

BME

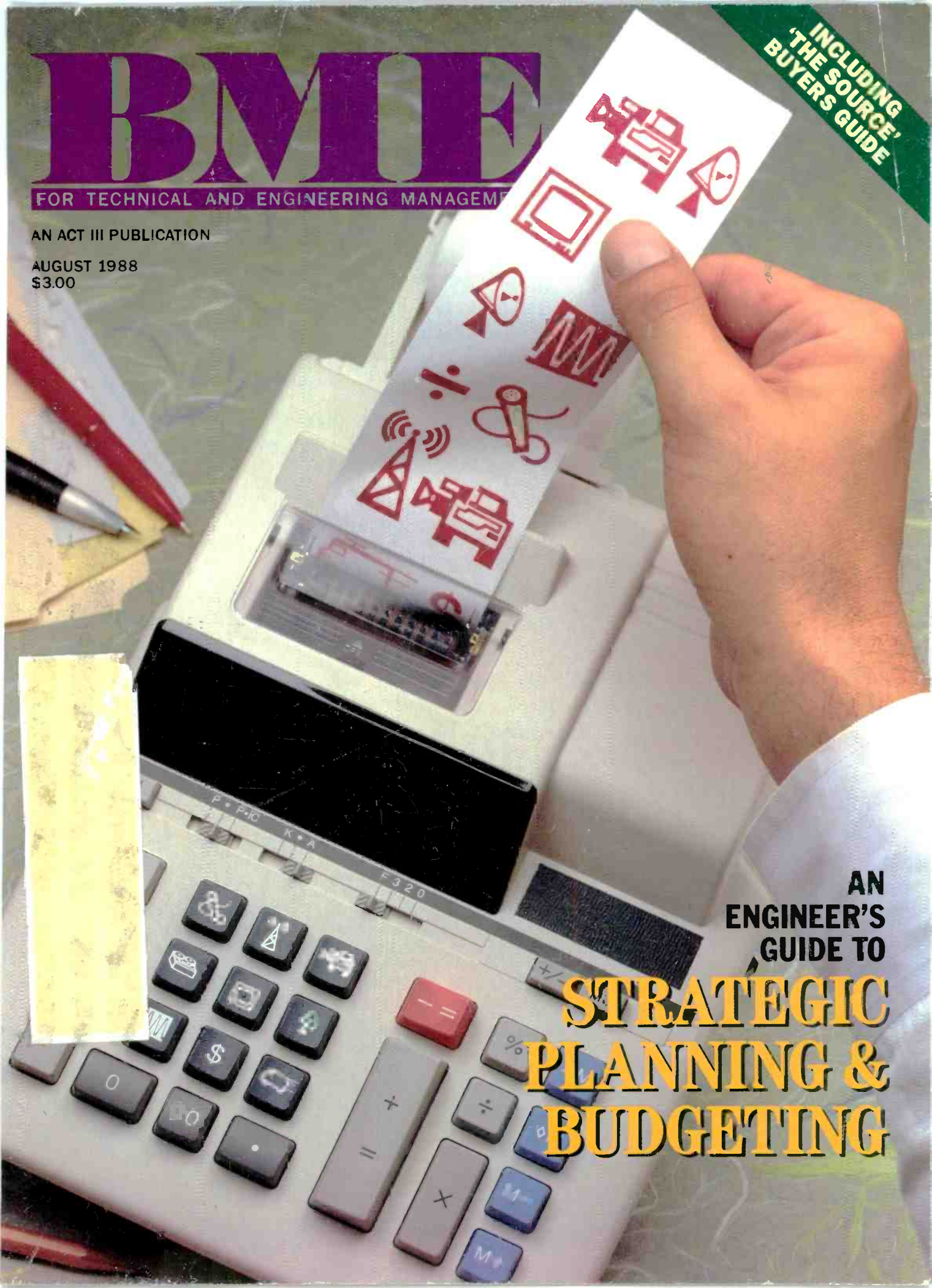
FOR TECHNICAL AND ENGINEERING MANAGEMENT

AN ACT III PUBLICATION

AUGUST 1988
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ports. Plus, they can read Control Track, Time Code and perform video/audio split edits. The list of features goes on and on, so by all means, read on.



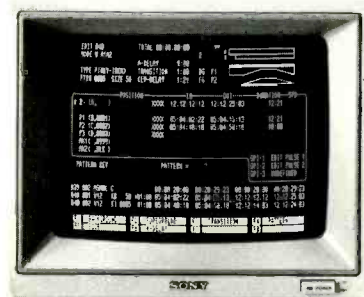
The BVE-9000. State-Of-The-Art That's Top-Of-The-Line.

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BVE-900



is on the f technology.

switcher Learn-With-Create features allow you to record a move without having to re-rehearse it. In addition, the temporary record assignment greatly speeds up multi-layering. And the most complete set of test diagnostics in the industry helps reduce system downtime. No wonder this top-of-the-line editing system can meet all your present and future needs.

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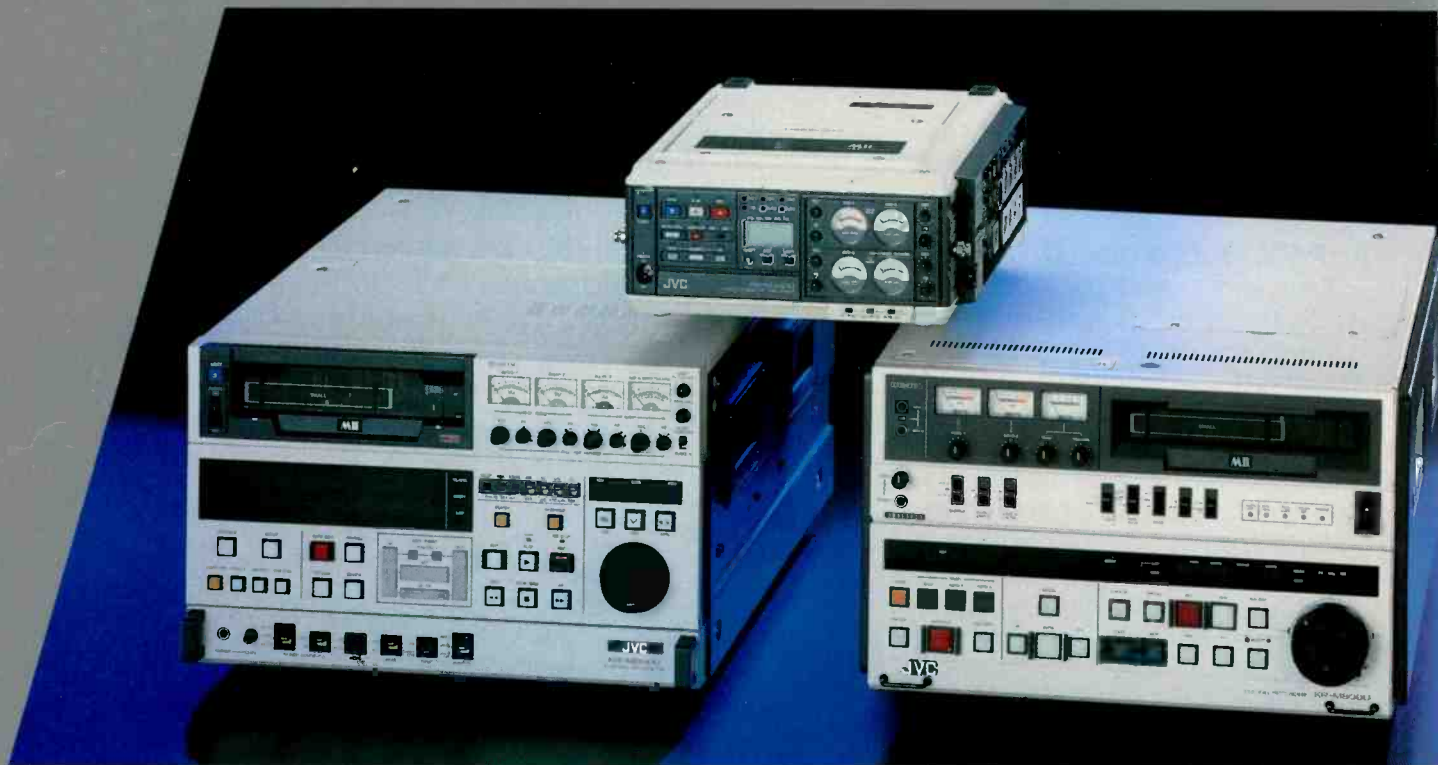


