....	8.7	6.3	10.0	11.5	2.8
Some college	32.3	27.0	21.1	....	36.0	29.2	34.9	37.5	40.0	40.2	19.4
College grad (bachelor's degree)	38.1	39.2	42.1	66.7	48.0	20.8	37.6	31.3	40.0	36.8	41.7
College grad (master's, Ph.D.)	18.8	28.4	26.3	16.7	12.0	50.0	14.1	18.8	10.0	5.7	33.3
Technical school	13.9	12.2	5.3	16.7	16.0	12.5	14.8	6.3	10.0	17.2	13.9
Other	1.3	1.4	5.3	....	....	....	1.3	....	....	1.1	2.8
No response	....	....	....	....	....	....	....	....	....	....	....
Age, Years											
Under 25	1.3	1.4	....	....	....	4.2	1.3	6.3	....	....	2.8
25 to 34	9.9	12.2	5.3	16.7	12.0	16.7	8.7	....	20.0	4.6	19.4
35 to 44	35.0	29.7	26.3	66.7	24.0	29.2	37.6	43.8	30.0	36.8	38.9
45 to 54	26.0	25.7	21.1	....	32.0	29.2	26.2	25.0	40.0	24.1	27.8
55 to 64	20.6	27.0	42.1	16.7	24.0	20.8	17.4	6.3	10.0	24.1	8.3
65 or over	7.2	4.1	5.3	....	8.0	....	8.7	18.8	....	10.3	2.8
No response	....	....	....	....	....	....	....	....	....	....	....
Median =	46.7	47.8	55.0	40.0	49.0	45.0	46.2	45.0	45.0	49.0	42.5

*Management staff: president, owner, partner, vice president, general manager.

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Radio markets

There is some good news for radio engineers, but you have to work in the right markets. The overall loss of 1% in median salary is not reflected across all markets. For instance, salaries for top 50 market radio engineers grew by 11%. That's extremely good, considering industry conditions. The top 100 market radio engineering salary fell by 6%, which was twice as bad as in the below top 100 markets. Here, salaries fell by 3%. The non-commercial engineers did well, showing an 8% increase in median salaries.

Radio operator salaries were either up or simply flat in all markets this year. That may be why, on a percentage basis, the overall markets radio operator salary was not only higher, but also twice as high as that for managers and engineers.

TV salaries

TV salaries parallel the results already described for radio. The results are summarized in Figure 2. Corporate TV salaries showed no change. Engineering salaries increased by 2%, and TV operator salaries fell by 6%. That drop resulted in the median TV operator salary again falling below the median engineer salary. That may be little consolation to the TV engineer trying to make ends meet.

Before radio engineers decide to jump ship to television, let's look closer at the results. The median TV engineering salary is almost $8,000, or 27%, higher than for radio. However, this big difference is not uniform across all markets.

Radio shows its weight in the top 50 and non-commercial markets. In the top 50 markets, the median TV salary is only $2,180, or 4.8% greater than the same-market radio salary. A similar condition exists in the non-commercial arena where the TV/radio differential is $2,060 or 7.2%.

The bottom drops in the comparison for the radio salaries in the below top 100 markets. The differential goes back to 27%, but the dollar difference is $17,400. So before radio engineers think they'd rather work in television for the "big bucks," spend some time checking out the salaries and markets. You could be better off staying where you are.

One disconcerting trend has been evident in television since 1986. Referring again to Figure 2, note that there is almost no upward movement in base TV engineering salaries. In 1986, the TV engineering salary was $34,900. Today, that same salary is only $36,290. This represents only a 3.9% increase in five years.

Dividing the pie

There is another way to compare your salary with the rest of the industry. Simply comparing the dollar amount doesn't provide a complete picture.

To determine if you're getting your fair share in salary, see what percent of the total survey base was being paid at your same category level. Although the amounts are market-related, a direct relationship does not necessarily exist. Other factors can come into play.

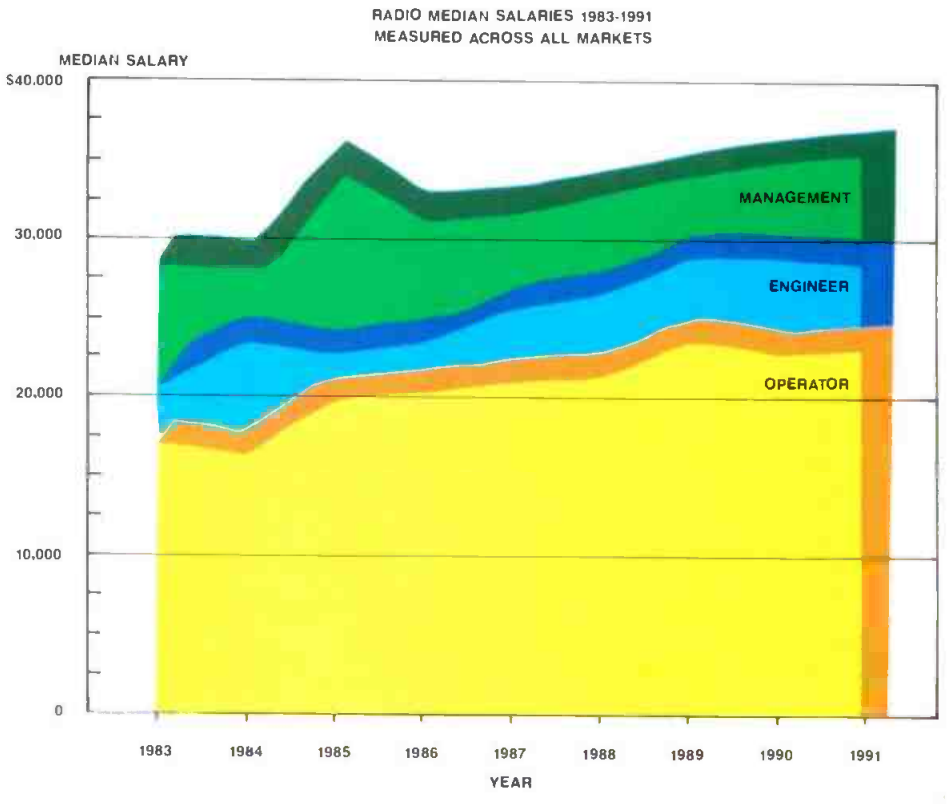
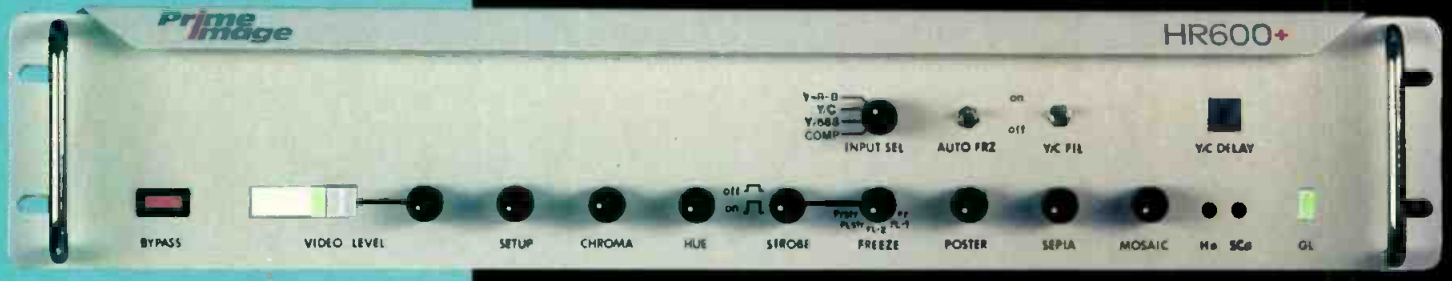


Figure 1. Radio's median salaries measured over all markets from 1983-1991.



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Benefits packages

Financial compensation involves more than base salary. A detailed look at Tables 1-3 shows vast differences in who gets benefits and in what markets they're likely to be available.

In almost every case, television offers more benefits than radio. For example, more than 85% of TV respondents said their station had a paid medical insurance plan, whereas only 75% of radio engineers said their stations did. In this one category, non-commercial TV and radio stations fared much better than their counterparts. More than 92% of all non-commercial radio and TV stations provide a paid medical plan higher than the commercial side. One reason for this high-coverage rate is because many such stations are owned by state or local governments. Government-operated facilities may tend to pay lower salaries, but they typically offer better benefits.

Vacation benefits are better in television than in radio. More than 97% of the respondents in the top 50 TV markets said they had paid vacations. Less than 80% of the radio respondents in the top 100 and below top 100 markets could echo that claim.

Stock purchases is another area where there continues to be a significant difference. Because many TV stations are part

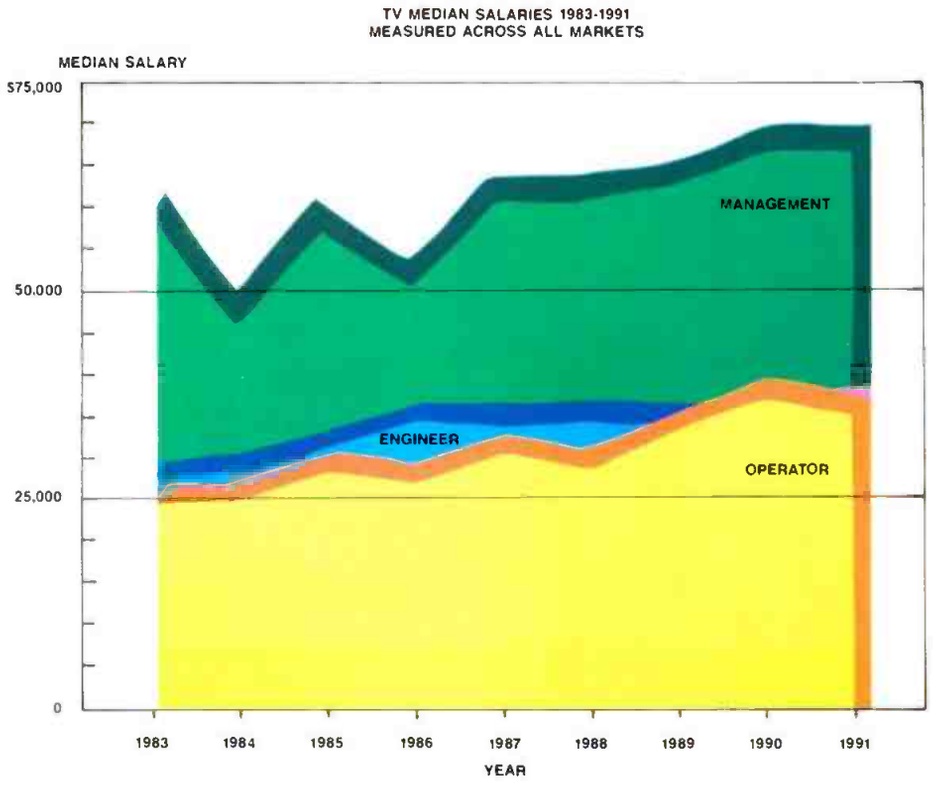
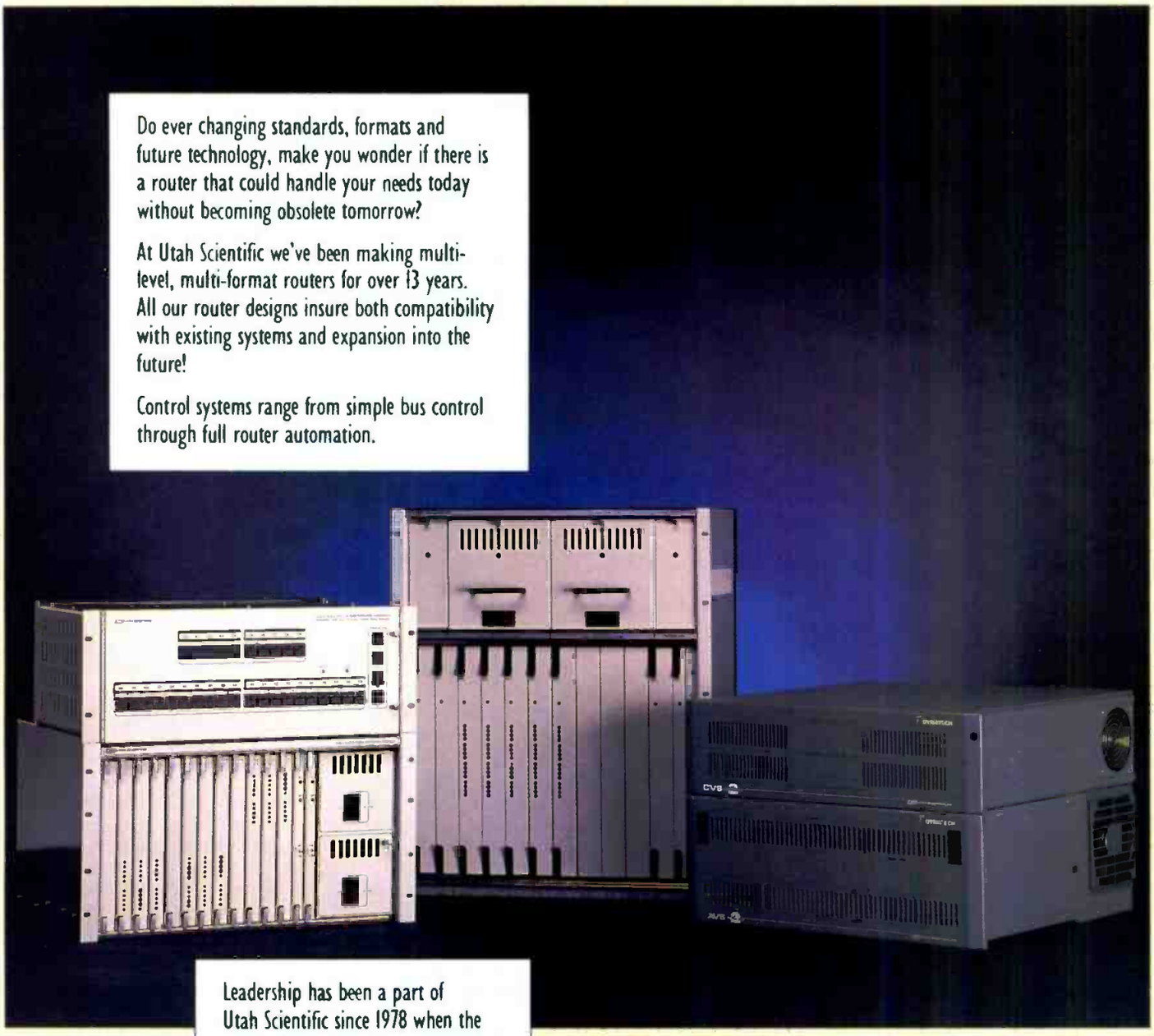


Figure 2. TV's median salaries measured over all markets from 1983-1991.

Multi-Level, Multi-Format



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BUSINESS AND PROFESSIONAL GROUP

Continued from page 42

Digital tops the list

Having skills to work with digital equipment topped the list of concerns for many readers. Those that spoke positively often mentioned digital as the key to success and the future. Those that have the skills to understand digital technology will not only be able to survive, but prosper.

High-definition television was quite low in the minds of the readers. When it was mentioned, it was usually with disdain. Managers didn't want it, engineers were ambivalent and operators didn't mention it at all.

Many engineers looked forward to digital audio broadcasting. The managers tended to see digital broadcasting as the replacement for AM. Most managers see the technology as a threat, not an opportunity. Engineers see it much the opposite.

To get a better flavor for the mood, this year's comments are broken down by job category. Notice how the managers often see technology as a threat, whereas engineers look forward to it. On the other hand, engineers seem more negative about the financial future of their stations than do many managers. Engineers are often quite bitter about the use of less-technical personnel and the ability to operate radio stations without full-time engineers.

The numerous comments made by engineers concerning the need to become financially responsible for their stations were encouraging. The technical professionals now recognize that broadcast is a business and that they can contribute to helping make it profitable. Such thinking is good news for stations and engineers.

Management comments:

"Revenue is down — perceived as being disastrous, but that's relative to prior years when money was falling off the table."

"The chief engineer needs to be a good manager and get into the business end of broadcasting."

"We need competent contract engineers."

"AM radio is receiving a bad rap. Not all AM stations are dead. We are, and have been, the number one station in our market for the past five years, and there are at least 10 FM stations. The bottom line is this: Give the people what they want and they will listen to you."

"The possibilities are endless for those willing to work."

"Maturity of the broadcast market requires engineering managers to concentrate on management of people and finances, and leave the technical work to supervisors and technicians."

"Tough to find maintenance engineers and qualified chiefs."

Engineers comments:

"Opportunities include involving your station with the audience. If you're aggressive in your community, people notice and you will become successful."

"Small market radio equals lower wages, but more 'peaceful' life."

"A lot of managers don't trust their engineers; many times it's the engineers' fault. We need to work with our GMs on helping to improve the bottom line rather than just being 'pure' engineers."

"I am the only full-time engineer left in a 4-station market. All the other stations have gone to contract people."

"Broadcast industry needs the SBE to do something beside frequency coordination."

Small Wonder.