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Circle 102 on Reader Service Card Page 91



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28
Strategic Planning



42
Station Evaluation

Features

- 28 Tough Times, Tough Calls**
Engineers responsible for strategic planning and budgeting face some difficult decisions in formulating intermediate and long-range goals.
- 37 Paying for Compliance**
Broadcast engineers can offset some costs of mandated change if they look to the IRS.
- 42 Applying the Engineering Yardstick**
The prepurchase engineering evaluation is the moment of truth that can reveal engineering excellence or neglect.
- 52 Engineering Budgets: Sample Forms**
Good documentation can expedite capital planning and implementation. Here's a template of forms that work.
- 57 The 1988 Source Buyers Guide**
BME's annual guide to manufacturers of broadcast and related products, this year broken out by equipment type and alphabetically arranged by company.
- 59 Product Guide**
- 72 Alphabetical Listing of Manufacturers**



57
1988 Source

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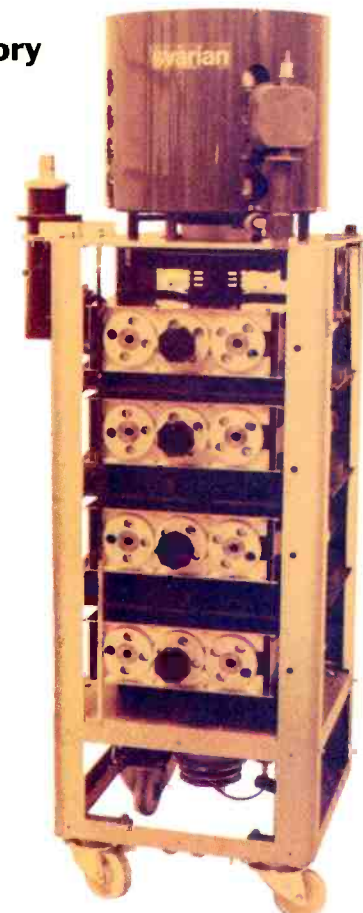


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Columns & Departments

- 11 Viewpoint**
The Business of Engineering
- 13 Feedback**
Took Another Look...No Favorites.. Refried Beans
- 15 Update**
Manufacturers Rally to Support DASH...Varian Under Federal Fire?...1125/60 Consortium Formed...Motorola Wares at CES...Lavsky's DAW
- 21 Crosstalk: An Engineering Management Journal**
Boosting NTSC...The Soul of Seoul
- 25 Tech Watch**
A Nationwide Computer Network
- 98 Compute**
A Compute Disk Menu
- 102 Spectrum: The Regulatory Environment**
Swaps and Upgrades: Strategic Planning and the FCC
- 106 New Equipment**
JVC's New Frame Sync... Skotel Time Code Generator... Ram Broadcast's SX Console
- 120 Business Briefs**
AME Receives D-2 Deliveries
- 121 Advertisers Index**
- 122 Currents: A Guest Editorial**
Help Wanted: Attitude. Interaction. Experience.



15
*Varian's
Klystron*



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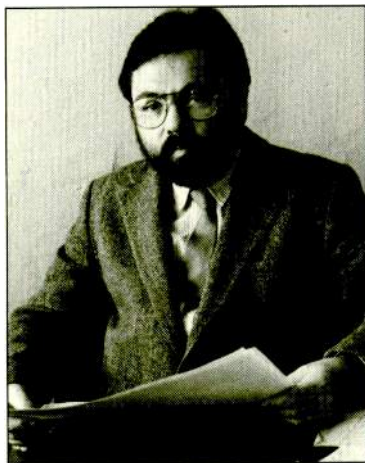
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Circle 104 on Reader Service Card Page E1

VIEWPOINT

Engineering is never completely divorced from the calculation of dollars-and-cents and cost efficiencies.



The business of engineering is a subject many in the industry feel drawn toward these days, especially with capital budgets and long-range strategic plans required from many chiefs' desks in the near future.

Engineering is never completely divorced from the calculation of dollars-and-cents and cost efficiencies—except at its purest level, where engineering approaches theoretical scientific research. The smart engineer always wants to know how much something will cost, how much it will cost to operate, how it will integrate with current equipment, and what the payoff will be to the bottom line of station operations.

At the same time, engineers are often faced with fear and loathing when asked to prepare a capital budget. Our basic advice here, having been through a similar process recently, is to just take it "one step at a time." As a good first step, we recommend looking over the sample engineering department budget forms that appear in this issue. Based on actual forms used by a group broadcaster, they can provide a useful template for structuring capital expenditures requests.

But what should those requests include? The increasing pace of technological change is making it harder than ever for engineers to stay on top of the industry. This month's piece, "Tough Times, Tough Calls" examines a few of the hottest areas of change. And when it's time to specify equipment, you'll find what you need in *The Source*, this year's edition of *BME's* annual engineering buyers guide.

It is with great pleasure that we announce the appointment of Eva J. Blinder as the new editor of *BME*. Having worked with her in the past and read her contributions as the magazine's Senior Editor, many will recognize Blinder as one of the outstanding journalists covering the technology of broadcasting. Her decade of experience and thorough knowledge of the industry make her the ideal choice to steward *BME's* continued growth. ■

Robert Rivlin
Editor-in-Chief

Video That Sounds as Good as it Looks.



Photographed at On Tape Productions, San Francisco, CA.

The video industry demands the same uncompromising audio quality the recording industry expects. Dolby SR/A-type noise reduction is now available for the Sony BVH-3000/3100 VTR. Contact your Sony representative and inquire about the optional

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Dolby SR
spectral recording

Sony Communications Products Co. Phone 201-833-5200. Dolby Laboratories Inc., 100 Potrero Avenue, San Francisco, CA 94103-4813, Phone 415-558-0200, Telex 34409, Facsimile 415-863-1373. 346 Clapham Road, London SW9 9AP. Phone 01-720-1111, Telex 919109, Facsimile 01-720-4118. Dolby and the Double-D symbol are trademarks of Dolby Laboratories Licensing Corporation. © Dolby Laboratories Inc. 1988. S88/8321

FEEDBACK

Take Another Look

Congratulations to you and your staff on *BME*'s new look! Being a fan of "production value" I especially congratulate Rick Stark for his designs. The old *BM/E* was just fine. I never expected anything better. The information value of the old *BM/E*'s, all on file here since my subscription began in the 1970s, remains intact and, I'm sure, will continue. What you've done is taken your place among the combatants contributing to the multitude of stimuli attacking broadcasters today—visual stimuli, all clamoring for their attention. You've won! The magazine looks fantastic! You're adding information, making it more valuable, and the ads remain the same (also a source of information).

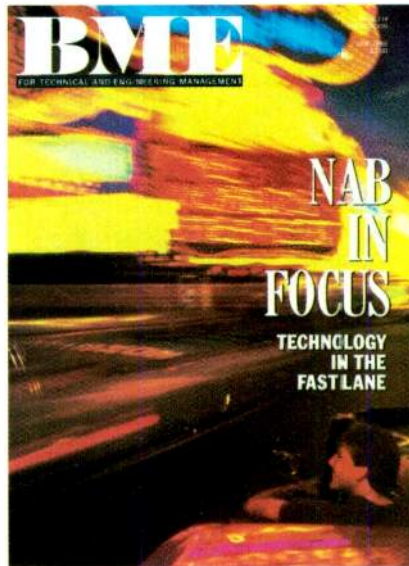
Again congratulations to your staff on the new look.

Tom Konard, President
The Aircheck Factory

No Favorites

I could not help but laugh when reading Tim Beasley's letter in the April *BME*, ("Feedback," p. 16), as he suggested that the FCC is more lax in its enforcement of the rules for NPR affiliates than for other radio or broadcast stations. As chief engineer for the past seven years at NPR affiliates, let me assure him that this is not the case.

Beasley is not too specific in his published letter, but if the unnamed community in southeast Alabama is near the tower of WTSU-FM, and the unnamed "local" television station is either WBRC-TV in Birmingham, AB, or WCTV-TV in Thomasville, GA, (both on channel 6), then the reason the FCC has not responded to citizen complaints is that there probably has not been any vi-



olation of the commission's rules and regulations.

WTSU broadcasts 100 kW at 89.9 MHz. The audio subcarrier of channel 6 is 87.75 MHz. There are very few television receivers, if any, that can tell the difference between the two—large-screen Mitsubishis seeming to be the worst offenders. The result is that the stronger of the two signals is heard. Since both of the channel 6 stations are 60 miles or more from Troy, AB, my guess is that the "stronger" signal of WTSU is "blanking" the weaker audio signal the local television station.

I really can't say if the FCC is doing a perfect or even adequate job of enforcement—I have no horror stories of my own to tell.

Mark Tomlonson, CE
WMUK, Kalamazoo, MI

Refried Beans

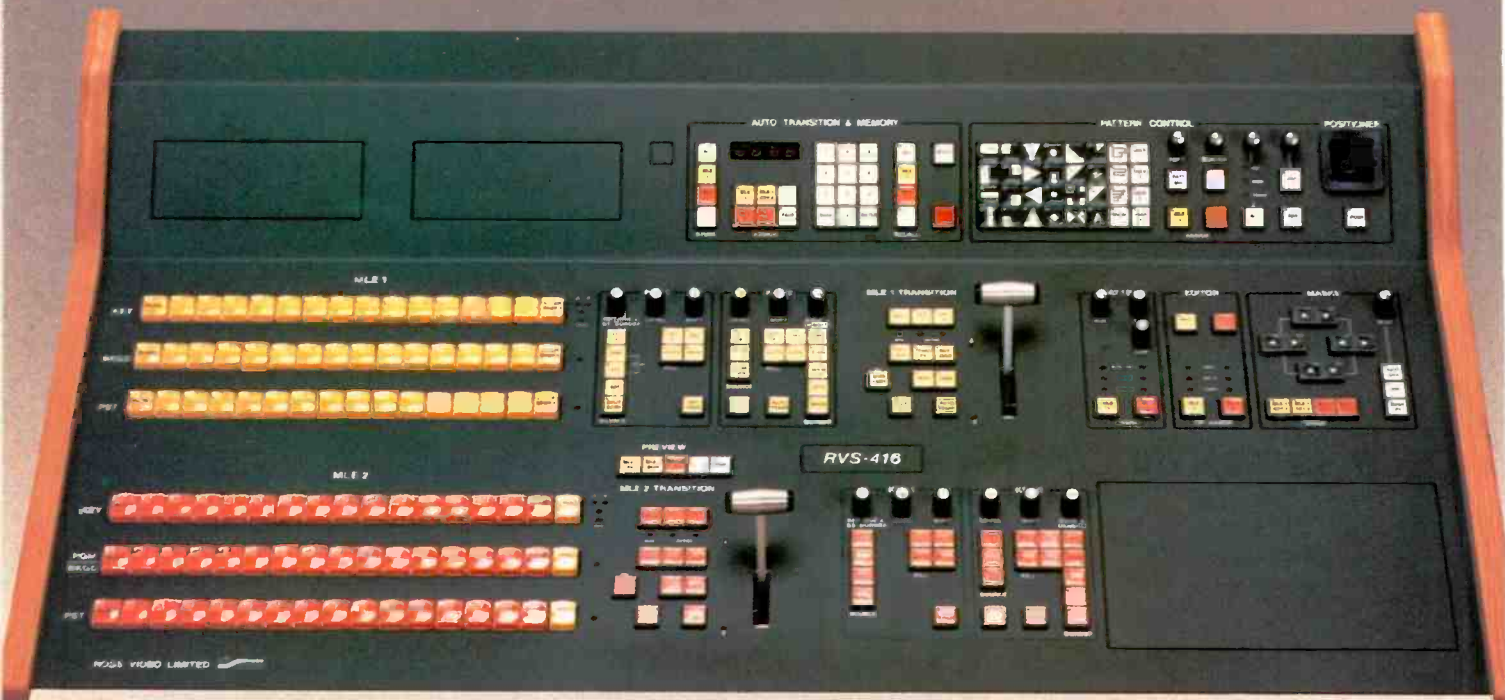
I enjoyed Robert Rivlin's editorial in the April *BME* ("Invasion of the Bean Counters," p. 12). The broadcasting industry should not feel

alone in its frustration with "budget-weenies." Government agencies have long had decisions made based entirely or mostly on economic and political rather than technical considerations (and look where that has taken them). Unfortunately, in business and government alike, "bean counters" are no more qualified to make decisions on technical issues without the advice of engineers than are engineers qualified to make managerial and profitability decisions without the advice from the appropriate experts. Profitability and survivability decisions are much too important to leave to the uninformed, and cannot be intelligently made unilaterally.