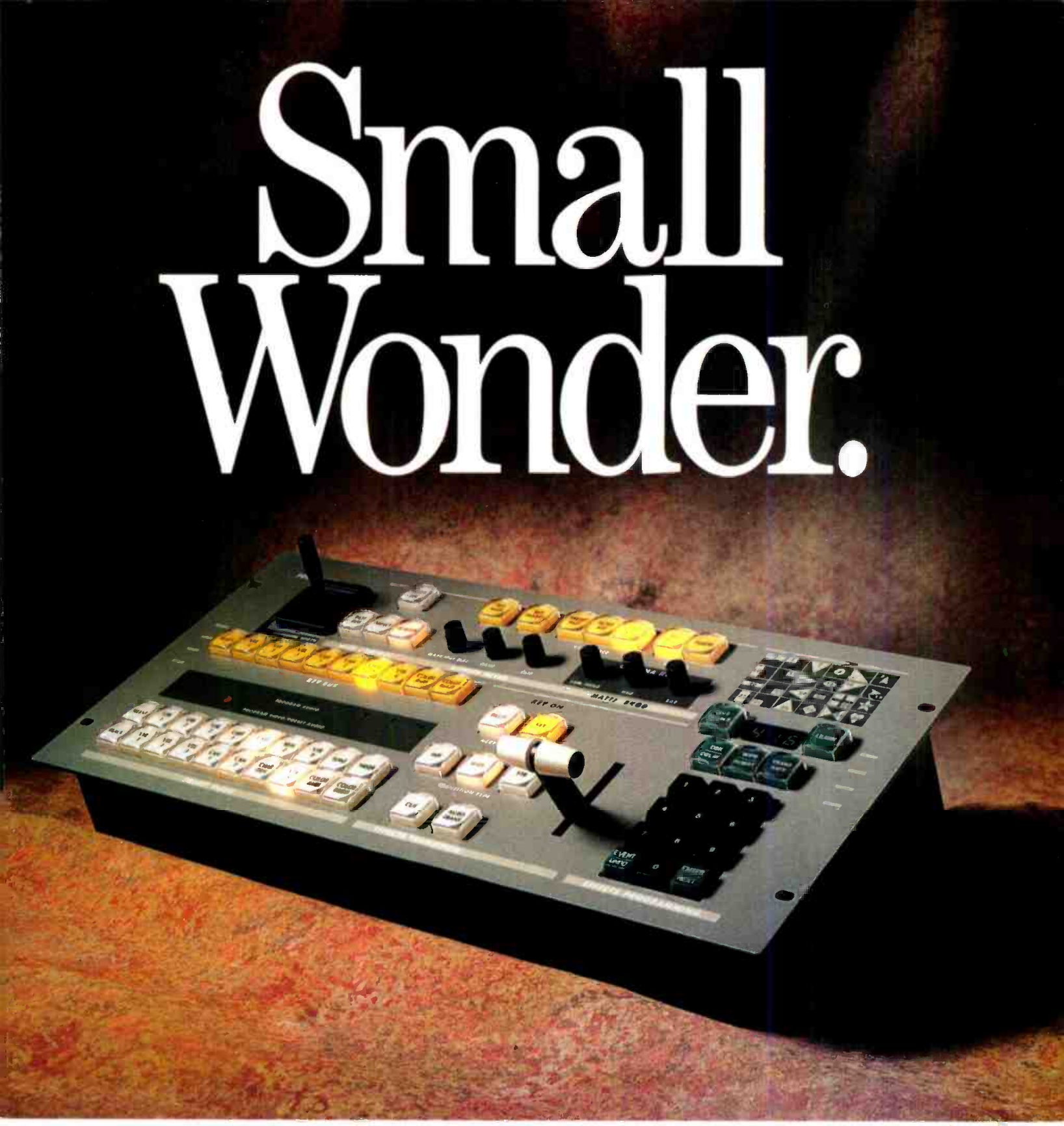

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TABLE 3. — OPERATIONS STAFF PROFILE*

Operations	ALL MARKETS Total %	TELEVISION Total TV %	TV Top 50 %	TV Top 100 %	TV Below Top 100 %	TV Non-Comm. %	RADIO Total Radio %	Radio Top 50 %	Radio Top 100 %	Radio Below Top 100 %	Radio Non-Comm. %
Salary Level											
Less than $15,000	10.0	2.9	....	....	9.1	5.3	16.8	7.9	26.7	20.5	15.1
$15,000 to $24,999	31.5	21.8	13.6	30.3	30.3	21.1	40.8	36.8	26.7	54.8	28.3
$25,000 to $34,999	23.8	24.7	12.1	33.3	39.4	26.3	22.9	18.4	26.7	17.8	32.1
$35,000 to $49,999	22.1	29.4	39.4	24.2	18.2	26.3	15.1	26.3	13.3	5.5	20.8
$50,000 to $74,999	9.5	17.1	28.8	9.1	3.0	15.8	2.2	....	6.7	1.4	3.8
$75,000 or more	3.2	4.1	6.1	3.0	....	5.3	2.2	10.5	....	....	....
No response	....	....	....	....	....	....	....	....	....	....	....
Median =	$28,000	$35,312	$44,375	$29,375	$27,222	$34,000	$23,194	$27,500	$25,000	$19,782	$27,500
Received Salary Increase During Past Year											
Yes	66.2	74.7	77.3	84.8	51.5	81.6	58.1	60.5	40.0	46.6	77.4
No	33.2	25.3	22.7	15.2	48.5	18.4	40.8	39.5	60.0	50.7	22.6
No Response	0.6	....	....	....	....	....	1.1	....	....	2.7	....
Percentage of Increase											
Less than 3%	14.6	18.2	12.1	21.2	15.2	28.9	11.2	15.8	....	9.6	13.2
3% to 4%	10.3	13.5	15.2	15.2	12.1	10.5	7.3	5.3	26.7	....	13.2
5% to 9%	30.4	35.3	40.9	33.3	18.2	42.1	25.7	15.8	....	20.5	47.2
10% to 14%	5.7	4.7	7.6	6.1	3.0	....	6.7	13.2	....	8.2	1.9
15% or more	5.2	2.9	1.5	9.1	3.0	....	7.3	10.5	13.3	8.2	1.9
No response	33.8	25.3	22.7	15.2	48.5	18.4	41.9	39.5	60.0	53.4	22.6
Median =	5.0	5.0	5.0	5.0	4.0	4.3	5.0	5.0	4.0	6.8	5.0
Fringe Benefits Received (Adds to more than 100% due to multiple answers)											
Medical insurance (paid)	78.8	86.5	92.4	81.8	75.8	89.5	71.5	81.6	66.7	63.0	77.4
Dental insurance (paid)	45.8	59.4	66.7	63.6	45.5	55.3	33.0	57.9	6.7	11.0	52.8
Life insurance (paid)	58.5	75.3	78.8	63.6	81.8	73.7	42.5	42.1	40.0	37.0	50.9
Sick leave	83.7	92.4	89.4	93.9	93.9	94.7	75.4	81.6	73.3	65.8	84.9
Vacation (paid)	90.8	97.1	95.5	100.0	100.0	94.7	84.9	92.1	86.7	83.6	81.1
Stock purchase plan	9.5	16.5	21.2	33.3	6.1	2.6	2.8	10.5	....	1.4	....
Profit sharing plan	12.6	18.8	21.2	33.3	15.2	5.3	6.7	13.2	6.7	6.8	1.9
Savings plan	11.7	21.2	27.3	6.1	18.2	26.3	2.8	5.3	....	1.4	3.8
Pension plan	33.0	45.9	51.5	36.4	21.2	65.8	20.7	15.8	13.3	1.4	52.8
401-K Plan	31.5	50.0	63.6	66.7	45.5	15.8	14.0	26.3	20.0	12.3	5.7
Bonus	16.9	18.8	27.3	21.2	18.2	2.6	15.1	18.4	6.7	20.5	7.5
Trade show/convention/ seminar expenses paid	36.1	41.8	33.3	33.3	42.4	63.2	30.7	13.2	20.0	27.4	50.9
Tuition refund plan	23.5	33.5	34.8	27.3	15.2	52.6	14.0	10.5	6.7	2.7	34.0
Automobile furnished	6.9	8.8	9.1	15.2	9.1	2.6	5.0	5.3	....	8.2	1.9
No benefits	3.4	1.2	....	....	3.0	2.6	5.6	5.3	6.7	4.1	7.5
Other	5.2	4.7	4.5	3.0	6.1	5.3	5.6	....	....	8.2	7.5
No response	0.3	....	....	....	....	....	0.6	....	....	1.4	2.8
Years In Present Job											
1 to 2	31.8	29.4	33.3	36.4	18.2	26.3	34.1	34.2	26.7	43.8	22.6
3 to 4	19.2	17.6	15.2	24.2	15.2	18.4	20.7	28.9	13.3	19.2	18.9
5 to 9	27.5	35.3	36.4	33.3	36.4	34.2	20.1	15.8	20.0	19.2	24.5
10 to 14	12.6	12.4	12.1	3.0	21.2	13.2	12.8	10.5	6.7	9.6	20.8
15 to 24	5.4	3.5	1.5	....	9.1	5.3	7.3	2.6	20.0	5.5	9.4
25 or more	1.4	0.6	1.5	....	....	....	2.2	....	6.7	1.4	3.8
No response	2.0	1.2	....	3.0	....	2.6	2.8	7.9	6.7	1.4	....
Median =	4.0	5.0	5.0	3.0	6.0	5.0	3.0	3.0	4.5	3.0	6.0
Years In Broadcast Industry											
Less than 5	7.7	6.5	1.5	12.1	3.0	13.2	8.9	5.3	....	9.6	13.2
5 to 9	18.1	10.6	13.6	12.1	6.1	7.9	25.1	21.1	26.7	28.8	22.6
10 to 14	26.1	30.0	34.8	18.2	39.4	23.7	22.3	21.1	20.0	24.7	20.8
15 to 24	32.7	37.6	37.9	42.4	36.4	34.2	27.9	28.9	33.3	24.7	30.2
25 or more	12.6	12.4	9.1	9.1	12.1	21.1	12.8	15.8	13.3	11.0	13.2
No response	2.9	2.9	3.0	6.1	3.0	....	2.8	7.9	6.7	1.4	....
Median =	14.0	15.0	14.0	15.0	14.5	15.0	12.0	14.0	12.5	11.0	11.0
Do Part-Time or Free-Lance Work											
Yes	46.4	46.5	47.0	48.5	45.5	44.7	46.4	52.6	80.0	34.2	49.1
No	52.4	52.4	53.0	48.5	54.5	52.6	52.5	47.4	20.0	63.0	50.9
No response	1.1	1.2	....	3.0	....	2.6	1.1	....	....	2.7	....
Education											
High school	4.6	2.9	3.0	....	3.0	5.3	6.1	5.3	....	8.2	5.7
Some college	29.5	29.4	27.3	36.4	39.4	18.4	29.6	47.4	26.7	34.2	11.3
College grad (bachelor's degree)	45.3	45.9	50.0	39.4	45.5	44.7	44.7	36.8	66.7	37.0	54.7
College grad (master's, Ph.D.)	12.3	12.9	4.5	18.2	6.1	28.9	11.7	5.3	....	6.8	26.4
Technical school	12.9	14.7	18.2	12.1	12.1	13.2	11.2	10.5	13.3	17.8	1.9
Other	2.0	2.4	3.0	....	3.0	2.6	1.7	....	....	1.4	3.8
No response	0.3	....	....	....	....	....	0.6	....	....	....	1.9
Age, Years											
Under 25	5.4	2.4	3.0	....	3.0	2.6	8.4	7.9	6.7	9.6	7.5
25 to 34	37.5	30.0	28.8	45.5	24.2	23.7	44.7	47.4	33.3	50.7	37.7
35 to 44	39.5	51.2	54.5	45.5	57.6	44.7	28.5	23.7	46.7	23.3	34.0
45 to 54	13.5	12.4	13.6	6.1	6.1	21.1	14.5	21.1	13.3	13.7	11.3
55 to 64	3.4	2.9	....	3.0	6.1	5.3	3.9	....	....	2.7	9.4
65 or over	0.3	0.6	....	....	....	2.6	....	....	....	....	....
No response	0.3	0.6	....	....	3.0	....	....	....	....	....	....
Median =	36.4	37.5	37.3	35.9	37.5	40.0	34.3	33.9	40.0	32.7	36.7

*Operations staff: operations manager, station manager, production/program manager.

TABLE 4. — MEDIAN SALARY SUMMARY FOR 1990 and 1991, TV

	1990 SURVEY					1991 SURVEY				
Category	All Markets	Top 50	Top 100	Below Top 100	Non-Commercial	All Markets	Top 50	Top 100	Below Top 100	Non-Commercial
Management	$66,964	$89,286	$66,667	$66,667	$48,125	$66,667	$92,500*	$100,000*	$67,500	$53,750
Engineering	$35,556	$47,000	$30,652	$27,222	$31,154	$36,290	$47,181	$33,750	$38,833	$30,625
Operations	$37,429	$39,737	$31,667	$25,000	$25,833	$35,313	$44,375	$29,375	$27,222	$34,000

* Sample size is small; use results with caution (less than 20 responses).

TABLE 5. — MEDIAN SALARY SUMMARY FOR 1990 and 1991, RADIO

	1990 SURVEY					1991 SURVEY				
Category	All Markets	Top 50	Top 100	Below Top 100	Non-Commercial	All Markets	Top 50	Top 100	Below Top 100	Non-Commercial
Management	$35,000	$60,000	$30,000	$32,692	$35,882	$35,500	$90,000*	$42,500*	$32,692	$33,750
Engineering	$28,871	$40,625	$28,636	$22,153	$26,333	$28,600	$45,000	$26,875	$21,429	$28,571
Operations	$22,750	$25,000	$25,000	$16,667	$24,091	$23,194	$27,500	$25,000*	$19,783	$27,500

* Sample size is small; use results with caution (less than 20 responses).

TABLE 6. — MEDIAN SALARIES ACROSS ALL MARKETS

	TELEVISION				RADIO			
Category	1988	1989	1990	1991	1988	1989	1990	1991
Management	$61,500	$63,125	$66,964	$66,667	$33,000	$34,200	$35,000	$35,500
Engineering	$34,700	$34,500	$35,556	$36,290	$26,600	$29,000	$28,871	$28,600
Operations	$28,900	$33,850	$37,429	$35,313	$21,300	$23,600	$22,750	$23,194

TABLE 7. — MEDIAN VALUE PROFILE OF BROADCASTERS (Radio and TV Combined)

	MANAGEMENT			ENGINEERING			OPERATIONS		
Category	1989	1990	1991	1989	1990	1991	1989	1990	1991
Salary Level	$42,100	$45,500	$42,647	$31,900	$32,821	$33,387	$28,100	$28,373	$28,000
Received Salary Increase	56.2%	51.2%	42.6%	67.8%	73.2%	65%	75.7%	77%	66.2%
Amount of Increase	7.4%	6%	5%	5.8%	5%	5%	5.7%	5%	5%
Years in Present Job	7.0	7.0	6.0	7.5	6.0	6.0	4.2	4.0	4.0
Years in Broadcasting	26.0	23.0	23.0	16.9	17.0	19.0	15.4	14.0	14.0
Does Free-Lance Work	32.1%	33%	30%	47.3%	45%	46%	56.2%	44.6%	46.4%
College Graduate	64.8%	60.5%	57%	32.9%	30.7%	31.7	60.6%	60.5%	57.6%
Age, Years	53.6	47.1	46.7	39.9	41.3	42.2	37.4	37.0	36.4

"Staff reductions and age discrimination."

"Deregulation hurt everyone but the owners. Let's clean up those overprocessed FM stations rather than worrying about starting digital radio. Who needs it but the Japanese and Europeans?"

"If you get the chance to work outside broadcasting, run don't walk. Broadcast is a dead horse."

"The trend seems to be going to RF contract engineers. Managers may hire a high-school student to repair the studio, but they are a little smarter when it comes to the transmitter. I have so much work, I'm turning down contract jobs."

"An engineer's ability and efforts to reduce operating costs is now valued as much as technical expertise."

Operators comments:

"Plenty of work, plenty of travel and plenty of accounts receivable."

"Salary level is stagnant. Opportunities are closing down."

"You'd better know computers and RF if you plan to stay in this business."

"Recognition of engineers by managers is, in fact, improving. Emerging technologies need qualified people. Stations need to know this if they're going to be competitive."

"I'm excited about the possibilities of digital broadcasting."

"Management wants to eliminate the technical employee. They don't sell or talk."

"The trend toward digital is great. Opportunities are fewer and fewer."

"I've fallen and I can't get up."

"Digital technology is here. How do I make management understand that?"

"Non-linear editing. Gimme, gimme, gimme."

"The most diverse person in technical operations will be the only survivor by the year 2000. Automation is coming."

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Engineering can be a profit center

Want more respect? Turn your engineering department into a profit center.

By Marvin Born

To quote comedian Rodney Dangerfield, engineers "don't get no respect." This oft-heard expression dots conversations wherever engineers gather. In the past few years, scores of papers and articles have addressed the engineer's need to abandon the pocket-protector image. This article explores ways to enhance the engineer's image from a different view, by looking at some business aspects of broadcasting. It will also provide strategies that may help engineers graduate from being pains in the bottom line to becoming part of stations' revenue team.

Dollars in, dollars out

The station sales department brings in cash. This makes sales a *profit center*. The production department can also bring in revenue. Although news departments don't often admit it, they can be profit centers as well.

Station managers are bottom-line oriented. Blazoned across their sky is the golden formula: *income – expenses = profit*. Anything that increases income, or decreases expenses, increases profit. That's good news for the bottom line.

Unfortunately, engineering departments are usually an expense. They have expensive hourly employees who purchase expensive new equipment. And when they repair that expensive equipment, they use equally expensive parts.

Get the message? When you call the general manager, what you are saying is "spend money." While you are making your pitch, the manager is probably mentally refiguring the balance sheet to account for your request. No wonder you get no respect. Often as not, you're bad news.

Revenue turnaround

Want more respect? Turn your engineering department into a profit center. Revenue enhancement and cost reduction (making more and spending less), and helping other departments do the same, is the engineer's key to the manager's heart.

The station's tower is one source of revenue enhancement. Many broadcasters lease some form of tower space. However, most rentals occur because someone has asked for it. That space was requested, not sold. Effectively using the tower for revenue enhancement requires engineers to take a proactive stance. Often, this must be preceded by a change in attitude. Thinking must shift from "Keep off our tower" to "Welcome to our transmission structure, can we help you?"

Going a step further, assume that your facility is a TV station on channel 6. Could you save money by diplexing one or more FM stations into your antenna? This would be attractive to the FM stations because they have no antenna, tower or transmission line expenses. They give you RF and money. You take it from there.

Any revenue-enhancement activities regarding the tower must be tempered by a concern for reliability and safety. You cannot load the tower until it snaps. The ideal situation is to design the tower and antenna system from the ground up for rental. (See the related article, "Net Present Value: The Time Value of Money," p. 62.)

To properly design such systems, the engineer must work through many scenarios. First, design with no rentals. Then, add platforms at one-third and two-thirds height for 2-way clients. Add additional rentals until you have a profile for each addition and how that addition affects your station's profit. This requires a

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

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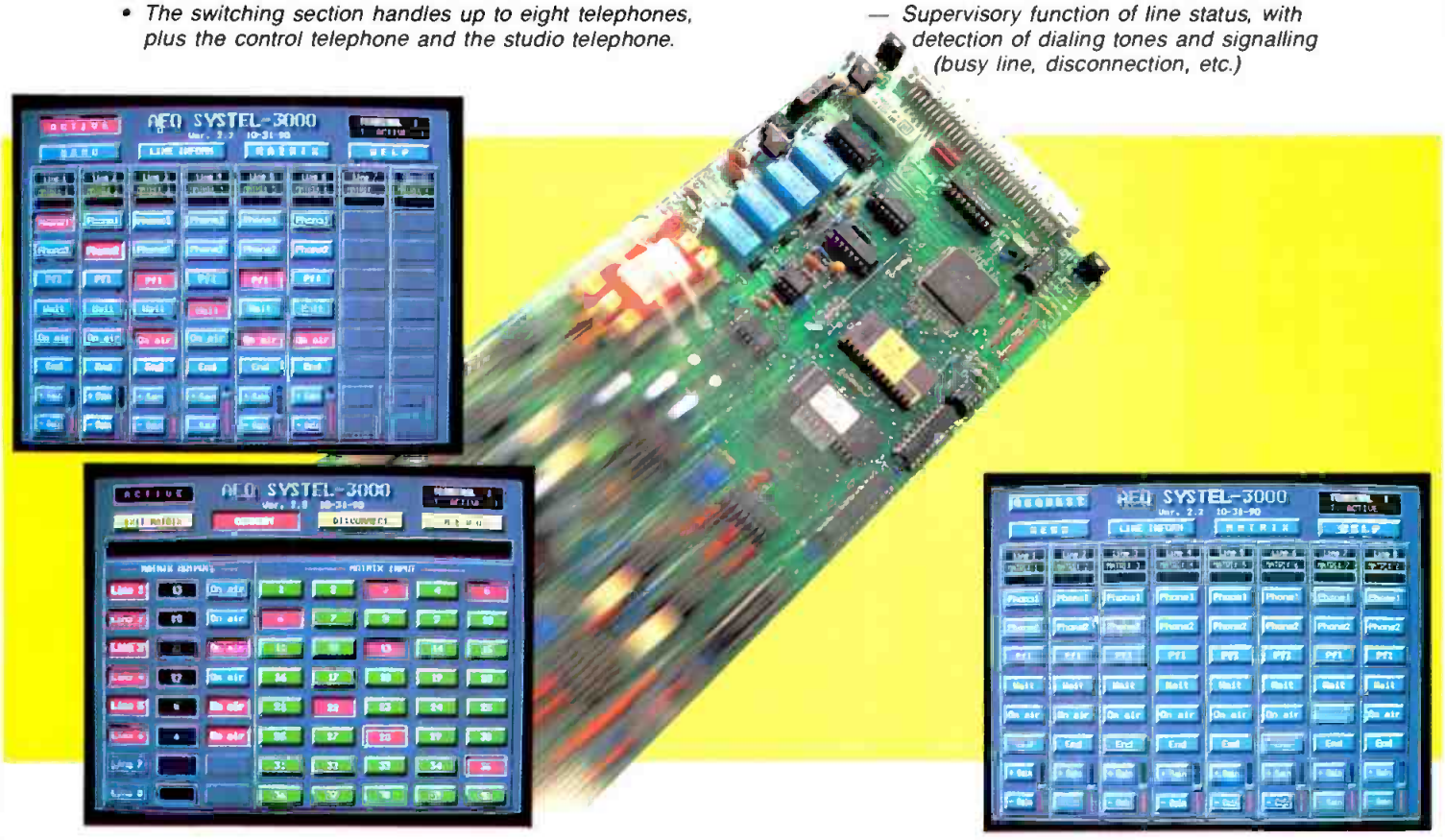

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lot of non-technical paperwork, but the rewards are great — and you probably will get the respect you deserve.