Not every M.D. is cut out to be a surgeon or family practitioner; not every engineer is cut out to be a line engineer or engineering manager. The trick is for the "system at large" to recognize those people better at engineering and let them stay there, not "promote" them into management slots when they would really prefer to stay in hands-on engineering. Figuring out how to financially and psychologically reward good quality engineers while allowing them to stay on the floor is a real problem for the owners and management...with the advice of the bean counters and engineers themselves, of course.

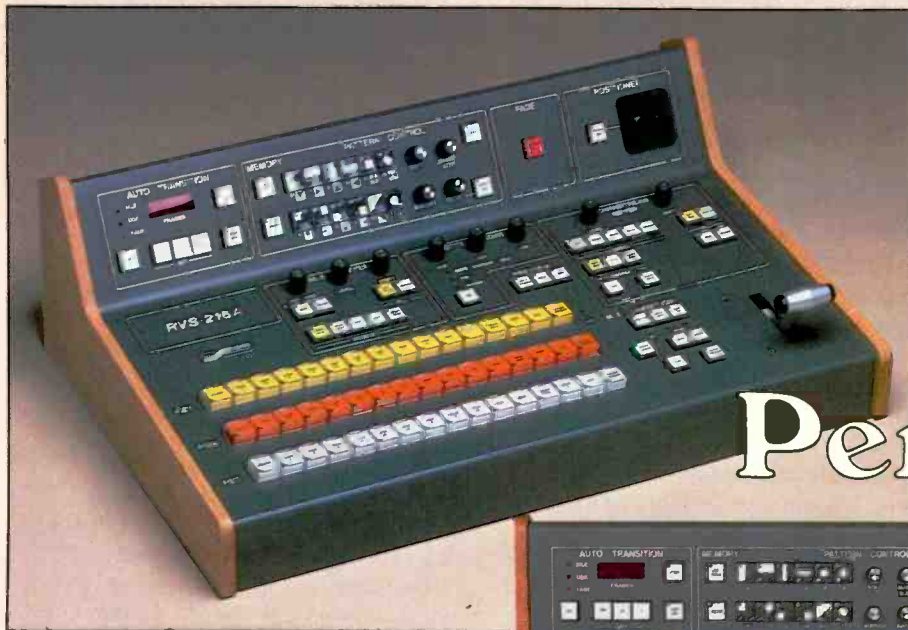
W.A. Hickey
Bowie, MD

Do you have any questions, comments, or criticisms concerning what you read in BME? Any bulletins or issues you want to open up to other engineering management readers? Our letter column, Feedback, is your forum. Write to: Feedback—BME Magazine, 295 Madison Avenue, 19th Floor, New York, NY 10017.



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& Trans Preview
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MEET the Performers



RVS 210A

10 inputs including black and color
Multi-Level Effects system
Ross Transition Preview
Pulse regenerator
Wipe to downstream key
Linear key border generator
Function button for increased flexibility



Circle 106 on Reader Service Card Page 91

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UPDATE

Manufacturers Rally to Support DASH...Varian Under Federal Fire?...1125/60 Consortium Formed...Motorola Wares at CES...Lavsky's DAW

Sony, Studer Revox and TEAC Reaffirm Support for DASH

Sony Corp., Willi Studer AG and the TEAC Corp. recently announced ongoing support for the Digital Audio Stationary Head (DASH) multichannel recording format. A joint statement was issued in Tokyo June 20 as the three companies introduced new DASH-format products.

DASH is a standard format that ensures compatibility between digital multitrack studio tape recorders with stationary, rather than rotating heads. It covers from two to 48 tracks and tape speeds from 12 to 76 cm per second. Intended as a worldwide tape interchange, it was introduced in 1982 by Sony, Willi Studer AG and Matsushita Electric Industries Corporation.

All three companies will develop and expand their respective lines of DASH products. Currently each company's recorder supports full digital audio interchangeability with DASH recorders from other companies. DASH components used in common include heads, signal processing and interfacing LSI, although other areas of product development remain independent.

Sony and Willi Studer AG also announced that the joint engineering work necessary to establish an upwardly compatible DASH 48-channel recorder has been completed. A product announcement is expected before the end of the year. A TEAC 48-channel recorder is also reportedly under development; 48-channel recorders from all three companies will be fully compatible with new and current 24-channel DASH recorders.

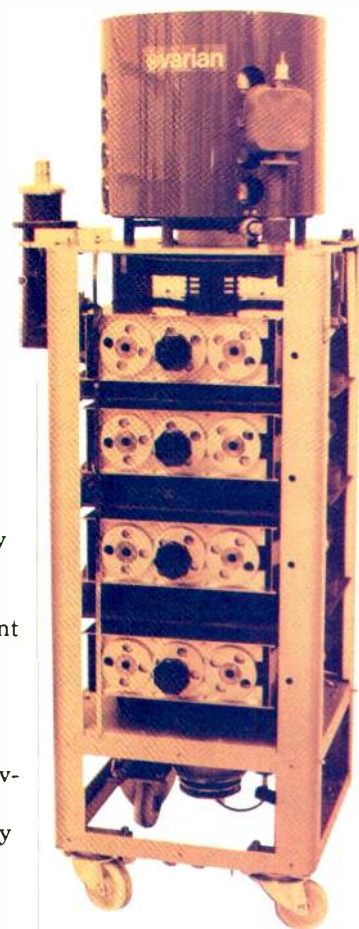
Product announcements for second-generation 24-channel DASH recorders included the Sony PCM-3324A, an upgraded version of the PCM-3324 DASH 24-channel recorder, with improved A/D and D/A converters and reduced power consumption, and a prototype TEAC DASH 24-channel recorder. The TEAC recorder will be displayed before the end of the year.

Continental Electronics Suspended by Government; Varian Klystron Unaffected

Varian Associate's Continental Electronics Division, recently searched by Federal agents as part of an investigation into irregularities in Department of Defense procurement, has been suspended from contracting with any agency in the executive branch of the Federal Government. The company was formally notified July 7 by the United States Navy.

Varian, which recently completed development of the Multiple Depressed Collector (MDC) klystron tube with the NAB, says neither the development nor subsequent sale of the klystron are part of the investigation. Varian, PBS and the NAB began the joint klystron development project, which is based on developing NASA technologies for commercial use, in 1984.

"The MDC klystron is not impacted by the investigation, which is a prod-



Varian's MDC external-cavity klystron.

uct of a completely separate operating unit from Continental Electronics," said Glen Huffman, manager for Cavity Amplifier Tubes for Varian's Microwave Tube division. "The klystron tube is designed for use in commercial television broadcast, not defense applications," he added.