Real estate sales or leasing may be another revenue option. Could a decaying DA be replaced by a smaller, more up-to-date configuration? If you could do away with one tower, could you sell the land or lease it for a different use?

Back on the ground

Cash flow opportunities also exist in the studio. Telemarketing is now popular. Some telemarketing companies will provide a machine for weather or sports information (along with a short commercial announcement before the information). They charge advertisers for the commercial, pay the broadcaster to house and service the machine, and most important to them, see that the information is current.

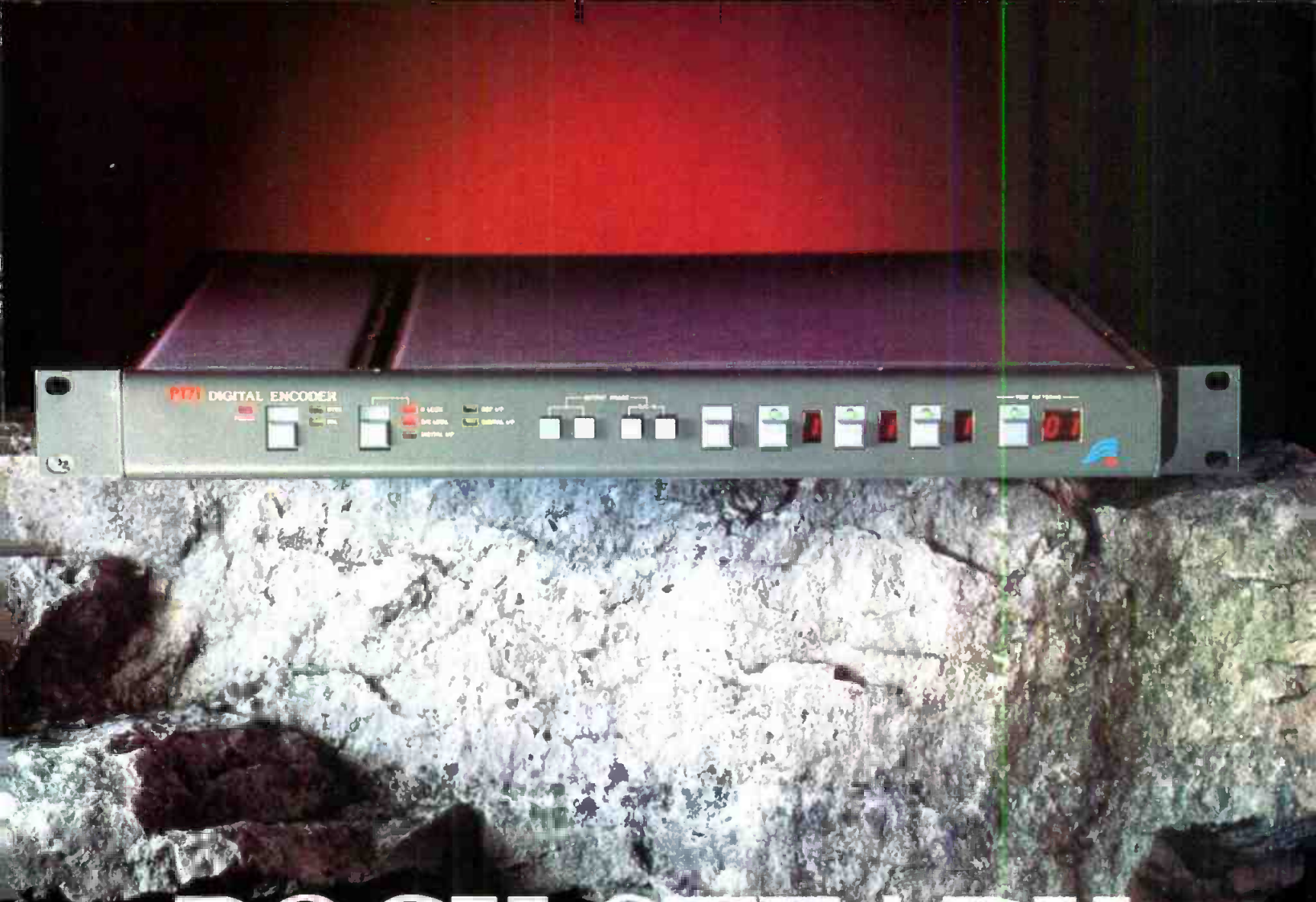
This will require approximately 15 minutes per day for the talent to voice the machine, and about a half-hour per week to service it. Some of these machines receive thousands of calls per month. If an engineer waits for someone else to think of this idea, the other person gets credit for the income and the engineer still services the machine. Why not receive the credit as well as the work?

Station managers are bottom-line oriented. Blazoned across their sky is the golden formula: income – expenses = profit. Anything that increases income, or decreases expenses, increases profit. That's good news for the bottom line.

How would you feel about renting your satellite truck to a competing company or network? How would you feel if it earned approximately $1,500 per day? Satellite trucks can make $1,000 to $2,000 early in the morning before most news departments are up for the day. The truck can often be home by 9 a.m. (Just make sure your news department understands that when the truck is rented, it would not be available to it. Be careful of late afternoon and early evening jobs.) Occasional rental can net approximately $25,000 per year. If handled properly, it need never be a problem for your news department.

Sharing an uplink could also mean potential revenue. If your news department takes the truck at the top of an hour

Continued on page 58



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36 USC 380

A candelabra on the top of the WBNS tower (Columbus, OH) holds the WBNS-TV and WCMH-TV antennas and an ENG receive site. A multistation FM panel antenna is mounted just below the candelabra.

news show and again for an update near the end, the whole second block is unused. So why not sell it to someone? Many stations will take a second block feed over nothing at all. The only thing to change is the mic flag. Get extra flags for the stations with which you share and add a little personal touch for them. Then take their money.

Payroll loading

Almost everyone charges clients for use of equipment and for the labor of personnel. A common technique is to charge the engineer's hourly rate plus a markup. This method can actually cost you money. In addition to the hourly rate paid to an employee, the company pays a share of the Social Security tax on that wage along with health insurance, life insurance, retirement, profit sharing and so forth. These costs can add 30%-50% to the actual wage. Furthermore, some employees are "support" employees. Their salaries are divided among the line employees. (The payroll clerk would be a support employee, while the master control operator would be a line employee.) This greatly increases the real cost of an employee. As an engineering manager, you must know the real cost of an employee, not just the hourly rate. Charge the real rate plus a reasonable markup.

Cost control

Let's look at ways to reduce cash outflow. The GM knows *you* spend the money, so try to reduce the pain. You can either reduce the budget, or get more value for the same money.

Every engineering department buys equipment and spare parts. Careful shopping can save big bucks. Most people usually order parts and pay the asking price. Spare parts prices from major manufacturers are usually fixed. However, generic spares go at market rate. You, not the vendor, determine the market rate.

For example, call three different suppliers and ask the price of a camera or transmitter tube. You will probably get the list price. Then, call them back later and tell them you want their best price, and that you will be buying from the least expensive source. Don't pass along a competitor's price, because they may then quote you something slightly below that price, not their lowest price. Let the salesperson make the offer. Never give a second shot. The first couple of times they may highball you, but after losing a few sales, they will change their tactics. If they know you give second chances, you will never get the best price.

Don't be embarrassed to ask for a discount. There is a price below which the salesperson cannot go. Your job is to find

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Spare parts prices from major manufacturers are usually fixed. However, generic spares go at market rate. You, not the vendor, determine the market rate.

that price and not pay a cent more.

For normal parts purchases, have one person order the parts. After awhile, that person will develop a general sense of what items cost and how much a given vendor will discount. Similarly, try to deal with only one person at each vendor. That salesperson will quickly learn how you operate and give a good price on all calls.

New equipment purchases

New equipment purchases require a few additions to the rules. First, know what you want to buy. Do your homework before you talk to a sales representative. Broadcast equipment sales are cyclical. Study your vendors and read the trades. Know how their sales are going for the month, and know when their business year ends. Learn how the economy is acting, and how it is affecting business. If you sense your vendor's sales are in trouble, use that information to force a lower price.

I would like to suggest a 2-step purchase process. After doing your homework, call the manufacturer's sales office and request that a salesperson visit your office. At the meeting, describe what you want. Ask for a tentative price for the whole package and tentative prices for the various items. Tell the salesperson that soon you will ask for only *one* formal quote, and that you expect that price to be the best one. Use the tentative prices to compare similar equipment between competing suppliers. Give each bidder the same request to simplify the comparison.

When you have selected your exact purchase, choose two or three manufacturers. Obtain permission to make the purchase from your GM or company treasurer. (The salesperson will want to deal with the decision maker. At the concluding round, you want that salesperson to know you make the final decision.)

Either call the vendor or meet in your office. Simply say, "Please prepare your final formal quote for the following equipment," then list it. Give this same information to all your vendors and give them a deadline. Accept the quote only in person and in your office, if possible. Otherwise, accept only original written quotes.

There is a price below which the salesperson cannot go. Your job is to find that price and not pay a cent more.

Make sure your salesperson knows that more than one manufacturer is bidding, and that you expect the best price the first time. Warn that attempts to change your decision will result in the loss of this business and possible future business.

Keep absolute control of every phase of the purchase. Give a formal air to all discussions. Go to lunch or dinner to learn about products, never to talk about purchases. Do all sales discussions in your own office, not over a dinner table or any other neutral place. Never talk in the salesperson's office. Consider the various vendors' prices to be private, and don't share that information with competing vendors. Don't accept a second "final" quote from a vendor.

Consider the various vendors' prices to be private, and don't share that information with competing vendors.

Fire sales

Someone else's problem can be your good fortune. Keep an ear out for "going out of business" sales or liquidations. Good items can be had at between 10 cents to 25 cents on the dollar. Don't be afraid to offer a low price. They may say no, but if you have done your homework, it will probably be yes.

Someone else's problem can be your good fortune. Keep an ear out for "going out of business" sales or liquidations.

In this situation, bargaining is fine. Before you make your offer, however, know the used market price and the maximum that you will pay. Liquidations take two trips. Make the first trip as soon as you find out about the sale. Buy what you really need and pass on items you like but are willing to live without. Make offers on anything you want. Make the second trip just before the auction. This will be the leftovers, and the owner may take a sure price over an unknown auction price. This time slot is home of the "5 cents to 10 cents on the dollar" prices. Buy only what you can use or intended to buy.

Dollars and sense

Consider that some of the ideas presented here are power tools. Modify them to work in your own environment. Remember that this "non-engineering" thinking may be considered by some to be intruding into their area. Tread gently until the other departments discover that you are trying to help the company and not interfere with their position.

Profitability is a prime measurement of performance for the GM, the other departments and engineering. Give up the old saw "all management worries about is the bottom line." Be concerned with that line. Then do your part to ensure it is always written in black ink.

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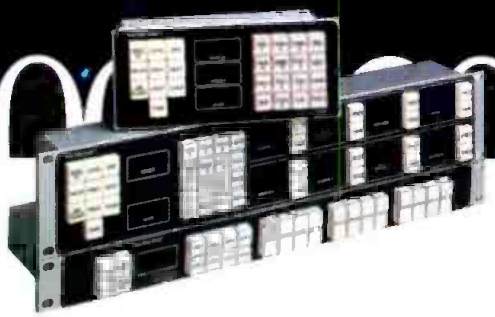

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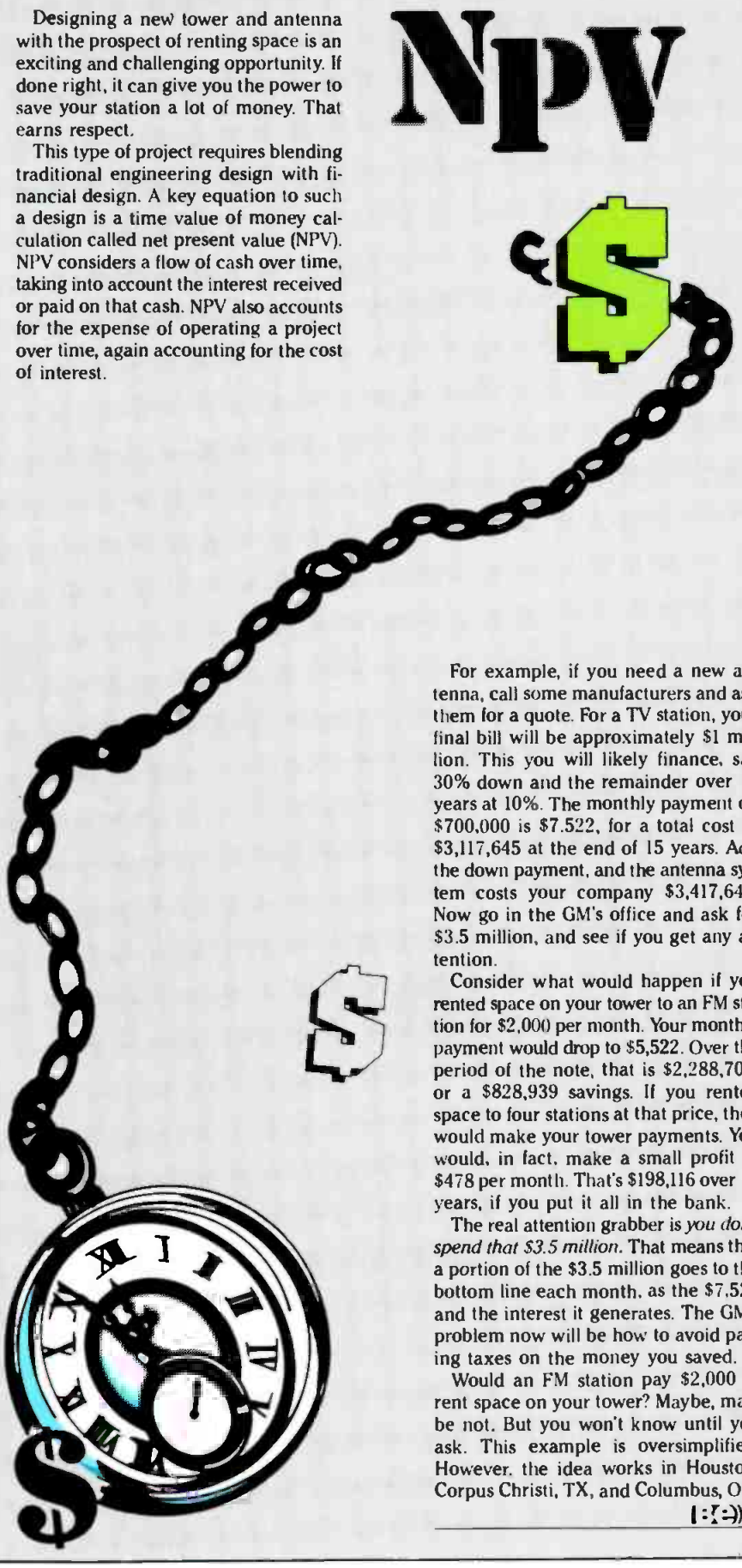
Net present value: The time value of money

Designing a new tower and antenna with the prospect of renting space is an exciting and challenging opportunity. If done right, it can give you the power to save your station a lot of money. That earns respect.

This type of project requires blending traditional engineering design with financial design. A key equation to such a design is a time value of money calculation called net present value (NPV). NPV considers a flow of cash over time, taking into account the interest received or paid on that cash. NPV also accounts for the expense of operating a project over time, again accounting for the cost of interest.



For example, if you need a new antenna, call some manufacturers and ask them for a quote. For a TV station, your final bill will be approximately $1 million. This you will likely finance, say 30% down and the remainder over 15 years at 10%. The monthly payment on $700,000 is $7,522, for a total cost of $3,117,645 at the end of 15 years. Add the down payment, and the antenna system costs your company $3,417,645. Now go in the GM's office and ask for $3.5 million, and see if you get any attention.

Consider what would happen if you rented space on your tower to an FM station for $2,000 per month. Your monthly payment would drop to $5,522. Over the period of the note, that is $2,288,705, or a $828,939 savings. If you rented space to four stations at that price, they would make your tower payments. You would, in fact, make a small profit of $478 per month. That's $198,116 over 15 years, if you put it all in the bank.

The real attention grabber is *you don't spend that $3.5 million.* That means that a portion of the $3.5 million goes to the bottom line each month, as the $7,522 and the interest it generates. The GM's problem now will be how to avoid paying taxes on the money you saved.

Would an FM station pay $2,000 to rent space on your tower? Maybe, maybe not. But you won't know until you ask. This example is oversimplified. However, the idea works in Houston, Corpus Christi, TX, and Columbus, OH.

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Competing for your job

Could you qualify for your job again?

By Richard Farquhar

If you were interviewing with your present employer, how would you answer the following questions:

- What are your strongest abilities?
- How do your skills relate to our company's needs?
- Why should we hire you?

These are tough questions that demand thoughtful and honest answers. This article will provide the fuel for some penetrating self-analysis. Honest self-appraisal is the first step toward making sure you could land your job again. Keeping skills sharply honed is the first step toward keeping yourself employable in uncertain times.

Who are you?

Self-knowledge is empowering. It allows you to build on strengths — and shore up weaknesses.

Try to answer these questions:

- What are your strongest abilities?
- Are you dependable?
- Are you someone the company can rely on when working with its most important clients?
- Do you have a thorough knowledge of the industry?

Farquhar is vice president, Television Systems, Inc. (TSI), Canal Winchester, OH, and is vice president of the Society of Broadcast Engineers (SBE).

Keeping current

You owe your company more than loyalty, teamwork and dependability. As an engineer in broadcasting and related industries, you must keep abreast of industry trends and technologies.

Self-knowledge is empowering. It allows you to build on strengths — and shore up weaknesses.

Are you knowledgeable about:

- The HDTV proposals?
- New videotape formats: D-1, D-2 and D-3?
- Digital audio techniques and processes?
- Your company's marketplace and clients?
- Automation and library management systems?

Look around your facility. What is in the marketplace now that could replace your tape machines, microphones, audio consoles, video switchers, character generators, graphics devices or automation systems? It is extremely important that you are aware of what emerging technology is bringing to the industry. It is also important that you understand that technology. Your manager needs your knowledge to make the decisions that will move your company ahead.

What price knowledge?

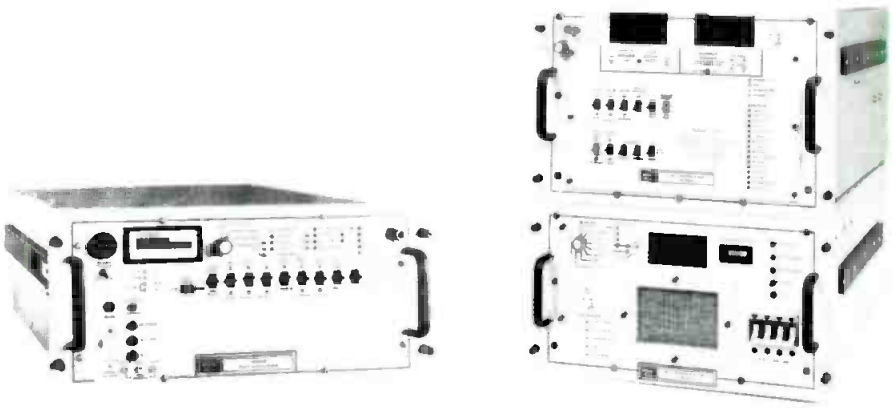
Here are some ideas on how you can increase your awareness of the industry:

- Seek out equipment sales representatives. Ask how their companies are responding to new trends and technologies.
- Read and understand the current technical articles in the various periodicals.
- Discuss the new technologies at SBE

Continued on page 68

12

Reasons To Specify MCL C-Band, Ku-Band and DBS High Power TWT Amplifier Systems.



1 Designed specifically for satellite earth station use in video, voice and digital communications applications, MCL High Power TWT Amplifier Systems are recognized worldwide for meeting the most demanding signal purity and reliability requirements. 2 TWT Amplifiers range from 50 to 3,000 + watts. 3 Commonality in design and operation provides module interchangeability, and minimizes maintenance and repair downtime. 4 Designed to operate under extreme environmental conditions, and in unattended remote areas. 5 Single Drawer Amplifiers (50-300W Ku-, 75-125W C-Band). 6 Double Drawer Amplifiers (300 to 750W C-, Ku-Band and DBS). 7 Single Cabinet Amplifiers (2.5KW-Ku, 3KW C-Band). 8 TWT Tube Protection. 9 Amplifier Performance Readout/Control. 10 High Voltage Component Protection. 11 "Remote" Capability (computer interface, also). 12 MCL's design, manufacturing and quality control processes ensure the highest quality satellite communications amplifiers and allied equipment available on the market today. All at competitive prices.
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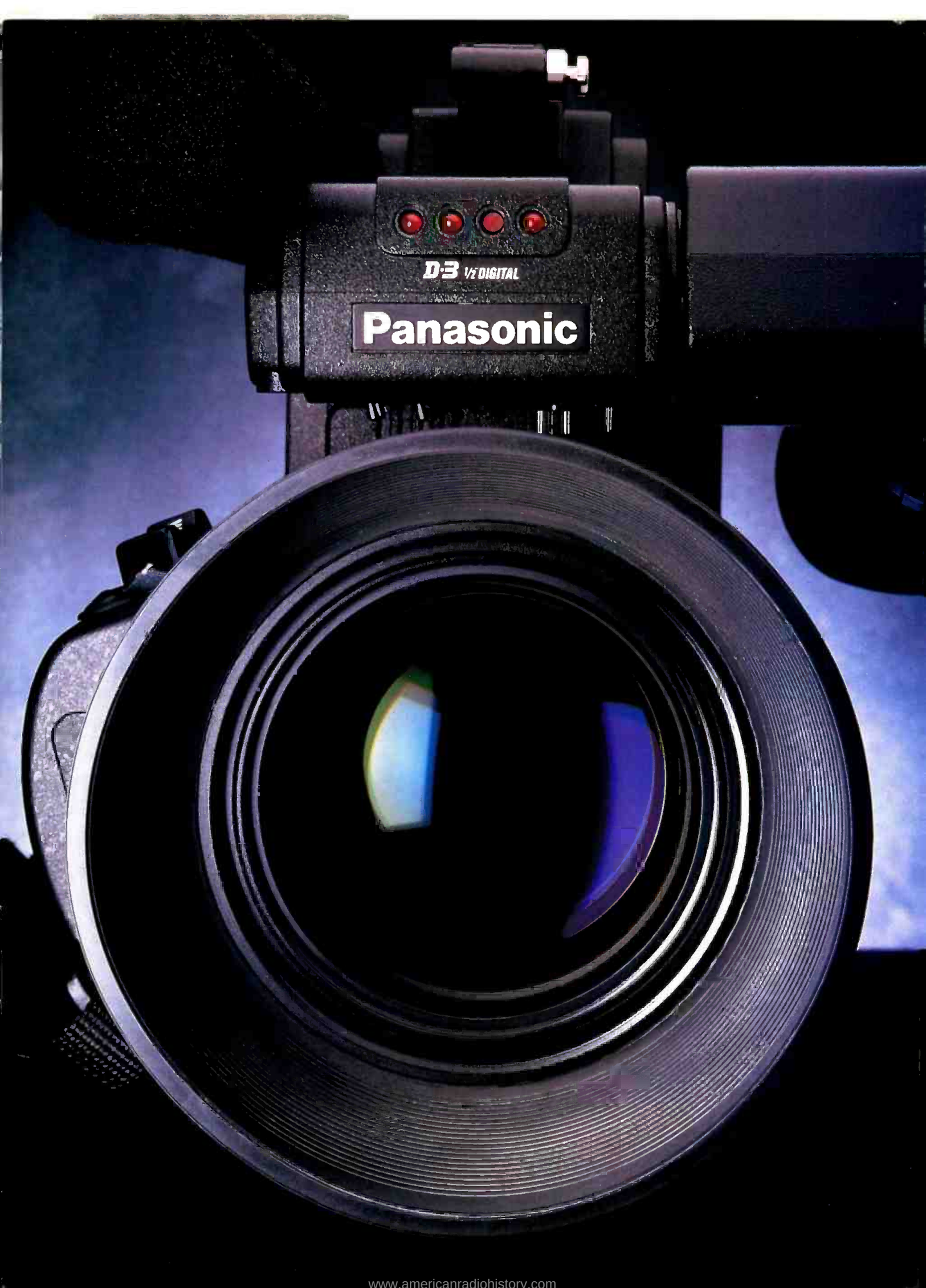

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36 USC 380

Software management

Managing software at the broadcast facility is an important job.

By Steve A. Rowell

The current software revolution can be disconcerting to many engineers. Keeping software current seems to be a constant calling. This article will provide you with some ideas to help put your facility in order.

Take inventory

First, find out what software-based systems you are currently using. Develop an up-to-date list of all such systems. Include all tape machines, editors, switchers, graphics devices and computers. Be thorough. Start with an equipment list and delete all the devices that do not have a microprocessor-controlled system. The list you end up with may surprise you. Almost every microprocessor-controlled device these days works from an EPROM, which can be changed and updated to enhance the operation of the device or remove a programming bug. Once everything is accounted for, make a master list with the equipment model number, serial number and list of systems. Be sure to include the current software version.

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

Include all departments

When you finish with engineering, offer your services to the rest of the facility. Check out the other departments that have PCs. Find out what programs and what versions are being used. Two PCs may be using different programs from the same software family. It is important to designate a *station format* so that everyone is using the same word processor, database, spreadsheet program and so forth. This will allow users to exchange files, and make job changes easier because everyone will be working with the same programs. Also, check to see if you need a *site* or *machine license* for the software programs. If your individual PCs have never been organized, you may find that many are being run on individual versions of the same software. If this is the case, a site license may save you money.

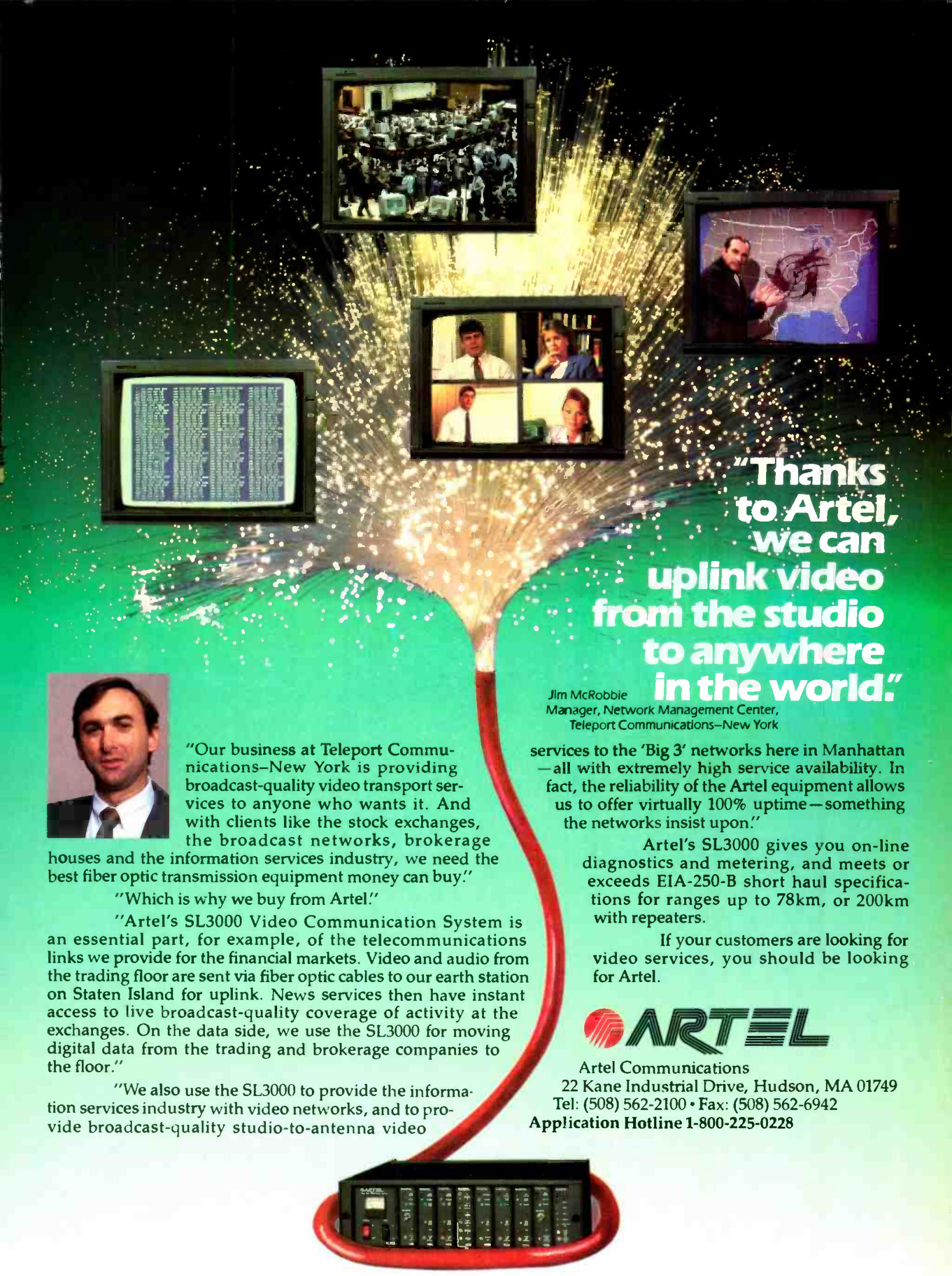
If you require the ability to exchange files between users, consider installing a local area network (LAN). This will allow all PCs to use all programs and files. Make an organizational list to handle any hardware changes you have found, and devise a plan to institute them. List the software by department, position, PC type, software program and version. This list will be of great value if an employee leaves or changes positions in the company. Don't forget the traffic department. It may have a mainframe that only its employees know how to operate. Include this system on your list. Contact the service department that handles the mainframe, and ask it to keep you up-to-date on the software.

Making everything current

Now that you have a handle on the problem, take a breather and review the list. Look carefully for different software versions being run. After everything has been sorted, see if the versions are current. This can be done by a simple call or letter to the machine manufacturer or software vendor. If you determine that you don't have the latest version, find out what enhancements have been added or bugs removed, and decide whether the new version should be purchased.

Create a position

Now, you've probably generated a great deal of paperwork, and you can foresee even more labor in the future. Consider creating a position that could handle all of this work. *Software manager* or *software engineer* would be a good job title.



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Depending upon the size of your station, this job could be full- or part-time. The software manager/engineer would be in charge of the master disks and manuals, and could add to or reconfigure any system. The position's other duties could include backing up important systems, troubleshooting any operational problems with PCs, and taking care of all software-related changes on the technical equipment in production and master control.

If it doesn't already exist, the software manager and other supervisors should instill a sense of high "software ethics" in the staff. Bootlegged applications should simply *not be permitted to run* on station computers. Beyond the purely philosophical arguments ("If you could get away with stealing a new CPU off the back of a truck, would you do it?"), there are serious practical problems. These include the lack of documentation, possible corruption of the program and the risk of virus contamination to other facility computers. The most important issue is the liability that can be incurred if you're caught using "stolen" software. The costs to resolve the resulting legal issues will more than offset the price of having legitimate copies for everyone that needs them. *Just say no to bootlegging.*

Supervisors should instill a sense of high "software ethics" in the staff.

Project purchases

When you are confident about where you are in the software jungle, project ahead to keep up with the ever-changing software world. Having a designated software manager will also help. When you talk with equipment and software manufacturers about their products, ask if they have a yearly fee that will assure you of the latest version as soon as it is released. This will allow you to budget the item and project the software cost.

Build software upgrades into your capital budget. When you purchase a computer-driven system, you might consider taking only the options you need or can afford at the time. Obtain a list of the other software options, and budget for them as capital purchases in the coming years. This will help to quickly restore operators' comfort with the system after enhancements are installed. It also prevents everything from being thrown at them all at once.

Don't forget to budget training for your software manager/engineer.

Consider a software budget line for the whole station. This allows all PCs to be updated, not just your technical equipment. Don't forget to budget *training* for your software manager/engineer. It is important that the person be up-to-date on the constantly changing software marketplace.

Although the previous suggestions will require the investment of staff time and some cash outlay, the benefits in increased efficiency, productivity and workplace serenity will be worth it. Achieving these goals sooner, rather than later, is also advised. Once your facility is in order, it will be easier to keep tidy.

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Testing coaxial lines

Courtesy of Andrew Corporation

Transmission line faults can be found without specialized hardware.

By Don Kolbert

This first installment in a 2-part series looks at the theory, techniques and hardware involved in transmission line testing. Part 2, which will examine practical applications, will appear in the November issue.

When a broadcast engineer needs to check out a transmission line or cable system, it's often either too late to buy a cable tester or the station can't afford one. The most common variety of these devices is the *time-domain reflectometer* (TDR). Some TDRs are so sensitive that they may not fare well when used in high RF environments, such as the typical transmitter site. But armed with an oscilloscope and a pulse generator, you can do a fairly accurate job of checking coaxial cables, finding the distance to a fault, and determining the nature of the fault (open, short, impedance mismatch and faulty connectors).

By carefully eyeballing oscilloscope graticule marks, you can resolve cable lengths to within several feet. Any broadcast engineer can make these types of measurements with some basic information about the technology involved, some practice and a little patience.

Some prerequisite information

First, recall that electromagnetic energy travels at a free-space velocity of 300,000,000 meters per second, which corresponds to 30 centimeters per nanosecond (30cm/ns) or 11.8125 inches per nanosecond (11.8125in/ns). This approaches a rate of one foot per nanosecond (actually 0.9844ft/ns).

Next, remember that the velocity of propagation (V_P) of electromagnetic energy traveling in the confines of a transmission line or coaxial cable depends on the dielectric constant (k) of the insulating material used to separate the conductors, as described by the velocity factor (V_F):

Equation 1:

$$V_F = 1/\sqrt{k}$$

The actual velocity of propagation V_P in a particular type of cable is defined as:

Equation 2:

$$V_P = 30/\sqrt{k}$$

For example, RG-8/U coaxial cable has a polyethylene insulating material with a dielectric constant of 2.3, and therefore a V_P of 7.8in/ns or 0.65ft/ns. (See Table 1.)

CABLE TYPE	Z_O (Ω)	k	V_F (ft/ns)	V_P (ft/ns)
63DRG-8/U	52	2.3	0.66	0.65
RG-11/U	75	2.3	0.66	0.65
RG-58/U	50	2.3	0.66	0.65
RG-59/U	75	2.3	0.66	0.65
HJ 5-50	50	1.19	0.916	0.902
HJ 5-75	75	1.23	0.901	0.886
HJ 7-50	50	1.18	0.921	0.906
HJ 7-75	75	1.17	0.924	0.909
LDF 5-50	50	1.26	0.89	0.876
LDF 7-50	50	1.29	0.88	0.866
HJ 8-50	50	1.15	0.933	0.918
HJ 8-75	75	1.14	0.936	0.921
HJ 9-50	50	1.16	0.93	0.915
561	50	1.004	0.998	0.982
562A	50	1.004	0.998	0.982
573	50	1.004	0.998	0.982

Table 1. *Some commonly used coaxial cable types, listed with surge impedance (Z_O), dielectric constant (k), velocity factor (V_F) and velocity of propagation (V_P).*

Kolbert is chief engineer at KLSE-FM and KZSE-FM, Rochester, MN.

Reflectometry

If a pulse of energy (incident wave) is fed into a properly terminated cable (for example, a 50Ω cable terminated by a 50Ω resistive load), it will travel to the end of the cable and be dissipated by the load. If the load is not matched to the cable, some of the energy will be reflected back to the source of energy and cause *standing waves*.

For cable lengths less than a few thousand feet, a rectangular pulse is often used. The pulse-width time in seconds must be greater than the time it would take a pulse to travel to the end of the cable and back. For example, using the Vp data shown in Table 1, a 100-foot section of RG-8/U provides a round-trip time of 2×100 feet ÷ 0.66ft/ns, or 303.3ns. If square waves are used for testing, the period must be at least 606.6ns (a full wavelength includes *two* pulses, one positive and one negative), corresponding to 1.648MHz ($f=1/T_{period}$).

Pulse amplitudes of one or two volts will normally be sufficient to overcome the effects of stray RF pickup. No harm will occur if larger pulse amplitudes are used, consistent with operator and equipment safety limits.

Caution: Do not connect the instruments to "hot" transmission lines. Equipment and/or personal hazard may result. Always test high-power RF lines with the transmitter off.

For cable lengths exceeding a few thousand feet, a ½-sine wave pulse is preferred. In this article, however, only the rectangular pulses used for typical cable lengths encountered in broadcasting will be considered.

Interpreting results

Figure 1 shows the waveform produced by feeding a pulse into a properly terminated cable. Even if the oscilloscope display is expanded, the pulse will appear to stay at the same amplitude, indicating that no energy is reflected.

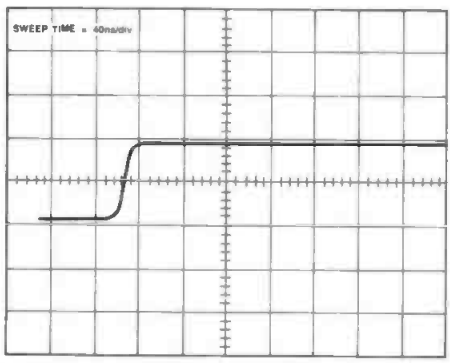

Figure 1. *Simulated display of pulse fed into a properly terminated transmission line.*

Figure 2 shows the pattern displayed when the cable is open at the end. The reflected energy causes an upward step in the pattern that is equal in amplitude to the incident wave. This indicates that all

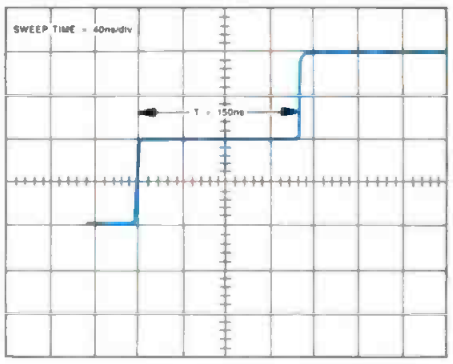

Figure 2. *Simulated display of pulse fed into an unterminated transmission line. Value of T indicates a distance of approximately 49 feet for RG-8 cable. (See Equation 3.)*

of the energy fed into the cable is being reflected back to the source. The time period for the incident wave portion of the display represents the time it takes for the pulse to travel the length of line and back. If the time base (horizontal sweep) of the oscilloscope is linear, time (T) can be converted into distance (D) as follows:

Equation 3:

$$D = V_P \times T/2$$

For example, if T = 150ns, and RG-8/U cable is being tested, the distance in feet to the open end is $0.65 \times 150/2 = 49$ feet.

Figure 3 illustrates the pattern created when a short is placed at the end of the cable. Here again, the distance to the short can be calculated using Equation 3.

An antenna will not appear as a resistive load to a pulse. It only appears resistive to the sine wave frequency at which it is resonant. The pattern produced by feeding a pulse into an antenna-terminated cable may appear as an open, a short, an inductance or a capacitance, depending on the type of antenna. The tuning networks used in AM antenna systems may show up as either inductive or capacitive when viewed from the transmitter end of the cable, depending on the configuration of the network.