The klystron project was developed by Varian's Mi-

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Now with corner pinning

crowave Tube division, based in Palo Alto, CA. Continental Electronics, which makes high-power radio equipment for military and commercial use, is based in Dallas, TX. Both are divisions of Varian's Electron Device Group, which makes a wide range of products including microwave and X-ray tubes. Varian Associates, the parent company of all the divisions, is also based in Palo Alto.

"Our role was solely to assist in the development

of the MDC klystron," said Michael Rau, vice president, science and technology, for the NAB. "How the product is marketed is up to Varian."

Entering a joint technology development project with a commercial manufacturer is considered unusual for the NAB, according to Rau, but the program was undertaken at the request of the association's UHF constituency. The NAB will address similar projects on a case-by-case basis, he said.

Manufacturers Form Group to Boost 1125/60 HDTV Production

A consortium of broadcast-industry manufacturers has joined together to urge the adoption of ATSC/SMPTE 1125/60 HDTV as an international production standard. Called the "HDTV 1125/60 Group", the organization will be headquartered in Washington, D.C. It has named William G. Connolly, currently president of the Sony Advanced Systems Group, to head its technical efforts.

The Group's primary purpose is to support 1125/60, which it bills as "a production standard for the world," as a standard for HDTV studio origination and program exchange.

"It's necessary to understand that accepting 1125/60 HDTV for program production does not

lock U.S. broadcasters into accepting MUSE as a transmission standard," Connolly told *BME*, adding that this also applies to any other transmission standard currently under consideration.

"1125/60 is an electronic mastering format for high-quality imaging and what's important to broadcasters is that it's transcodable to the proposed transmission standards," he said. At least three of the 17 different transmission standards currently proposed to the FCC have specified 1125/60 for program production.

The North American HDTV production standard is the result of six years of study by the ATSC and SMPTE. This standard has been carried by the U.S. Department of State to current international studies on HDTV production and represents the formal position of the United States and Canada

Lavskymusic Bows World's Biggest DAW

NYC-based audio production house Lavskymusic has installed what it says is the "world's largest digital audio recording system." Designed and developed for Lavskymusic, the digital audio workstation (DAW) system is based on New England Digital's Synclavier digital music computer and Direct-to-Disk post-production system.

The system features a 96-voice computer with 64 Mbytes of polyphonic random access memory plus optical disk storage with 2 gigabytes of memory per disk. It also hosts 200 sequencer tracks of digital sampling and direct-to-disk digital multitrack recording. The systems lock to video through SMPTE time code.

The facility plans to use the DAW to expand its capability for original music and sound production. Consequently Lavskymusic and the Musician's Union "have spoken" and reached an agreement, according to Richard Lavsky, owner of the facility and chairman of SAMPAC (Society of Advertising Music Producers, Arrangers and Composers).

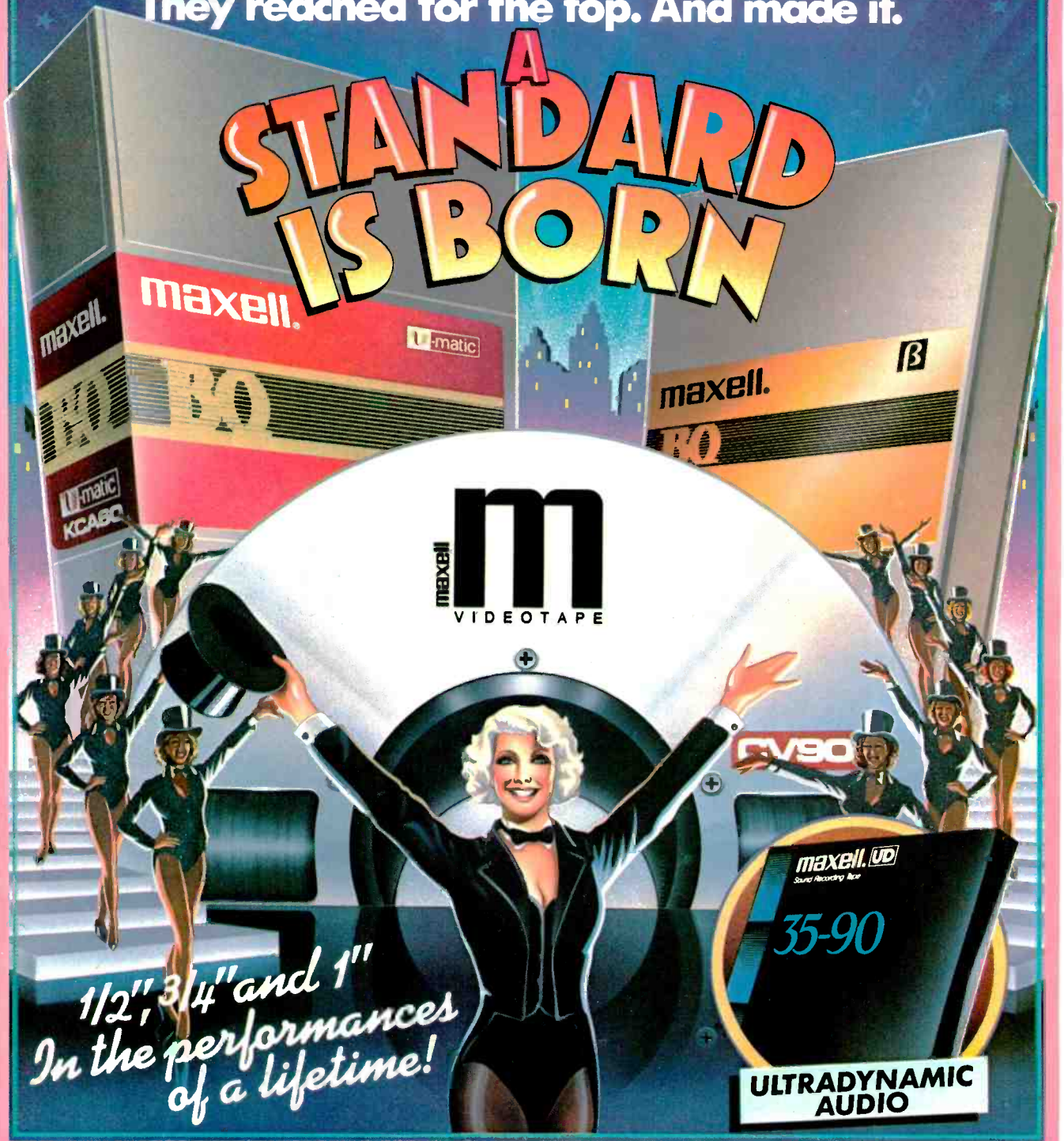
Lavskymusic, which owns and operates a second Synclavier system and two 24-track analog studios, has scored projects including the Purina Cat Chow "Chow, Chow, Chow" advertising campaign and the New York Mets 1986 winning season theme song.



Lavskymusic owner Richard Lavsky (left) and creative director and electronic music composer Tamara Kline.

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in worldwide efforts to achieve a single HDTV production standard.