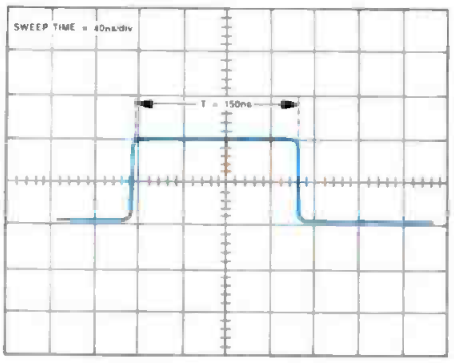

Figure 3. *Simulated display of pulse fed into a transmission line with a short at its far end.*

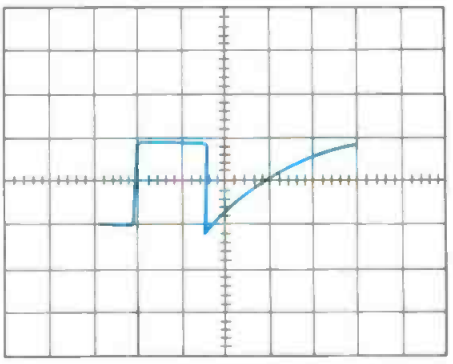

Figure 4. *Simulated display of pulse fed into transmission line terminated by a capacitance in parallel with the 50Ω load.*

Figure 4 shows the effect of capacitance in parallel with the 50Ω load at the end of the cable.

Figure 5 shows the pattern produced by an inductance in parallel with the 50Ω load at the end of the cable.

Measurement accuracy

The accuracy of the measurement will depend on the following factors:

- *Time base range, resolution and linearity:* Using an oscilloscope with a maximum sweep rate of 0.2μs/div will provide a display scale of 200ns per division, with each small subdivision representing 40ns. That

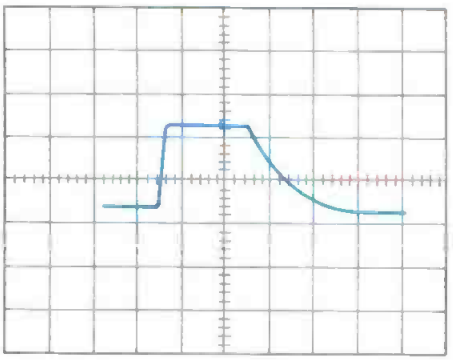

Figure 5. *Simulated display of pulse fed into a transmission line terminated by an inductance in parallel with the 50Ω load.*

means that the best eyeball resolution that can be expected is approximately 26 feet when testing RG-8/U coaxial cable. This will not provide accurate distance calculations. But if the scope has a 5X multiplier, it will provide 200ns ÷ 5 or 40ns per major division as the fastest sweep rate.

In this case, each subdivision represents 8ns, giving a resolution of approximately 5.2 feet with the same cable. This is about as close as you can get with a typical broadcast station service-type oscilloscope. (*Editor's note:* The accuracy of an oscilloscope's sweep multiplier will typically be less than that of the time base, therefore reducing the accuracy of the measurements.)

The linearity of the oscilloscope can best be checked by feeding in pulses of known frequency and accuracy, and observing the CRT display. For example, by setting the horizontal sweep rate to 1μs/div and using precise 1MHz pulses, the pulses should line up with equal spacing between them. With a bit of horizontal centering adjustment, they can be lined up with the vertical graticule markers. (Check your service manual for specific manufacturer's instructions on linearity adjustments.) Horizontal linearity should be checked on *each* horizontal sweep setting. Choose pulse frequencies that will match the sweep settings.

Industrial- and scientific-grade oscilloscopes are more apt to have higher sweep rates and delay time multipliers (either analog or digitally controlled), which can magnify the sweep rates by many orders of magnitude, and thus provide much greater measurement accuracy. Their linearity will normally be better than that of a service-type oscilloscope.

• *Oscilloscope and pulse generator rise time:* The rise time (T_r) of the oscilloscope is a function of the bandwidth of the instrument, following this formula, where BW is the bandwidth in hertz:

Equation 4:

$$T_r = 0.35/BW$$

Therefore, an oscilloscope with a band-

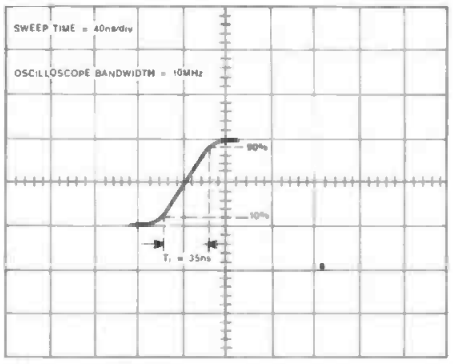

Figure 6. *Rise time (T_r) is a function of oscilloscope bandwidth. (See Equation 4.)*

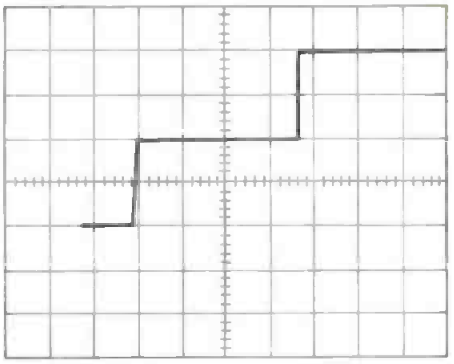

Figure 7. *Simulated display of the "ideal" pulse waveform, exhibiting zero rise time.*

width of 10MHz exhibits a rise time of 35ns. That means that the first 35ns of pulse travel time is lost in the rising portion of the waveform. In the case of RG-8/U, the first 35ns represents 0.65 × 35/2, or approximately 11.4 feet. In order to minimize the lost cable length to one foot, the oscilloscope rise time would have to be approximately 3ns. This would require a scope bandwidth of slightly more than 100MHz.

Cable length measurements can be made with a reasonable degree of accuracy using instrumentation normally available to the broadcast engineer.

The rise time of the pulse used to test the line should be faster than the rise time of the oscilloscope, keeping the display as the limiting factor. (See Figure 6.)

Ideally, pulse and oscilloscope rise times would be zero seconds, as illustrated in Figure 7. Commercial time-domain reflectometers have rise times in the picoseconds, allowing cable length measurements with resolution down to several inches.

In summary, cable length measurements can be made with a reasonable degree of accuracy using instrumentation normally available to the broadcast engineer. Next month, Part 2 of this series will discuss the technology and practice of measuring unknown impedances within and at the end of transmission lines.

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Acknowledgment: The author wishes to thank Ron Olson, chief engineer at KWEB/KRCH, Rochester, MN, for his help in researching this article.

Continued from page 4

a less-qualified applicant."

Proposing new changes, NAB said it could live with a pioneer policy that would provide clear guidance for would-be applicants, and make the preference, "at best, a weighted — not decisive — factor in the licensing process."

NAB urges FCC to liberalize radio ownership

The National Association of Broadcasters (NAB) has urged the FCC to liberalize radio ownership limits and to take actions that allow radio stations to share resources.

The federal government limits group owners to 12 AM and 12 FM stations. NAB said these limits once served to encourage diversity and competition, but there has been a dramatic expansion in media outlets, from increasing numbers of radio stations and cable systems, to regional newspapers and magazines. These outlets offer news and information and often compete for the same ad dollars.

NAB said enlarging group ownership limits can give struggling radio stations the resources necessary and management and programming expertise to compete effectively.

In urging changes in radio ownership guidelines, NAB called on the FCC to reject national ownership limits and other policies that prevent ownership of AM-AM or FM-FM combinations in local markets.

Broadcasters tell FCC to preserve TV spectrum

The NAB opposes one portion of a radio spectrum proposal for personal communications services (PCS). The proposed new service's use of the 1,990-2,110MHz band would displace TV stations that use this spectrum for mobile news gathering and program transmission.

In addition to its comments, NAB submitted two industry reports, each measuring the level of congestion in the TV auxiliary bands.

The NAB acknowledged congestion among TV broadcasters has been so great in recent years, that many TV stations have chosen to relocate to other auxiliary bands voluntarily. However, NAB said it believed most broadcasters would continue to use the 2GHz band because of the substantial investment in equipment and the high cost of replacement or conversion.

The NAB has strongly urged the commission not to reallocate this band for PCS or any other communication service.

New dates set for '92 SMPTE TV Conference

The 26th annual Television Conference of the Society of Motion Picture and Television Engineers (SMPTE) will be held on Friday, Feb. 7 and Saturday, Feb. 8, 1992, in San Francisco at the Westin St. Francis Hotel.

Peter Hammar (Hammar Communications) is the TV Conference program chairman; John A. Carlson (Monaco Labs) is the general arrangements chairman.

On Feb. 6, the society will sponsor an all-day tutorial tentatively called "Computers for Video, Video for Computers." Professional use of new low-cost computer technologies in graphics and editing will be discussed.

This educational program is a must-attend for anyone interested in the newest non-linear techniques of TV post-production.

Continued on page 98

LMS modification enables second feed

By George J. Krug

Approximately three years ago, Lifetime Television began offering a time-delayed feed to its West Coast affiliates. Although the change accommodated the difference in time zones, the second feed did not accommodate the difference in advertising markets. The feed was a straight 3-hour delay. The West Coast audience saw exactly what the East Coast audience saw three hours earlier.

Last year, the specter of a second feed for advertisers arose. The challenge was to insert varying numbers of commercials over the East Coast feed in such a way that only West Coast viewers would see them. This would enable Lifetime's advertisers to target West Coast consumers.

Visions of a second control room with additional staff danced through our heads, but we wanted to avoid that great of an expense. We knew that other services were using various methods of generating a second feed, including editing the second feed spots into the delay tape. Our goal, however, was to design a system that would be simple and efficient. We wanted equipment that would mesh with our existing systems and level of automation.

Using existing equipment

Here is some background on our operations: For nine months we had been using the Sony BVC-1000 library management system (LMS) as our primary on-air source for spots and programs. The BVC-10 Betacart, our original spot playback device, was still on hand acting as a backup spot-insertion system during the phase-in of the LMS. To convert our traffic system logs to a Betacart (and now LMS) playlist, we had been using the Jefferson-Pilot Data Systems BIASLINK program.

We debated several scenarios, each requiring varying amounts of equipment purchases, operator intervention and engineering department inventions. We decided to use the capabilities of both cartridge machines to run the West Coast spots at the appropriate times.

The concept was simple: Both systems allowed for the use of a "logo" event. These events are inserted onto the playlist as if they are taped programs. They switch the systems to an external source and provide a pulse that triggers an external device. It was decided to use the pulse output feature of the LMS logo event and the external source feature of the Betacart logo event. The East Coast feed would be the external source to the Betacart, and the LMS pulse would trigger the West Coast insertion. Therefore, master control would feed our time-delay system through the Betacart. The LMS pulse would trigger the Betacart to override the West Coast spot. The spots would be timed so that a neat overlay would occur. The Betacart would then simply advance to the next log event (the East Coast feed) when the spot had finished. (See Figure 1.)

Not as easy as it sounds

In practice, the implementation was not as simple. First, the LMS was unable to provide the pulse we needed. A software update addressed that problem. Once the update was done and testing began, another problem was encountered. The pulse supplied by the LMS system was too short to trigger the BVC-10 device to roll. A pulse stretcher was created by our engineering department, and our equipment needs were filled. (See Figure 2.)

The stretcher uses one IC, a 74LS123 dual timer chip. A 3-legged regulator powers the circuit from a 24V input. A network composed of a 1MΩ resistor and a 0.3μF capacitor sets the timing. A second timer duplicates the first and fires an LED. This serves as a convenient checkpoint for troubleshooting the system.

Developing appropriate software

On the playlist side, our traffic system service representatives helped us design — and then delivered — the necessary software enhancements to our system. The system now provides a second playlist of West Coast spots and inserts appropriate logo events. Only a few additional adjustments need to be made during playlist preparation.

The final phase of development involved experimenting with the timing of the in-

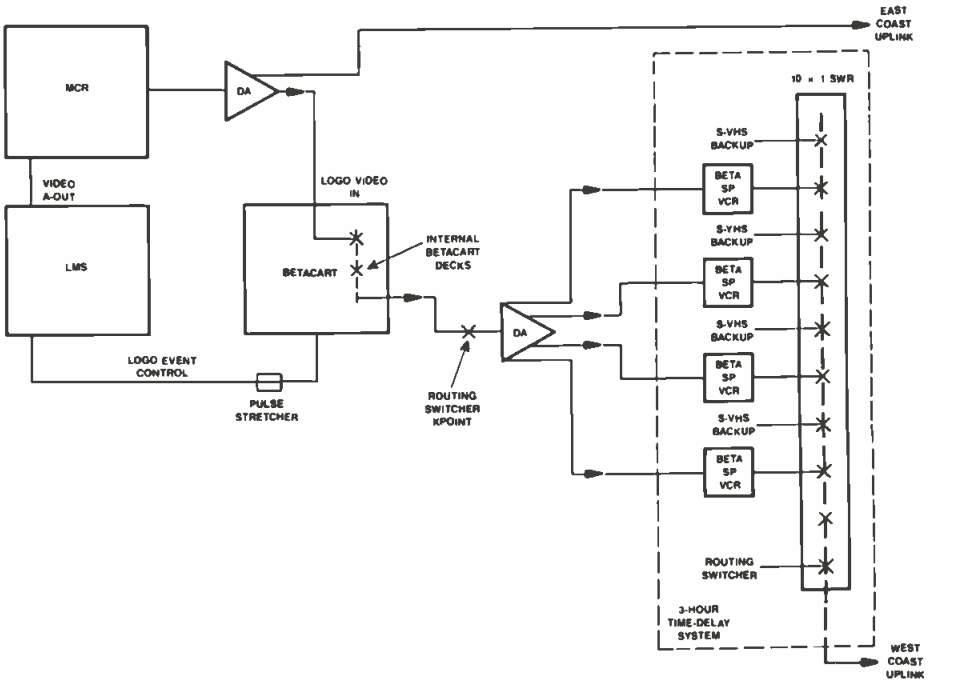

Figure 1. The first LMS system provides the network feed to the master control room. A logo event control pulse, modified by the pulse stretcher, feeds the second cart machine. The second cart machine either passes the MCR signal to the time-delay system or overwrites parts of it.

Krug is director of technical operations, Lifetime Television, Astoria, NY.

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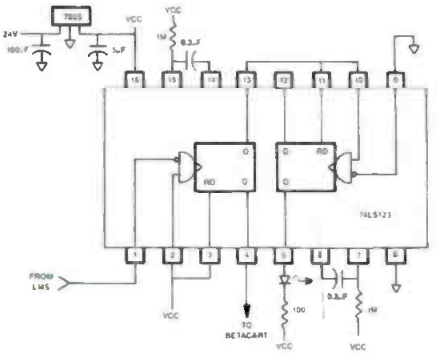


Figure 2. *The pulse stretcher lengthens the pulse supplied by the LMS so it can activate the Betacart. The second half of the IC runs an LED, serving as a troubleshooting aid.*

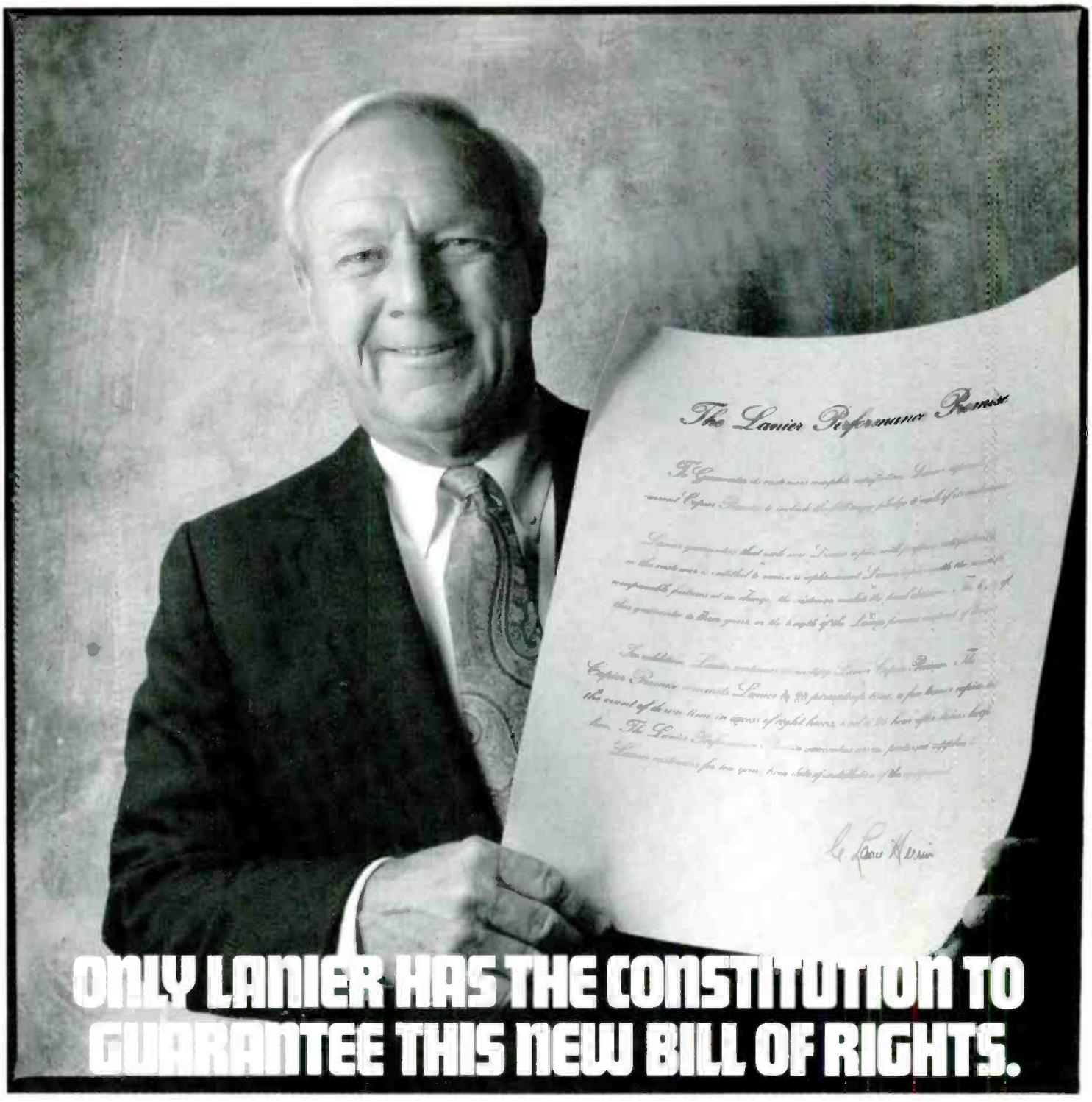
sertion. Through trial and error, we concluded that the pulses needed to occur three seconds and eight frames before the logo event. The eight frames compensate for the BVC-10's reaction time to the pulse. By extending the duration of the West Coast spot an extra seven frames, a complete overlay of the East Coast spot is ensured. When viewing both feeds, the overlap is imperceptible.

A system that works

The system works well, is expandable and requires little operator intervention. A West Coast as-run log is provided by the Betacart for client confirmations. Should an insertion be missed, the spot can be edited into the delay system tape. We can now simultaneously sell peanut butter on the East Coast and salsa on the West Coast.

The system works well, is expandable and requires little operator intervention. We can now simultaneously sell peanut butter on the East Coast and salsa on the West Coast.

The demand for such alternate feed systems seems to be growing. Although we were able to come up with a system that worked, it is somewhat a force fit. Hopefully, systems that mesh more cleanly and completely with existing accounting and operations mechanisms are in the offing. In the meantime, we will be able to help our advertisers target Lifetime's West Coast audience.



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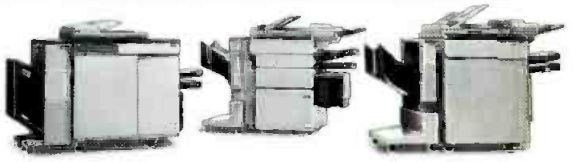

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Advances in sound localization processing

By Chris Gill

Within the last year, significant advances have been made in the technology of sound localization processing. One recent development of interest is the introduction of spatial enhancers, which produce sound localization effects over standard 2-speaker stereo systems.

Psychoacoustic research has determined that localization of sound is based upon four primary phenomena: 1. difference in a sound's *arrival time* between the listener's ears (interaural time difference); 2. differences in a sound's *volume* between the ears (interaural intensity difference); 3. phase shifts and timbral changes caused by *reflections* in the outer ear (*pinna effects*) and; 4. *shadowing* of the head. Depending on where a sound comes from in the space around a listener, its differing path lengths to the ears will create such volume and arrival time differences; its spectral content and angle of incidence will set off different reflections and absorption effects caused by the listener's outer ears and head.

Using this knowledge, the new spatial enhancers simulate interaural time differences, and duplicate the phasing characteristics that result when a sound moves to different locations in an aural environment. These systems also replicate the effects of reflection, diffraction and resonance at the head, ears and shoulders of the listener. Finally, they can introduce additional localization cues that might be caused by the room or surroundings in a real listening environment.

"Instant" compatibility

The main advantage of these localization systems is their single-ended or non-complementary nature, meaning that they are *encode-only* — they do not require the end-user to purchase any additional decoding hardware or any additional speakers. Listeners need only to sit at a point relatively equidistant to both speakers (along the *median plane* of the listening environment) to obtain the "spatialized" effect of the processing. Listeners outside of this area will typically experience an expanded sound field, but without as dramatic a localization effect as is noted along the median plane.

Because people typically watch television or listen to stereo radio from a stationary position, the median plane requirement is often satisfied for most broadcast applications. With the increased popularity of stereo television, these sound localization systems provide broadcast engineers an alternative to traditional encode/decode surround-sound systems.

These localization systems provide an alternative to traditional encode/decode surround-sound systems.

One of these new sound localization systems is the Roland Sound Space (RSS) processing system. It allows the creation of an expanded aural environment during post-production mixing by letting an operator place sounds along a 360° horizontal radius. A measure of control over the vertical elevation of a sound is also provided, enhancing the illusion of sound placement. The system encodes all localization data during mixdown, and the end result can be played back over a conventional 2-channel, 2-speaker stereo system without any additional decoding processors.

The system's control surface is designed for ease of use and instant operation, without the need for additional engineers or programmers. The unit processes sound in real time, allowing engineers and producers to hear the results immediately.

Beyond binaural

The system transforms a mono sound source into a localized sound image. It accomplishes this using *binaural* and *transaural* means. Traditional binaural recording techniques use an anatomically correct human dummy head, with microphones placed where the eardrums would be. Such recordings faithfully reproduce the ambience of the original sound field, but only when listened to over headphones, in most cases. The binaural process works poorly at forward sound localization through speakers, which relies heavily on the "phantom center" effect of traditional stereo imaging. But it has been shown that if binaurally processed sound is passed through a filter that flattens the transfer function of frontal sounds (a so-called transaural processor), speaker playback can achieve remarkable results, providing convincing imagery and localization.

In the RSS system, individual tracks of material recorded using established multimicrophone techniques are used. The panpots traditionally employed for stereo localization (which simply control the volume differences between the left and right channels) are replaced by individual binaural processors. (See Figure 1.) These localize audio in the sound field in a manner similar to dummy-head binaural recording, simulating the response of a listener's ears in real space. The transaural processor then enables the accurate reproduction of such a binaural recording over a 2-channel speaker system by canceling the *interaural crosstalk* that occurs when signals from the left speaker reach the right ear, and signals from the right speaker reach the left ear.

Applications

Digital audio signals are routed from the source (typically a mixing console) directly to the system's Sound Space processor unit. Analog signals must first proceed to the system's A/D/A converters, and then via digital I/O to the processor unit. Next, signals are processed and localized, as directed by the operator's adjustment of the azimuth and elevation controls. It is then routed out of the processor to the A/D/A converter, where it is split into two separate analog signals (left and right). These are in turn routed back to the console for final mixdown to a master tape.

The system can be used along with other effects, such as equalization, reverb and delay, without significantly altering the localization effect. The stability of placement and the valid range of imaging will

Gill is director of engineering for Roland pro audio-video group, Los Angeles.

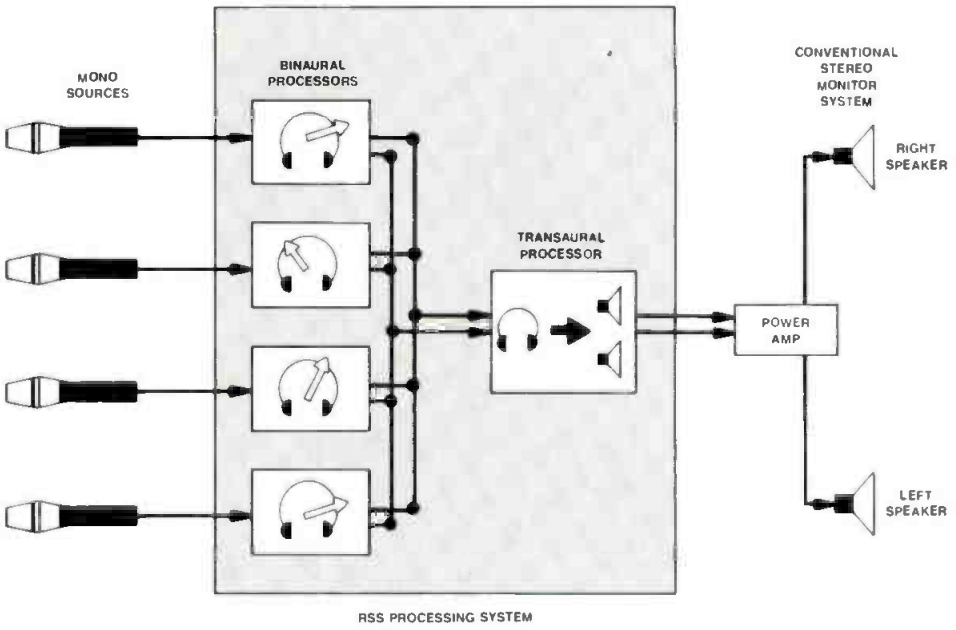

Figure 1. *A block diagram of the RSS processing system, showing the positioning of standard monaural audio signals using individual binaural processors. The "binaural bus" is then processed through a single transaural processor for proper speaker reproduction on a standard 2-channel stereo system.*

vary, depending on the nature of the input sound. Placement is more successful with sounds that encompass a wide frequency spectrum. In general, the system is effective with most natural sounds and electronic instrument sounds.

The RSS system consists of a Sound Space processor unit, two A/D/A converter units (all rack-mounted) and a tabletop controller unit. The processor incorporates four 24-bit internal processing circuits, and the controller features four sets of azimuth and elevation controls that allow simultaneous control of four individual sound sources. For controlling more than four signals, up to 12 Sound Space processor units (48 total channels) can be ganged to a single controller unit.

Digital sound sources are connected directly to the unit's optical I/O terminals (AES/EBU, CP-340 II), and analog sound sources are connected to XLR terminals on the system's A/D/A converters. The A/D/A converters each feature 2-channel, 18-bit linear A/D processing, and 4-channel, 20-bit linear D/A processing, with selectable sampling rates of 44.1kHz or 48kHz. MIDI in and out connectors are also provided, allowing users to manipulate channel control signals via MIDI messages from an external device, such as a MIDI sequencer.

Sound localization processors, such as Roland's RSS system, offer engineers an entirely new means of control and expression. The creative options and enhanced realism that these systems provide to engineers make their introduction as historically important as the development of stereo nearly three decades ago. It is highly probable in the future that sound localization processing will be every bit as common as stereo is today.

Ampex ACR-225 auto cassette system

By Brian Lay

Our goal at WHDH-TV in Boston is to automate the tape room operations to the fullest extent possible, while maintaining or improving on-air quality. In selecting an automated videotape cartridge system, we considered the factors that would most likely fulfill our objectives of labor reduction, time savings and accuracy.

We replaced our two existing TCR-100s with two Ampex ACR-225 D-2 format composite digital systems. The result has been an 85% reduction in labor hours.

The D-2 format provides excellent digital video and audio quality. With its error-correction and error-concealment processes, the digital format allows tapes to be copied without degradation. The four channels of digital audio, with a dynamic range greater than 90dB, allow stereo and secondary audio programming (SAP). Furthermore, D-2's digital electronics and system diagnostics yield improved reliability over analog systems.

System overview

The basic machine consists of three transports, the signal system and the cassette-storage bay. There is an operator interface as well as a robotic assembly to load and unload the transports. A fourth transport and second signal system are available optionally. A central processing unit coordinates the activities of the various subsystems. These elements, along with audio- and video-monitoring equipment, power supplies and an air compressor, all are housed in a 6'×6'×3' cabinet. An external 80386-based computer (supplied) holds a database of cassette contents and the daily schedules of events.

We configured each of our systems with the optional fourth transport and second signal system. One ACR-225 is used for playback of all commercials, promotions and public service announcements. The second unit is being prepared for the task of recording and playing back syndicated, satellite-delivered programming. In the meantime, it serves as a backup to the first.

Both machines use our existing PC network to access a shared database. Our traffic system is connected to an automated switching system. One PC translates the schedules received from traffic to meet the requirements of the switcher and tape systems. Two more PCs handle the database functions for the two ACRs and serve as gateways to the WHDH-TV computer network. (See Figure 1.)

Lay is engineering manager at WHDH-TV, Boston.

Performance at a glance

- *D-2 composite digital format*
- *Multi-event-per-cassette operation*
- *AutoResolve playlist conflict-resolution software*
- *256 on-line, 32-minute cassettes*
- *Integral database management to 50,000 events on one million cassettes*
- *Multi-user Novell "ThinNet" LAN interface*

Multi-event per cart operation

Our library consists of about 2,200 spots, spread over about 150 cassettes. This is actually rather conservative. The system has a maximum capacity of 256 32-minute D-2 cassettes. The system can record 42 30-second spots on each 32-minute cassette. For each event, the system automatically assigns a 5-second head and tail. The system also sets aside an additional 5-second *machine handling zone* to ensure proper editing. If you multiply 42 30-second spots by 256 cassettes, the potential storage capacity works out to more than 10,000 events.

The system tracks each recorded element in the library, storing its start-of-message (SOM) time code, an address and a duration. A permanent bar-code label identifies each cassette. The robot reads the bar code when the cassette enters the system through one of the eight access ports.

When a playlist loads, the system validates it. This process involves an examination of the list to determine whether the system can cue the requested elements in the required time. The system provides a *validation report*, which lists the possible conflicts, as well as any elements that are non-existing (not yet recorded) or missing (recorded, but not currently in the on-line library).

Automatic conflict resolution

Two situations will cause an irreconcilable error condition. If two or more events are at different locations on the same cassette, it will be impossible to play them back to back. Events that are of shorter duration than the system's minimum cycle time for back-to-back operation also will cause problems. The minimum cycle time for commercial playback machines varies from manufacturer to manufacturer. It is largely determined by transport acceleration, robotic speed and threading/cuing time.

Earlier this year, Ampex introduced a feature called *AutoResolve*, which makes possible multiple-event-per-cassette operation. In the single-event-per-cassette mode, the ACR-225 can play 10-second spots back to back continuously with three transports; it plays 7-second spots back to back with four. Anything that cycles in less time requires creation of a buffer copy in advance of airtime.

WHDH-TV was one of the first software beta-test sites for AutoResolve. The feature remedies conflicts without any adjustments to the playlist. Before airtime, the software compares the selected playlist with the contents of the on-line library and identifies conflicts. Then, during system idle time (periods between commercial breaks, commonly known as programs), it precues the events and automatically creates a buffer copy of the troublesome spots. For this purpose, it uses specific cassettes designated for conflict resolution. As a result, we have unrestricted access to any portion of the on-line library at any time.

The AutoResolve feature is invoked once each day. At the start of each broadcast day, the master-control operator activates the daily schedule. The machine automatically prepares the copies it requires to alleviate conflicts.

The system first asks how many transports are to be used. We specify three. This leaves a transport available for recording new material, as well as serving as a spare. When the operator pushes the READY button, the system makes the necessary buffer copies. On a typical day, this may require six to eight spots. The process usually takes less than 10 minutes. The

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system is highly accurate in predicting how much time will be needed to make the copies. After the dubbing is done, the system automatically cues the first break and is ready for playback.

Scheduling four transports would require less dubbing time, and two transports would require considerably more. Future versions of the software also will use idle time to make the required copies.

Traffic interface

We wrote our own software to filter the schedule file being sent from the traffic system to the automated switching system. The filtering leaves a daily schedule of all commercial breaks separated by standby events. The schedule is imported into the ACR with only a few keystrokes.

After fine-tuning the software and educating traffic personnel and ACR operators, we have eliminated the need to edit the imported schedule. Previously, certain barter or promotional spots had floated under standing house numbers. The operator was expected to verify that the physical cassette was actually the correct one for the day. This was unacceptable in a fully automated system.

Now, the only schedule editing done on the day-of-air is by the master-control operator, in response to last-minute changes. To allow the operator to edit the schedule without physically going to the ACR in the next room, we have added an extra keyboard and machine stack display in master control. This editing capability, along with the usual play, stop and recue functions, means that our videotape area

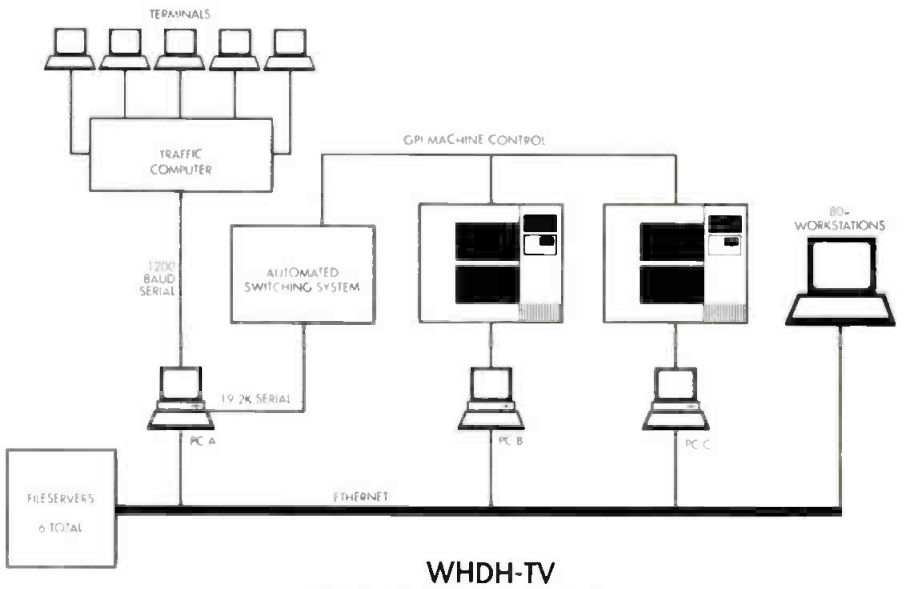


Figure 1. WHDH-TV's two ACR-225s network into the station's existing Novell LAN. PC "A" performs data interface between the station traffic computer and the cart machines and automated switching system. PCs "B" and "C" perform database functions for the cart machines and act as gateways to the network.

operates virtually unattended through much of the day.

Entering new material

Because recording new spots is the most labor-intensive task, we have concentrated our efforts on streamlining the process. Most commercials arrive on 1-inch media. These are dubbed from a source deck controlled serially by the ACR. With the deck placed near the ACR-225, the operator can control both systems conveniently.

To make the dub, the operator merely cues to the first frame of video, calls up the spot house number on the ACR menu and presses the *dub* button. The machine controller cues both source and destination tapes, then records in the first available space on the destination cassette. We have found there is no need to worry about which spots are recorded on which cassettes. The AutoResolve feature handles all possible conflicts.

An experienced operator easily can dub about 20 spots per hour. Today, the system controls VTRs using Ampex serial protocol. An expected software upgrade will include Sony protocol to enable dubbing from Betacam SP.

Reliability

Any system responsible for on-air commercial playback must be extremely reliable. Ours is operating now with few problems. There have been no failures of any electronic components, and the robotic system has performed well.

In the early days, soon after the system was delivered last June, we saw problems in the software of the control computers, in the transport mechanics and in the tape itself. The manufacturer was responsive to the reported problems, and new disks of software arrived via overnight mail. In addition, the tape manufacturers continually improve their products.

All ACRs originally were shipped without AST capability, but the company announced a complete retrofit program for all of its D-2 products late last year. Once we received new transports with AST playback, our troubles with the D-2 format disappeared. The transports now have logged about 5,000 hours with 60,000 threading and loading cycles, and they continue to work well. A station taking delivery of an ACR-225 today probably would not have any problems.

Future developments

Even though the machine is handling the job of playing back commercials for WHDH-TV, Ampex will soon deliver additional software that will allow us to reach our automation goals. These features will include the capability to start recording at a specified time of day, and to record two different signals simultaneously. It also will be possible to compile breaks on a single cassette, control more than one external VTR and activate machine control from any workstation on our network.

Automation is eliminating some jobs, but, in many cases, those employees were responsible for relatively simple tasks, such as loading carts into a TCR-100 or operating a single camera in a news studio. Today's automated system operator, whether using studio or tape room robotics, must be ready to acquire new skills to handle a much more technically demanding job.

Our two TCR-100s had required no less than three operators per day, seven days a week (168 man-hours). Our two new machines require one operator assigned for five hours a day, five days per week (25 man-hours). This 85% reduction in labor enables a single operator to do the job of importing schedules from traffic and dubbing new spots into the system, with time left open for other tasks. In an era of continually shrinking operating budgets and increased pressure for station profitability, the Ampex ACR-225 has made a favorable impact on WHDH-TV's bottom line.

Continued from page 87

CPB System Development Fund supports courses

National Public Radio (NPR) and the Society of Broadcast Engineers (SBE) have developed live interactive courses using NPR's Training Channel. The courses, which are supported by the CPB System Development Fund, include a 6-part course to prepare engineers for the Technologist-level certification exam administered by SBE and the Operator-level course, to prepare non-technical staff for a general SBE certification. For further information, call NPR Training at 800-235-1212, ext. 2730.

Broadcasters urge OMB to rein in FAA

The National Association of Broadcasters (NAB) has urged the Office of Management and Budget (OMB) to restrain the Federal Aviation Administration (FAA) from adopting a new and costly set of broadcast regulations.

The FAA has argued that FM stations and other radio spectrum users are at the root of alleged interference problems near some of the nation's airports. However, broadcasters have challenged this assertion.

Broadcasters claim the aviation agency has overstepped its regulatory bounds with proposals that would impose excessive industry and government costs, NAB said in a letter to Janet Hale, OMB's associate director of economics and government. The FAA proposals would block or unreasonably delay broadcasters' efforts to renew their licenses or upgrade their transmitter power requirements.

In filings to the FAA and the FCC, NAB said that FM interference has never been documented at airports to the extent claimed by the FAA. Poor aeronautical receivers, developed without federal standards, are the real problem, NAB told OMB.

Criticizing the FAA's analysis of the interference problem, NAB pointed out that the FCC has rejected the FAA's interference measures, citing lengthy FAA delays and regulation costs.

Furthermore, the FCC has joined broadcasters and other spectrum users in opposing the FAA proposals, NAB told OMB.

NAB urges safeguards against interference

The National Association of Broadcasters (NAB) has told federal regulators it won't oppose a new interactive TV service, but asked the Federal Communications Commission (FCC) to take steps to prevent any interference the new service may cause to adjacent channel 13.

TV Answer is a wireless, interactive video data service (IVDS) that proposes to use the nation's airwaves to offer viewers home shopping, banking and educational services off their home TV screens. The service works using a hand-held remote and menu-driven system, which will allow viewers to interact with TV programming without picking up their phones.

In its comments to the FCC, broadcasters noted substantial developmental progress by TV Answer, but said many technical details need to be ironed out.

To address these concerns, NAB recommended regulators move the TV Answer service further away in the frequency band to prevent interference to nearby channel 13. In addition, NAB asked that minimum distances be required between TV Answer transmitting stations and the nearest home. NAB also recommended spectrum allocation for interactive television to be limited, allowing regulators and the marketplace to effectively evaluate consumer interest in interactive TV services.

In other comments, NAB told the FCC that TV Answer should make its operational plans public. Among the positive benefits of an interactive TV service, there are also potential misuses.