Opponents of 1125/60 as a production standard include Philips, which is currently developing a 1050/59/4 transmission standard, and NBC, which argues for the same standard for production and transmission. Companies currently proposing transmission systems are not necessarily specifically linking production and transmission standards, but argue that advantages of disassociated standards are outweighed by the mandated conversion process.

"Our goal is to help the U.S. broadcaster to better understand the issues and to work closely with him or her in the implementation of HDTV into the production operation," Connolly said. The 1125/60 HDTV Group will also provide information to technical and non-technical groups currently studying Advanced Television Systems (ATV).

In addition to manufacturer members, the Group includes advisors from U.S. video and motion picture production and



William G. Connolly, president of the Sony Advanced Systems Group.

post production companies, broadcasters and cable system operators.

Charter member manufacturers who will offer production equipment using the ATSC/SMPTE 1125/60 production standard include Chyron, Cinema Products, Compression Labs, Dynair Electronics, Dynatech Broadcast Group and the Grass Valley Group. Others are Hitachi America, Ikegami Electronics, Magni Systems, NEC America, Panasonic, Panavision, Quantel, Rank Cintel, Sony Corp. of America, Symbolics Graphics, Toshiba America, Ultimatte Corporation and U.S. JVC.

Motorola Shows AM Stereo Wares at CES

Thank the Chicago Cubs for something, sports fans. IF KFMB-AM San Diego hadn't aired the games in glorious AM stereo, the Cubbies wouldn't have stormed hometown WGN-AM and demanded same. Consumed by envy, the Detroit Tigers wouldn't have muscled WJR-AM, and now Pittsburgh wants in, and well, we'll take converts any way we can, says Motorola, which has been on the road to Damascus it seems like forever trying to turn the unbelievers on to AM stereo.

Like Broadcast Technology Partners, Motorola also stumped the hustings hard at the SCES in Chicago in June in an effort



Motorola C-QUAM equipment displayed at recent CES in Chicago.

to get the broadcast industry to talk to its final constituency, and to receiver manufacturers.

"You can really hear that ball," they say, pointing out an increasing tendency for broadcasters to use AM Stereo to spice up live sports events. The Detroit Grand Prix Formula 1 auto race, for example, will be broadcast live in AM Stereo for the second year in a row in June, miked across a 40-foot mobile truck.

Motorola also showed off its new MC13022 and MC13024 chips. The first is an advanced medium-voltage AM stereo decoder with a 10kHz notch for automatic or user adjustable audio bandwidth control; the second is a low-voltage AM stereo receiver for use in portable "Walkman"-style products.

In addition to personal AM portable stereos, Motorola also showed C-QUAM AM Stereo modulation monitors (model 1410) and exciters (model 1400). Over 100 stations and many major suppliers of car stereo equipment including Blaupunkt and Alpine have signed on to the

format, although car stereo makers like Kenwood say that while their AM stereo model is a best-seller, it's because it's an excellent high-end unit and not specifically because of the AM stereo feature.

It's the classic chicken-and-egg: manufacturers won't make the receivers if they don't perceive demand; stations won't push the format to generate demand if they don't feel there's much equipment installed.

"There's a lot of equipment out there—broadcasters just don't know it," said Don Wilson, engineering manager for Motorola. Out of a user base of some 500M receivers, over 140M are C-QUAM AM stereo, the company says, adding there are a lot of misconceptions about the format.

"You don't need a new antenna and you don't need a new transmitter," Wilson said. "Converting to stereo offers you the opportunity to examine your system, check the entire audio chain from studio to transmitter and update if necessary." ■

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Boosting NTSC . . . The Soul of Seoul

Boosting NTSC

Amid all the talk about digital video and high-definition television, lowly NTSC is the unwanted stepchild of the industry. The butt of frequent jokes, reviled for its supposedly inherent artifacts, NTSC has had more than its share of bad press.

Nevertheless, certain segments of the engineering community have continued to assert that there's more in NTSC than meets the eye. The latest addition to the list of NTSC boosters is Central Dynamics Ltd., which invited a small group of journalists last month for a demonstration of a new NTSC encoding and decoding technology the company hopes will knock the socks of the industry at its upcoming SMPTE introduction.

The new technology, which CDL is calling E-NTSC (for Enhanced NTSC, in contrast to Yves Faroudja's Super NTSC), was developed at INRS-Telecommunications, a Montreal-based research facility affiliated with the University of Quebec. While INRS's chief mandate is to conduct strategic research and provide academic training for postgraduate students, it maintains close ties with industry and licenses the techniques it develops for commercial use wherever possible. CDL, right down the road, was apparently a prime candidate.

The new technology behind the new codecs arises from a new and unusual perspective on the NTSC spectrum. As is well understood, cross color and