People/ Business

Jeffrey Brownstein has been named regional sales manager for Shure Brothers, Evanston, IL. He is responsible for sales territories in the Northeastern and North Central states, as well as Northern California.

Gaylen C. Evans has been promoted to director of North American field sales for Harris Broadcast Division, Quincy, IL. He is responsible for U.S. and Canadian field sales of all Harris-manufactured and distributed broadcast products.

Charles Meyer has been promoted to vice president of engineering for NVision, Nevada City, CA. He is responsible for research and development of the company's line of digital audio-video distribution and transmission equipment.

William J. Cadogan has been appointed chief executive officer for ADC Telecommunications, Minneapolis, effective Nov. 1, 1991.

Philip Mendelson has been named vice president of engineering for Digital Magic, Santa Monica, CA.

Jeff Berry and **James M. Ruse** have been appointed to positions with Audio Animation, Knoxville, TN. Berry is customer service supervisor. He is responsible for fielding technical questions to support the company's product line, and he will coordinate and supervise all departmental procedures. Ruse is product development and marketing manager. His responsibilities include researching future product development concepts, preparing product specifications, market research, sales support, literature creation, advertising and dealer support.

Howard Kirsch has been named district sales representative for JVC Professional Products, Elmwood Park, NJ. His territory encompasses Northern California, Oregon, Washington, Alaska, Montana, Idaho and Northern Nevada.

Dave Collie has been appointed manager of western operations for Solid State Logic, Los Angeles. He heads the sales and support team in the Los Angeles office, overseeing console and digital product sales and service to the area's music, film and post-production marketplaces.

Gerald E. Anderson, Richard Chocolate, Jim Hammett and **Oscar Harris** have been promoted to positions with Celwave, Marlboro, NJ. Anderson is director of OEM sales. Chocolate is manager of technical and international sales. Hammett is Southeast regional manager. Harris is director of cellular sales.

Victor L. Kong and **Paul McGoldrick** have been appointed to positions with Magni, Beaverton, OR. Kong resigned as president and chief executive officer of Magni to accept the chairmanship of the company's board of directors and the newly created position of chief technical adviser. McGoldrick is director of international sales.

Pat Noble and **Keith Pierce** have been appointed to positions with Dynatech Broadcast, Berks, England. Noble is public relations manager, and Pierce is sales manager for Utah Scientific products.

Rick Davis has been appointed director of business development and third-party relations for Digital F/X, Mountain View, CA. He is responsible for OEM prod-

uct development and for identifying and managing relationships with third-party developers of complementary hardware and software products.

Stanley Salek has been hired as an engineer for Hammett & Edison, San Francisco.

Tom Dolan has been named international marketing/sales director for MCL, Bolingbrook, IL.

Carl Proescholdt, Don Carpenter, Pat Humke, Don Winget, Marcy Evans, Dan Musholt and **Rick Scott** have been appointed to positions with Harris Broadcast Division, Quincy, IL. Proescholdt is manager of radio service and repair. Carpenter is manager of TV field service and systems integration. He is responsible for the worldwide support of the company's Quincy-manufactured TV transmission products, U.S. customer support of equipment manufactured by the company's TVT operation in Cambridge, England, and field installations and systems support. Humke is manager of the radio manufacturing team. Winget is order administration team leader. He is responsible for domestic and international order administration and international service parts. Evans is business systems administrator. She coordinates forecasting and product availability, and is in charge of computer services for customer service, resale purchasing and returns. Musholt is domestic parts team leader. Scott is manufacturing systems coordinator. He is responsible for the manufacturing and service of computer systems, programming support, and special projects in manufacturing engineering.

Mary Ahern has been named Northeast regional sales manager for Quanta, Salt Lake City.

Richard Broadhead has been appointed to the sales and marketing team for Jampro Antennas, Miami.

Walt Lowery has been appointed as a sales representative for Broadcast Supply West, Tacoma, WA. He is responsible for servicing customers in the Southwest region.

Joe Roghelia, Joe Mosner, Mark Darrow and **Darryl Martin** have been appointed to positions with Penstock, Sunnyvale, CA. Roghelia is field sales engineer, and Mosner is inside sales engineer. Darrow and Martin cover key accounts in the San Diego and Los Angeles areas.

Mark Drummond, radio field sales representative for Harris Allied Broadcast Equipment, died July 22, 1991, at Crawford W. Long Hospital, Atlanta, from lung disease. He was 36.

Drummond was a member of the Society of Broadcast Engineers.

He is survived by his wife, Barbara.

Memorials may be made to the Lung Association or to the First Baptist Church, 6754 Church St., Douglasville, Georgia 30133.

Mark Siegel has been appointed Western sales manager for Alta, San Jose, CA. He is responsible for the sales of the entire Alta product line throughout the western United States.

Matt Ward has been promoted to training and product manager for Studer Editech, Menlo Park, CA. He is responsible for the operational training of the company's domestic and international personnel.

Donald L. Brittain and **Ricardo Fuchs** have been appointed to positions with Wavefront Technologies, Santa Barbara, CA. Brittain is vice president of research and is responsible for strengthening the company's ability to predict market trends and incorporating new technologies into innovative computer graphics software. Fuchs is managing director, Wavefront Asia. He is responsible for the development of marketing opportunities throughout the Far East and Australasia.

Ian C. Dodd, John Wase, Jonathan Redman and **Mike Wood** have been appointed to positions with Digital Audio Research, Surrey, England. Dodd is the director of sales. He is responsible for worldwide sales of the company's SoundStation and DASS 100. Wase has been promoted to European sales manager. Redman and Wood are sales representatives.

Ray Niznik and **Kerby D. Long** have been appointed to positions with New England Digital, Lebanon, NH. Niznik has been promoted to Western regional manager, and Long is a sales representative.

Karl Roth has been named vice president of engineering for Davidson Optronics, West Covina, CA. He is responsible for the company's TV-Optoliner line of test pattern projector/receiver systems.

Gary Crowder has been named director of marketing for Northeast Broadcast Lab, South Glens Falls, NY. He is responsible for the overall coordination of marketing and sales.

Harris to acquire part of Midwest Communications

Harris Corporation, Quincy, IL, plans to acquire two of Kentucky-based Midwest Communications' broadcast equipment manufacturing operations. Midwest has signed a letter of intent for Harris to acquire its Systems and Radio Frequency divisions.

BTS and Maxell form strategic alliance

BTS, Salt Lake City, and *Maxell* have entered into a strategic alliance to pursue a variety of technological and marketing goals in North America and South America.

Ampex implements worldwide reorganization

Ampex Recording Media Corporation, Redwood City, CA, is reorganizing to increase productivity while continuing to invest in new recording format technologies.

As part of this reorganization, the company has streamlined operations, improved coordination among R&D, engineering and manufacturing, and eliminated 250 positions from its worldwide workforce.

The rebalancing of resources will enable the company to absorb the economic pressures brought on by a prolonged U.S. recession, coupled with the recent appreciation of the dollar vs. most international currencies. Also, the changes are geared to enhance organizational effectiveness and to better meet the needs of customers.

Videotek appoints Rohde & Schwarz as dealer

Videotek, Pottstown, PA, has appointed *Rohde & Schwarz* as its authorized dealer for Austria and all Eastern European countries. Rohde & Schwarz-Austria is selling the entire Videotek PAL line.

Basys and Grass Valley undertake cooperative agreement

Grass Valley Group, Grass Valley, CA, and *Basys*, Newton, MA, will develop a worldwide marketing undertaking, aimed at making the sophistication of full automation practical and cost-effective for all elements of the TV industry.

Award given to OpTex UK

An Outstanding Achievement in Engineering Development Plaque has been awarded to *OpTex UK*, New Barnet, Herts., England, for the development of its OpTex/Litton mini-image intensifier for ENG cameras.

Marcus Technology named dealer for Standard Communications

Standard Communications, Los Angeles, has appointed Marcus Technology as an authorized dealer of its land mobile 2-way radios and accessories.

Vistek Electronics names Reddy-Color as mid-Atlantic dealer

Vistek Electronics, Bucks, England, has named Reddy-Color, Harpers Ferry, WV, as a dealer for the mid-Atlantic area.

Tannoy names Ron Tunks Sales as factory rep

Tannoy, Ontario, Canada, has named Ron Tunks Sales, Tamarac, FL, as the factory representative for Tannoy professional products in Georgia, Tennessee, North Carolina, South Carolina, Mississippi and Alabama.

Neve appoints reps in Canada and United States

Neve, Bethel, CT, has appointed Leader Sound Technologies and Soundings as representatives for the Neve and Mitsubishi product lines. Leader Sound Technologies covers British Columbia, Alberta and Saskatchewan, and Soundings covers Washington, Oregon, Idaho, Montana and Wyoming.

Symetrix names Quad-Tech Marketing as Midwestern rep

Symetrix, Seattle, has named Quad-Tech Marketing as its representative for Kansas, Missouri, Nebraska, Iowa, North Dakota and South Dakota.

Wohler appoints overseas reps

Wohler Technologies, San Francisco, has appointed three companies to serve as its overseas representatives. F.W.O. Bauch will represent the company in the United Kingdom, Studer France S.A.R.L. in France and Sterling D.O. in Brazil.

Connectronics Corporation relocates

Connectronics Corporation has relocated its headquarters. The address is 300 Long Beach Blvd., Stratford, CT 06497; phone 800-3-CABLES; fax 203-375-5811.

Neutrik USA appoints network representatives

Neutrik USA, Lakewood, NJ, has added Hartman & Associates and Hart-Mann Associates to its representative network. Hartman & Associates represents the company in North Dakota, South Dakota, Minnesota, Wisconsin, northern Illinois, Indiana, Kentucky, Michigan and Ohio. Hart-Mann Associates represents Neutrik in Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey and West Virginia.

Nady Systems wins award

Nady Systems, Emeryville, CA, has won the Innovations '91 Design & Engineering Award for its MCM-400 camcorder microphone mixer.

Euphonix opens headquarters and demo suite

Euphonix has opened its worldwide sales, service and marketing office, complete with a full demo suite, in Los Angeles. The address is 10647B Riverside Drive, North Hollywood, CA 91602; phone 818-766-1666; fax 818-766-3401.

New products

Special-purpose camera
By Chinon America/Industrial Products
• **Model CX-1000:** 2-piece, remote-head CCD camera; color operation with choice of Y–C or NTSC outputs; 6-foot cable connects head with control unit; 300-line resolution; switched shutter speeds from 1/60 to 1/1,000; operates from battery power for special-purpose applications, surveillance.

Circle (393) on Reply Card

Power receptacles
By Daniel Woodhead Company
• **Outlet boxes:** power distribution device features two duplex receptacle plates with individually fused outputs; 15A or 20A versions for film, video, studio and stage operations; available in textured black or high-visibility yellow finish with black or yellow cables.

Circle (394) on Reply Card

Color video processing
By daVinci Systems
• **68020 CPU enhancement:** provides significant processing speed for Renaissance color-correction system, including event list management and transport control; two versions are available, one with 2Mbyte, second with 4Mbyte RAM for larger event lists; required for operation of Kilovectors upgrade.

Circle (395) on Reply Card

VTR controller
By DNF Industries
• **Model ST60-S:** transport controller for BVH, BVU, Betacam and Sony D-2 VTRs; includes record, play, rewind, fast-forward, jog-search functions, each with status LEDs; additional editing and recording choices for assemble, insert and AV split functions.

Circle (396) on Reply Card

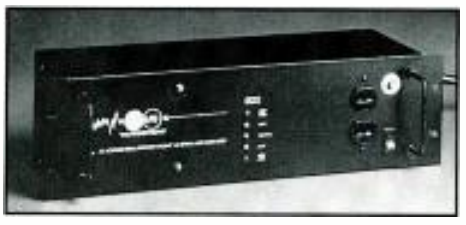
Digital audio equipment
By nVision
• **Model EM2012-00:** dual program input module for NV2000 high-definition audio system; 18-bit A/D converter uses 62× oversampling with delta sigma concept; AES/EBU digital output; 18dB input gain available; transformerless input.

Circle (401) on Reply Card

Noise reducer
By CEDAR Audio
• **CEDAR:** computer-enhanced digital audio restoration system; removes unwanted noise, scratches, buzzes, hum from audio recordings without degrading original character of the recorded sound; operates on PC with individual DSP software modules for various noise types.

Circle (392) on Reply Card

Power control
By Indus-Tool
• **Model LCR-2400:** voltage regulator in rack-mount package; holds input range from 87-104VAC to 120VAC output; 2.4kW output with 14 receptacles; Isobar level surge-suppression handles spikes, line noise, RFI/EMI interference; 20A circuit breaker.



Circle (397) on Reply Card

Cable repair
By Siecor Corporation
• **ERK kit:** provides additional loose tube optical cable, two splice enclosures, items to repair damaged optical cable, tool kits; CamSplice no-epoxy pre-installed connectors enable quick, low-reflectance splicing; full instructions included.

Circle (404) on Reply Card

Data transmissions
By Mainstream Data
• **IDR intelligent data receiver:** receive-only unit for FM² satellite transponders for C-/Ku-band frequencies; permits enhanced features of variable baud rates, multiple addressable output ports; forward error correction; parallel port printing; available separately or with 0.75m dish downlink.

Circle (400) on Reply Card

AF power, mic amplifiers
By Sonosax SA
• **FD-M4:** pre-amp with quad outputs; independent floating balance with Eurocard-type construction; 28dBu maximum output signal, −130dBu EIN; low noise; monitor section includes phase check, VU meter, headphone amplifier.
• **FD-A100:** compact audio power amplifier; 2×50W system measures 12×5.7× 2.85-inches; 120dB S/N ratio from fully discrete design; limiter with frequency response from 10-40kHz; 0.003% distortion at 1kHz.

Circle (405) on Reply Card

Time-code systems
By Gray Engineering Laboratories
• **DTR-313 family:** transmitter/receiver units for time code; read and generate modes for all 30-frame, 25-frame and 24-frame time-code standards; RS-232/-422 remote as well as front-panel control; full support for LTC is standard, for VITC is optional; eight models in family include some with TC character inserter; DTR-313D+ includes all family features and options.

Circle (411) on Reply Card

Air purifier
By United Air Specialists
• **SMOKEETER SE40:** electrostatic air cleaner; removes 95% of smoke and other particulates from the air through ionization process; clean air provides better working environment and increased life to tape heads; installs on wall or hangs from ceiling; 450-950 CFM air-flow adjustment.

Circle (410) on Reply Card

Digital image store
By Recognition Concepts
• **DataSTORE 120:** combines videodisk recorder with CCIR 601 and SMPTE RP125 interface; 44-minute capacity for true color images; database management software; random access time less than 100ms to any of 80,000 images; loop sequences from 1 to 80,000 frames with slow, stop motion.

Circle (402) on Reply Card

FO prep tools
By Ripley Company
• **JST-fiber optic:** jacket stripper for optical fiber cable; blades lift and remove jacket from underlying material; no nicks or scrapes to FO cable; requires bushing sized for cable OD, jacket thickness.
• **CRFO1 crimp tool:** universal unit with 0.128, 0.151, 0.178, 0.213 hex cavities; designed for consistent crimping action.
• **Model F0103-S stripping tool:** 0.006-inch diameter hold for 0.125 micron fiber cable with coating.

Circle (403) on Reply Card

At Ampex, we never stop engineering.

We believe that good enough is never good enough. That's why we're as committed to refining and improving our existing products as we are to developing new ones.

Ampex 196 Master Broadcast Videotape, for example. It was designed to give you the most consistent, reliable performance for all your critical applications, such as mastering, editing, film-to-tape transfer, and duplication.

But we didn't stop there. Since we first introduced it over ten years ago, we have continued to make it better. From the newest manufacturing technologies, such as computer-monitored process controls, to the latest materials, such as tougher cross-linked binders and hotter oxide particles, we've made sure Ampex 196 has kept pace with your changing needs.

From the tape to the flange to the hub to the shipper, we've never stopped improving Ampex 196. Because we've never stopped knowing that you depend on it to deliver the highest levels of performance, consistency, and reliability. Reel after reel, box after box, year after year.

And, as it has been since the beginning, it is still backed by the industry's most acclaimed customer service and technical support.

Ampex 196. Engineering that never stops improving.

AMPEX

Ampex Recording Media Corporation, 401 Broadway, M.S. 22-02, Redwood City, CA 94063 (415) 367-3809

Circle (59) on Reply Card

Mic accessory

By Ac-cetera

• **Rubber-Neck "hollow center:"** gooseneck-type microphone mounting; rubber core to reduce creaking of positioning, provides for internal wiring; external surface has black finish for no glare; standard 10-, 15-inch lengths or custom sizes.

Circle (391) on Reply Card

Voltage stabilization

By TrippLite

• **OMNI-2000 LAN:** voltage-regulated battery backup system; capable of serving large LAN file server or minicomputers with 2kW power rating; Db9 remote connector; features automatic network shutdown if used with UPS monitoring software; does not use battery assistance unless total power mains failure occurs.

Circle (409) on Reply Card

Satellite communications

By TIW Systems

• **Dual-band earth station:** 18m antenna capable of simultaneous C- and Ku-band use; meets requirements for INTELSAT networks; includes capability for element set tracking and smart tracking of satellites in inclined orbits with AC3 antenna control.

Circle (408) on Reply Card

Microwave equipment

By ITS Corporation

• **Model ITS-1610E:** 20W transmitter for wireless cable system; design revision from ITS-1610D adds integral modulator, multilevel diagnostics; improved cooling.

Circle (398) on Reply Card

FM signal measurement

By Titus Technical Laboratories

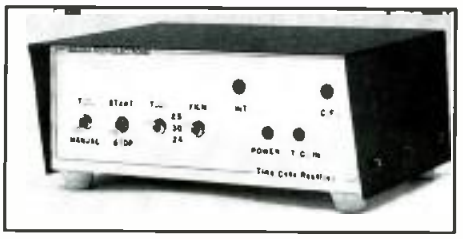
• **FM stereo composite monitor:** measures composite clipping and limiting with peak hold function; also monitors pilot injection and two SCA levels; two levels of accuracy available; semi-demodulated scope output and digitally filtered pilot and SCA outputs.

Circle (407) on Reply Card

Film transfer accessory

By Magna-Tech Electronic

• **Time-code resolver:** post-production device locks to pre-recorded time-code SMPTE, film or EBU time code to assist audio mixing; for any format combination of 24-25, 25-24, 25-25, 30-24, 30-25 and 30-30 rates; accomplishes same task as more expensive complete synchronizing systems.



Circle (399) on Reply Card

Time-code equipment

By Sony of Canada

• **BVG-200 portable:** time-code reader/generator for PCM-2000 DAT recorder; operates in NTSC drop/non-drop frame, EBU and film modes; reads PCM-2000 LTC data in playback with time-code regeneration feature; generator and display hold functions.

Circle (406) on Reply Card

NiCad charger

By PAG

• **PAG AR30:** fast charger unit for 24-30V batteries; PAC ACS analyzes condition of each cell to save charging of 30V 4Ah battery in one hour from total discharged state; high-frequency switching mode power supply permits unit to be used with AC power sources worldwide.

Circle (368) on Reply Card

Microwave equipment

By MCL

• **M/N 10931:** X-band high-power amplifier; 2.5kW TWT device covers 7.9-8.4GHz frequency with 500MHz bandwidth; for small communications satellite ground terminals in commercial applications.

Circle (365) on Reply Card

CAD software package

By American Small Business Computers

• **DesignCAD 2-D V5.0, 3-D V3.1:** easy-to-operate, pull-down menu computer-aided design packages for 2-D and 3-D representations; all commands also available through 1- or 2-key keyboard commands; for IBM/compatible platforms; support for numerous dot-matrix and laser printers, mouse or stylus interface; drivers for all CRT types.

Circle (412) on Reply Card

Conversion services

By Video Conversion International

• **Videotape conversions:** copies of any videotape from NTSC, PAL or SECAM to any standard; using AVS ADAC converter with 1-inch, Betacam SP, U-matic SP, VHS and Beta formats; same day turnaround.