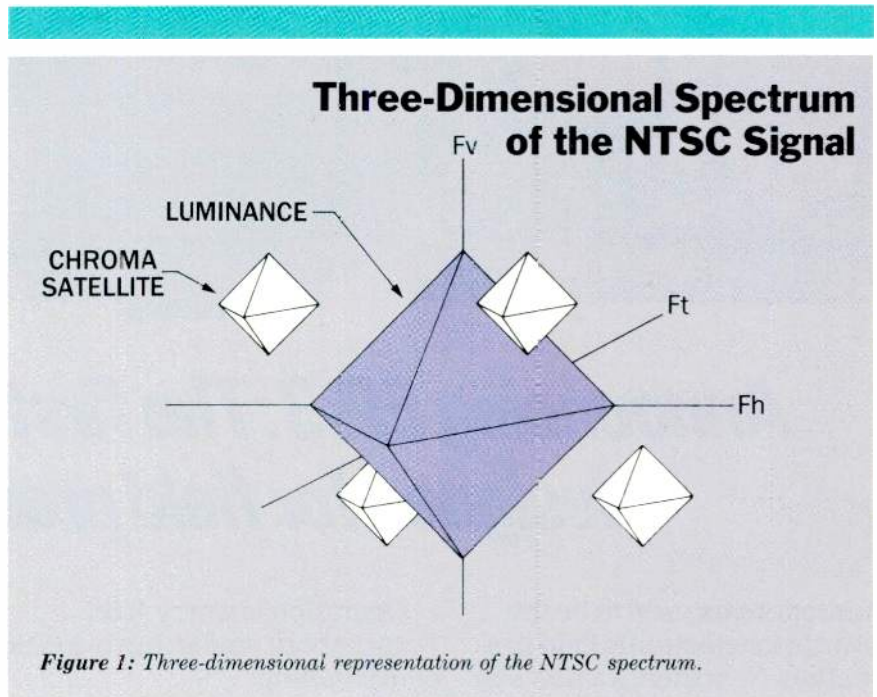


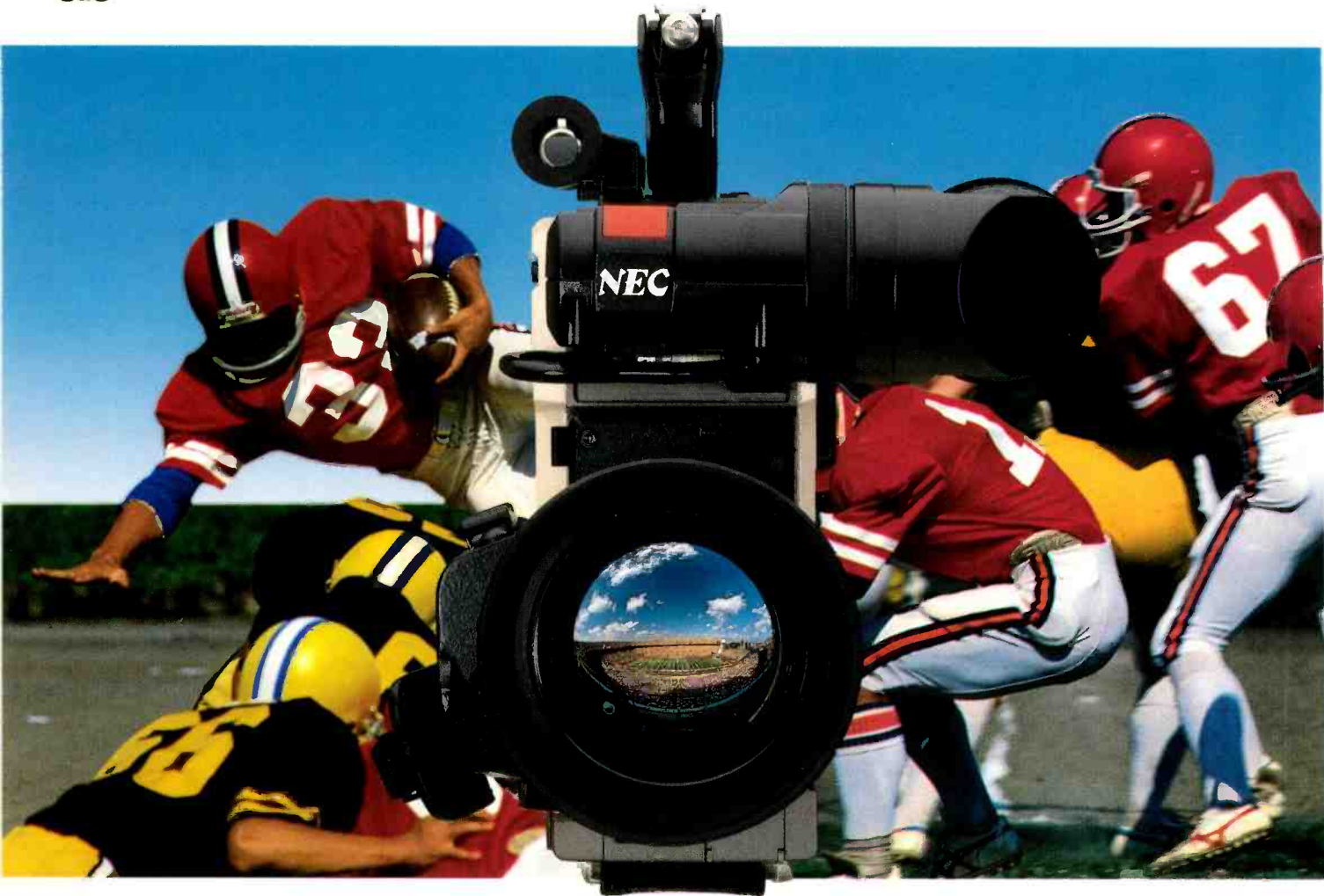
Figure 1: Three-dimensional representation of the NTSC spectrum.

cross luminance artifacts in NTSC result from the difficulty of separating the color subcarrier from the luminance signal.

The research conducted by Dr. Eric DuBois and others at INRS-Telecommunications suggested that separating the chroma from the luminance could be done much more effectively if the signal was visualized in three dimensions, as opposed to the more usual two-dimensional waveform most engineers recognize. (DuBois and a colleague, William F. Schreiber of MIT, described their work in the

June 1988 issue of the *SMPTE Journal*.) Using this 3D waveform enabled the researchers to isolate the chroma much more accurately, without the loss of luminance resolution that can result from standard notch filtering techniques.

Most of the work so far has taken place in INRS-Telecommunication's sophisticated computer simulation facility, in operation for more than a decade, which was recently upgraded to include real-time video simulation capabilities. By mid-July, a working prototype of the encoder had been



Announcing EP-3: The first CCD camera designed for field production

Tube cameras used to be the favorite for electronic field production. Now there's a new star in the field: the EP-3 from NEC.

This sharp new CCD camera offers 700-line horizontal resolution and 62dB S/N ratio. So it goes head-to-head with tubes in picture quality. And when it comes to freezing fast action, the EP-3 gives you far greater clarity than tube cameras. Because it has a 7-speed electronic shutter, with a top speed of 1/1500 second.

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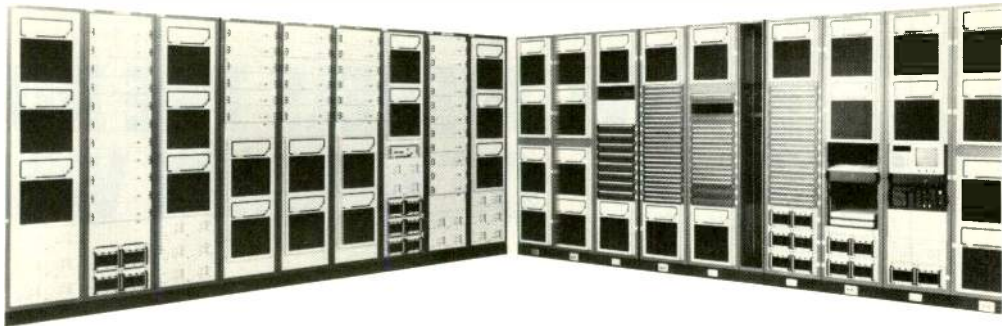
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NEC

CROSSTALK

built, and this was demonstrated for the audience. The subject selected for the live demo was the stuff of which NTSC nightmares are made: a patchwork quilt composed of tiny triangles of contrasting colors and patterns. An assistant moved the quilt in front of the camera while various encoders and decoders were switched on and off. The reduction of artifacts with the new CDL encoder was remarkable, producing a signal nearly as clean as the original, unencoded RGB feed.

According to Christian Tremblay, who has been named to head product development at CDL, the company plans to introduce seven products in the Prism-1 line, all sharing the proprietary multi-dimensional digital filter that is the heart of the system. (It should be noted that this is a nonseparable 2D filter, as opposed to cascaded V and H filters.) The first two products will be an encoder-decoder pair for coding D-1 digital component video to NTSC and back. A D-2-to-NTSC coder-encoder pair will be the third and fourth products.



The Soul of Seoul

While most of the engineering community's attention has been focused on the technological "golds" of NBC's Summer Olympics coverage—the largest field trials yet of the MII component analog video recording system, an all-component graphics compositing process, and the extensive use of stereo audio—few have realized the enormous burdens each of these has placed on signal routing and distribution.

Those responsible for engineering the Olympics, however, began working on the problem as one of their first priorities once NBC had received the contract for American coverage.