Circle (448) on Reply Card

Lighting peripherals

By Rosco Laboratories

• **Designer Patterns series:** 6-page catalog illustrates Mini/M and Micro/E-size pattern gobos for use with lighting instruments in creating backgrounds and atmosphere effects; Mini/M units fit $3\frac{1}{2}$-inch ellipsoidal spots; Micro/E patterns fit MR 16 framing fixtures.

Circle (437) on Reply Card

Equipment actuator

By Circuit Research Labs

• **Real time event sequencer:** keypad programmable system controls a combination of eight or one of 255 outputs; output may latch on or be $\frac{1}{2}$- to 1-second contact closures; LCD display assists in programming and status monitoring; 7-day clock program; backup battery provision.

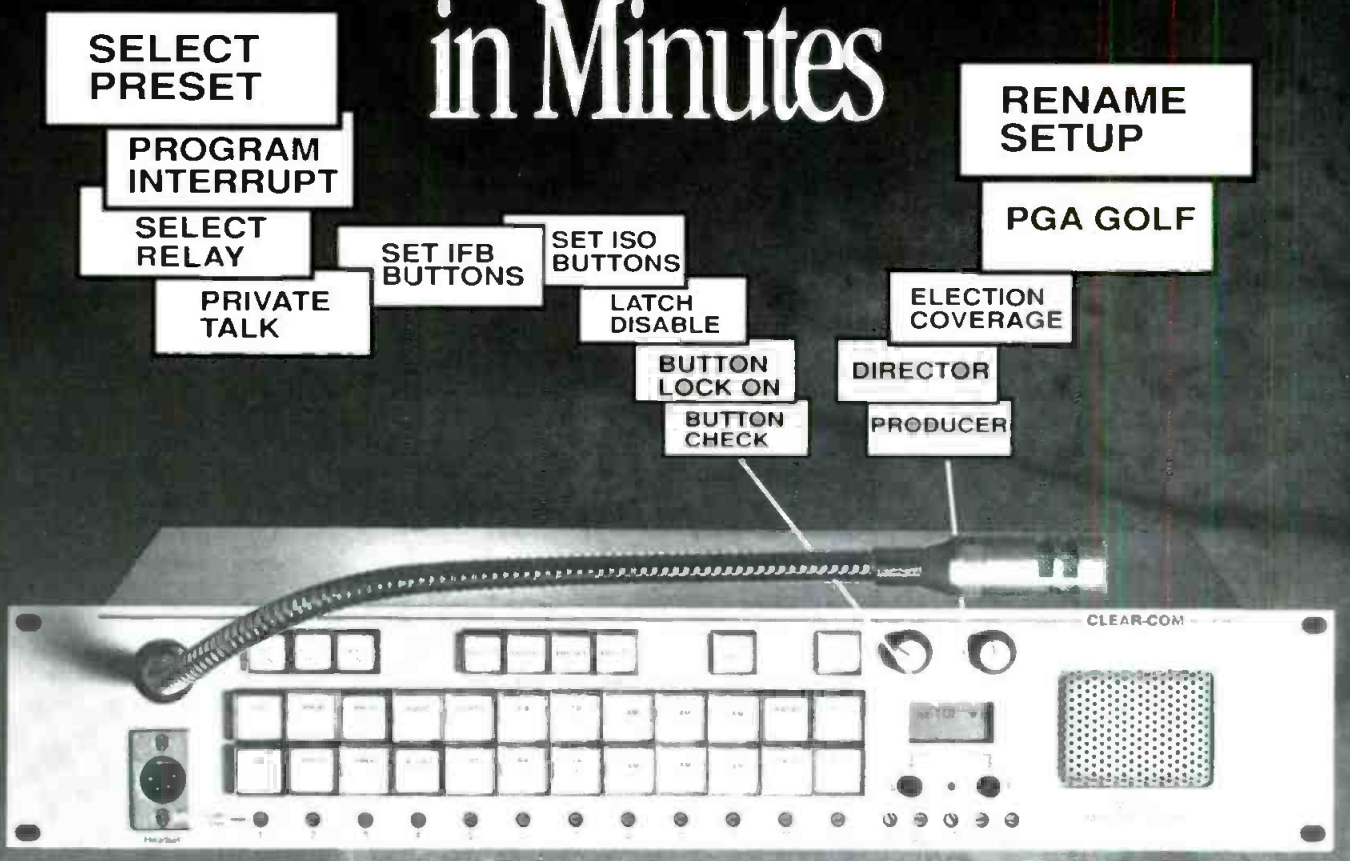
Circle (419) on Reply Card

Graphics translations

By Inset Systems

• **HiJaak V2.02:** IBM/compatible software package permits numerous 2-way and some 1-way graphic file translations;

A Master Station You'll Master in Minutes



Now what did I program this button to do? Even if you've never used a master station before, sit down in front of the MS-812 and you'll set up a custom mix of over 30 features without ever reading a manual or picking up a screwdriver.

Program the buttons for intercom, 8 IFB and up to 16 external ISO channels, 12 talks and listens, interruptible program feeds, relays and privacy. The "prompt" messages won't let you make a mistake. And the unique "button check" feature instantly confirms each function.

Four complete setups...just check the window. The MS-812 master station instantly recalls your preset configuration for any event. Not just a feature or two, but the whole setup. Think how easy it will be to rent your mobile truck or facility when it comes with a preprogrammed intercom!

A front panel you'd know in the dark. The dual action controls are where you'd expect them to be, and they respond to the lightest touch. There's also an adjustable brightness control, visual/audible signaling and automatic headset detection...in fact, the MS-812 has all the features you want in a top-of-the-line master station, at a price you can afford.

We haven't skimped on audio quality, either. Clear-Com combines crystal-clear audio technology, the ruggedness of its beltpacks and the advanced engineering of a party line intercom to produce the MS-812. The result is the most usable, flexible and reliable master station ever. Call us for complete specs today.

Clear-Com SYSTEMS

USA/Canada
945 Camelia St., Berkeley, CA 94710
TEL 415-527-6666 FAX 415-527-6699
International-FAX 415-932-2171

ends most problems of incompatible graphics files; supports most popular raster and vector file types, including TARGA, TIFF, PCX, HPGL, IMG, PCL, CGM; also supports many PC FAX cards and provides 1-way translation to Encapsulated PostScript; includes screen capture feature; allows nearly any type of computer graphic to be converted, in conjunction with a scan converter, to standard video.

Circle (413) on Reply Card

Video delay line

By Allen Avionics

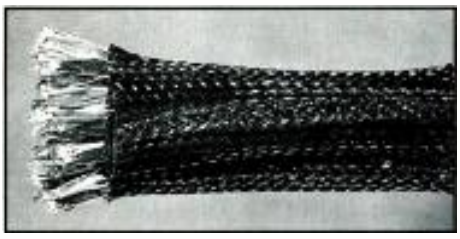
• **Model TDL487:** provides 360ns fixed and 127ns variable delay networks to compensate for a 400ns delay inherent in the NewTek Video Toaster (with Commodore Amiga PC); this unit on other video lines permits correct timing in post-production and broadcast systems.

Circle (414) on Reply Card

Wiring accessory

By Alpha Wire Corporation

• **ZIP-GRP webbed sleeving:** constructed of expandable polyester material; quick closure secures wire bundles for temporary or permanent installations; protects threaded parts and hoses from damage resulting from abrasion; open-weave dissipates moisture and heat.



Circle (415) on Reply Card

Network image library

By Thomson Broadcast

• **PIXTORE:** modular still-store based on 80386 computer; 4:4:4:4 architecture; data compression permits several hundred pictures to be stored locally; networked terminals exchange pictures, keywords through Diana server; handles 525-/625-line, 4:3 or 16:9 aspect ratios.

Circle (379) on Reply Card

Standards conversions

By Snell & Wilcox

• **Model HD2020:** HDTV universal downconverter; options permit conversion from 1125 or 1050 to 525, 1250 to PAL and 1125/60 to 625/50, permitting HDTV programming to be used on current standards systems.

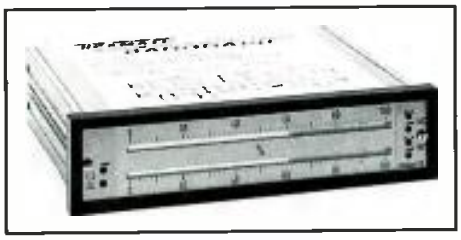
• **ALCHEMIST:** fifth-generation standards conversion system; 24-point linear aperture converter handling CCIR 601 signals with phase correlation motion measurement; 10-bit processing, D-1/D-2 interface; TBC, decoding features; inputs, outputs for all world standards and tape formats.

Circle (375) on Reply Card

Metering units

By Texmate

• **AM-100 series:** dual and single bar graph displays constructed of 101 LEDs; active bar graph length is four inches; may be oriented horizontally or vertically; permits signal comparisons with various modes of display available; for 60MV to 250VDC and 100μA to 1ADC current.



Circle (446) on Reply Card

Power analysis

By Dranetz Technologies

• **Model 8000 energy analyzer:** 8-channel instrument for troubleshooting and analyzing commercial facility electrical systems; combines 3ϕ true RMS measurements of voltage, current, frequency, phase and harmonic distortion; senses out-of-tolerance conditions; replaceable battery provides 2-hour operation if AC is unavailable.

Circle (420) on Reply Card

HDTV test equipment

By Tektronix

• **11A34V module:** for TEK oscilloscope; 4-channel amplifier with 300MHz bandwidth; 75Ω input impedance.

• **11T5H module:** for TEK 11000/DSA mainframe oscilloscope; multistandard video trigger; locks O-scope display with video signals including 1,280-line, interlaced and progressive scanning technology; detects and displays scanning type on LED panel; line select mode.

• **TSG-1001 enhancement:** programmable generator upgraded to produce CCIR 601 component digital test signals with PGFD1 upgrade kit; includes test signal library and oscillator assembly downloadable to generator from PC.

Circle (376) on Reply Card

Informational videocassette

By Shelburne Films

• **The Era of DBS:** 56-minute program includes history, the technology and the current state of direct broadcast satellite communications; highly visual and graphics oriented, the videocassette was prepared for an audience interested in the future of satellite communications.

Circle (374) on Reply Card

Full-line catalog

By Jensen Tools

• **Summer Supplement catalog:** 96-page color catalog illustrates established line of products and introduces a family of frequency counters for use with video waveforms, broadcast frequency monitoring and peak metering; meter range extendible to 1.3GHz.

Circle (425) on Reply Card

Rack-mount printer

By Recortec

• **Model RMP-309:** a special design using Okidata 182 Turbo 9-pin dot-matrix printer; enclosure fits 19-inch rack; standard parallel printer interface compatible with PC/AT computers; 6-inch stack of pa-

per stores in printer housing; draft, NLQ, utility and graphic print modes.

Circle (373) on Reply Card

Test power source

By Behlman/Astrosystems

• **Models ACP, ACM:** programmable AC power sources for test and measurement functions; covers 45Hz-10kHz frequencies with 0-270V range; ACP uses microprocessor and IEEE-488 control interface; ACM requires manual adjustments with no preprogrammable events.

Circle (417) on Reply Card

TV antenna variations

By Andrew Corporation

• **Standard aperture TRASAR antennas:** feature "null-free" vertical patterns; reduced-cost systems result from standard lengths, rather than extended antennas typically required for "smooth" pattern coverage; produce no additional wind-loading.

Circle (416) on Reply Card

Betacam line expansion

By BTS Broadcast Television Systems

• **BCB 85:** Betacam SP studio editing recorder, player; extends capabilities of BCB 75 with optional digital audio system with PCM A85; in 2-channel PCM recording, longitudinal channel 1 is disabled, but channel 2 and AFM channels 3 and 4 function normally; unit plays existing Betacam and Betacam SP cassettes.

Circle (418) on Reply Card

Audio cables, connectors

By E-Z-HOOK

• **Test Accessory catalog:** 130-page publication features recently introduced series of standard and custom professional audio cables and connectors; additions products include XLT to PJ-310, bantam and banana devices, alligator clips and E-Z-HOOK clips, as well as specialized cables with dual banana, WE-310 phone plugs and alligator clips.

Circle (421) on Reply Card

Terminal protection

By Electro Insulation

• **Versafit/CFR-125:** heat-shrink tubing from $^{3}/_{64}$-inch ID to 2-inch ID; ideal for use in jacketing and bundling of wiring harnesses as well as protecting wire terminations; made of radiation cross-linked polyolefins, the tubing reacts to temperatures of 90°C, 10° lower than previous products; recognized by UL and CSA agencies.

Circle (422) on Reply Card

Advanced audio console

By Euphonix

• **Crescendo System II:** digitally controlled audio studio console; features fully automated control of all signal routing and control factors; reconfigures in less than 30μs; fully user-definable signal paths; modular for expandability; MixView visual display of EQ, setup, track sheets.

Circle (423) on Reply Card

Adapter assortment

By ITT Pomona

• **Model 5748 kit:** includes array of BNC, TNC, SMA, N, UHF, F, RCA, T and banana plug devices as adaptations for almost any coaxial/termination requirement for telecommunications, data and broadcast system wiring; devices may be combined to make adapter combinations.

Circle (424) on Reply Card

Audio pre-amp

By NAIM Audio

• **Model NAC52:** remote-controlled audio pre-amplifier; infrared remote control; optocouplers connect signal relays, potentiometer motors; multiple inputs and plug-in modules for different requirements; LEDs in volume, balance and input switches show status at a glance.

Circle (430) on Reply Card

Effects/TBC

By JVC

• **Model KM-D600U:** special-effects generator, combined with 2-channel field store/TBC; brings Y/C (S-VHS) video editing to production and broadcast standards; numerous wipe, key and digital effects; inputs and outputs accommodate composite as well as Y/C signals; Y/C separation circuit suppresses apparent visual differences between the two video formats.

Circle (426) on Reply Card

Expanded editing control

By Sony

• **BVE-9100:** video editing controller extends features of previous 9000 unit through a 68030 microprocessor and 4.5Mbytes of RAM; increased speed, color or monochrome display monitoring, four GPI ports and 1.4Mbyte 3.5-inch floppy disk drive enhancements; multiple EDL, advanced match frame menu, "Quick Trace" software and extended GPI menu features.

Circle (441) on Reply Card

Digital component equipment

By Thomson Broadcast

• **DIGIPHASE:** automatically phases digital 4:2:2 component signals; four independent channels with 270Mbit serial inputs, outputs; manual mode for operator control of delay in each channel; features split-screen function, A/B switching, black image and image freeze.

• **SYNONYM:** digital component mixer for 11 sources; extensive keying includes upstream, midstream, downstream or cascaded functions; primary mix configures as multilayer or double mix to extend switcher capacity.

Circle (447) on Reply Card

Speaker control switch

By RF Engineering

• **SI series:** integrated sensor and switch allows one set of speakers to be used in two audio systems; if both audio systems are operating, priority is given to one source; operates from 12VDC with 110V adapter available.

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Digital image store

By Recognition Concepts

• **DataSTORE 120:** combines videodisk recorder with CCIR 601 and SMPTE RP125 interface; 44-minute capacity for true col-

or images; database management software; random-access time less than 100μs to any of 80,000 images; loop sequences from one to 80,000 frames with slow, stop motion.

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On-camera microwave

By RSB Steadicam

• **Steadiwave:** miniature microwave transmitter designed for use with Steadicam operation; FCC-approved unit operates from the on-board batteries of the Steadicam or ENG equipment; eliminates the need for camera cables; for 1.7-2.7GHz with visual and aural signals.

Circle (438) on Reply Card

C-/Ku-transceiver

By Scientific Atlanta

• **Model 7890/95:** 2-part system with electronics to control uplink and downlink on single or multiple carriers; for 2-way VSAT, MCPC, IBS and higher data rate networks on C- and Ku-band frequencies; use with No. 8881 modem for 32kbit-512kbit MCPC or digital SCPC, with No. 8880 modem for IBS and higher data rate signals.

Circle (439) on Reply Card

Mobile equipment racks

By Sound Designers Studio

• **Rack 'n Roll:** building-block approach to easily movable equipment rack construction; 7/8-inch square-tube members formed into 14×20-inch rectangles; drilled and tapped for standard mounting screws; casters attach to bottom unit, additional "frames" may stack several units high.

Circle (442) on Reply Card

Teleprompting systems

By Technical & Management Consulting

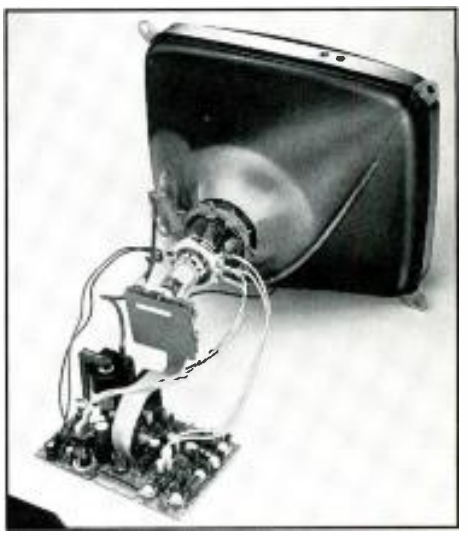
• **CUEWORD systems:** range of on-camera displays as well as complete computer-based text-generation equipment including IBM/compatible hardware; standard- and custom-designed systems for studio and mobile operation; displays of five inches, 12 inches; integrated text exchange systems.

Circle (443) on Reply Card

Utility monitors

By Wells Gardner Electronics

• **Customizer IV series:** monochrome monitors with 5-inch to 14-inch diagonal CRTs; 900-line horizontal resolution at scan rates from 15.7-22kHz; includes CRT and driving circuit board with 10-pin edge connector; various optional faceplates to fit your custom enclosure.



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In Touch Ministries, an evangelical Christian ministry, has an immediate opportunity for a TV Maintenance Engineer. The applicant must possess a BS in electrical engineering with communication emphasis, or a BS in electrical engineering technology, or equivalent experience. Must be able to troubleshoot equipment. Excellent benefits. Send resume and salary requirements to:

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Vetter Communications Company, Inc. has an opening for a qualified broadcast engineer. FCC or SBE certification required. 2-5 years experience in television studio equipment maintenance required. Experience in radio broadcasting and related equipment desirable. Send resume and references to VCCI, P. O. Box 14685, Baton Rouge, LA 70898, ATTN: Larry Dietz. VCCI is an Equal Opportunity Employer.

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EIGHTH ANNUAL STATION MAINTENANCE REPORT

• Troubleshooting Analog Systems

Servicing the high-quality analog equipment in a radio or TV station can be difficult. Sometimes, the performance of the equipment exceeds the measurement capability of the test equipment. The article looks at techniques that can help isolate and resolve analog problems without a truck full of test gear.

• Troubleshooting Digital Systems

Repairing modern digital equipment requires a special expertise. High-pressure-environment control rooms and production suites demand that the problem be diagnosed and solved in minutes, not hours.

• Caring for High-Power Tubes

Most broadcasters still use tubes in their transmitters. Today's tubes are reliable and efficient. Yet, to maintain long life they need proper care and treatment. The article looks at important steps the engineer can take to ensure a long life from the transmitter tubes.

• Digital and Analog Fiber-Optic Transmission Systems

As video signals improve, the paths they travel must also improve. Component, RGB, M, D-1, D-2 and new signals must now be interconnected to a variety of equipment within the station. It's important that engineering managers understand where and how fiber fits within the TV station.

December...

TECHNOLOGY FORECAST FOR 1992

• State of the Industry Report

One way to help make the correct decisions is to pool the knowledge of your fellow professionals. The annual State of the Industry Report has become the hallmark barometer for the broadcast industry's health and direction.

• View from the Top

The 1991 SBE Convention in October provided the unique opportunity to tap the resources of broadcasting's most knowledgeable engineers. These professionals joined forces in a "broadcasting technology summit" to help identify the major technological trends that may impact this industry.

• Profiting from Technology

The most successful stations look to value-added areas to help increase their profits. Often it's the station technical staff that helps the manager see how technology can improve the bottom line.

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