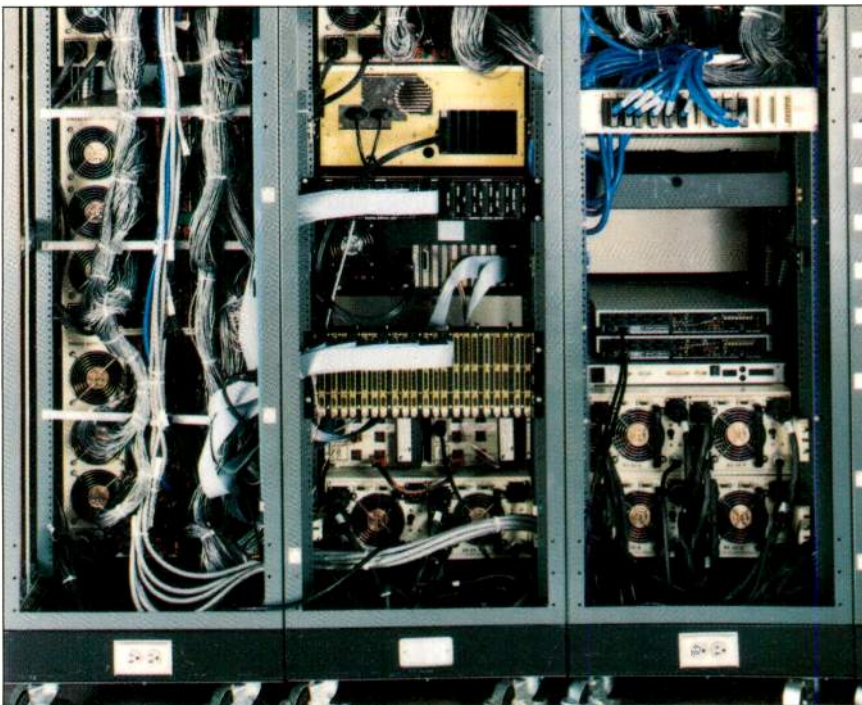
3M Series H routing switcher used by NBC for the 1988 Summer Olympic Games in Seoul, Korea.

"We had been in constant touch with the production people," explains Charlie Jablonski, managing director, engineering for NBC's Olympics effort, "so we knew some of the things they had in mind. We put the routing switcher out for bids almost immediately."

The responses that began to come back amazed both Jablonski and his boss, Jack Weir, who coordinates NBC's operations and engineering efforts for the Games. "We knew all the 'big boys' in the routing switcher market," he notes. "But at 3M we found a group we felt would not only be able to deliver the switcher we needed, but could also do the work within really tight time constraints."

The Seoul switcher consists of a 256 x 340 five-level matrix, with 176 x 271 signals on each of the two stereo audio levels (four audio levels total). These basic dimensions only tell part of the story, however. For in addition to audio and video, the switcher also carries a 65 x 183 matrix for distributing time code and a 69 x 117 matrix for a separate video key signal.

3M's engineers needed to do more than simply design the switcher into a reasonable number of cards. Almost from the beginning they faced the equal challenge of coming up with control panel configurations that would allow NBC to provide its operating personnel (almost all of them freelance at the games) with tools that could be readily comprehended. "Each type of operator gets a control panel uniquely configured for his or her needs," Jablonski explains. ■



Rear view of NBC's massive 3M router. The router will be split into several pieces after the Olympics for installation at NBC O&Os.

MULTI-FORMAT INTEGRATION

JVC DISPELS THE RUMORS OF FORMAT WARS

The video world is alive with talk about formats, old and new. Editors write about "the new age of video". Trade show attendees pack the booths to see the newest formats.

It makes great conversation. But it's making the people who buy and use video equipment uneasy, and confused.

The trouble is that all the formats— $\frac{3}{4}$ -in., S-VHS, and MII are being perceived as little islands unto themselves, with no connecting bridges, and no transitions.

It's time someone told the real story about multi-format integration, because the truth is that these formats can work together. They can be complimentary, not confusing. And they can offer more than the individual parts alone can provide.

How can this be? It takes a commitment to create a bridge between formats, so that the production suite is a place of harmony. Not hostility.

JVC has made that commitment. Our $\frac{3}{4}$ -in., S-VHS, and MII products work together. They will also work well with equipment from other manufacturers. The result is a production suite that links yesterday's technology with today's innovations, and today's innovations with

tomorrow's technology.

It didn't happen by accident. We planned for it. Rather than beat our chests about the "exclusivity" of our formats, we committed our company to products that ease the transition from MII to S-VHS to $\frac{3}{4}$ -in. to VHS. And even to 1-in.

Imagine the benefits: The field production crew brings S-VHS footage to the production suite, where it is edited in the most desirable manner—at the component level. The material can be integrated with existing libraries of $\frac{3}{4}$ in., VHS, or *any* other tape, and it can be alternately monitored in component form, or in any format, on a single monitor. The end result can be S-VHS, $\frac{3}{4}$ -in., MII, 1-in. or VHS.

So much for exclusivity.

And so much for the belief that a multi-format world must also be confusing and expensive. While our competition is boasting the benefits of one format over the other, JVC is integrating the benefits and applications of *all* the formats to make life easier, less confusing, and less expensive.

Let JVC show you that there really is such a thing as multi-format integration, and how it can make your production suite complimentary—not confusing.

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A Nationwide Computer Network?

By Eva J. Blinder

There's a bug in the system. You're staring at a potentially huge problem. A problem that could cause dead air. Severe weather conditions have all but downed your primary transmitter, and the manufacturer support person is out for the week....A prison riot in rural New Mexico demands immediate coverage, not to mention the coordination of sat uplinks, terrestrial microwave, and possibly fiber to get the live audio back to your Miami radio station.

As you mentally rewrite your resume, you suddenly remember talking with a manufacturer at the NAB show in Las Vegas who had an easy fix for this; he showed you a CAD screen shot of his product's circuit design....You read an article in a trade journal that detailed a remote broadcast from the Grand Canyon; there was a list of outside transmission services for most of the Southwest included. If you could only get a look at that circuit; if you could only remember which issue of the magazine the story was in.

The missing link in these scenarios is a dedicated nationwide computer network for broadcast engineers: a network that provides access to a vast library of material, that offers a method for high-detail image transmission and manipulation, and that provides for an interactive, lively bulletin board-like communication forum. Large field-dedicated networks already exist for researchers and educators, and although the obstacles to such a system are numerous, movement towards the establishment of a

nationwide "interstate highway" system for information is already taking place.

So far, the most comprehensive groundwork for a nationwide computer network has been laid by the scientific and governmental communities. The National Science Foundation, for example, has established communications links among the six national supercomputer centers it funds. This network links with computers at universities throughout the U.S. to form NSFNET, allowing researchers to share their work quickly and efficiently.

Other, similar computer networks

have arisen to serve different segments of the scientific community. One of these, ARPANET, links researchers at companies with Defense Department contracts. Another, BITNET, links university-based computers.

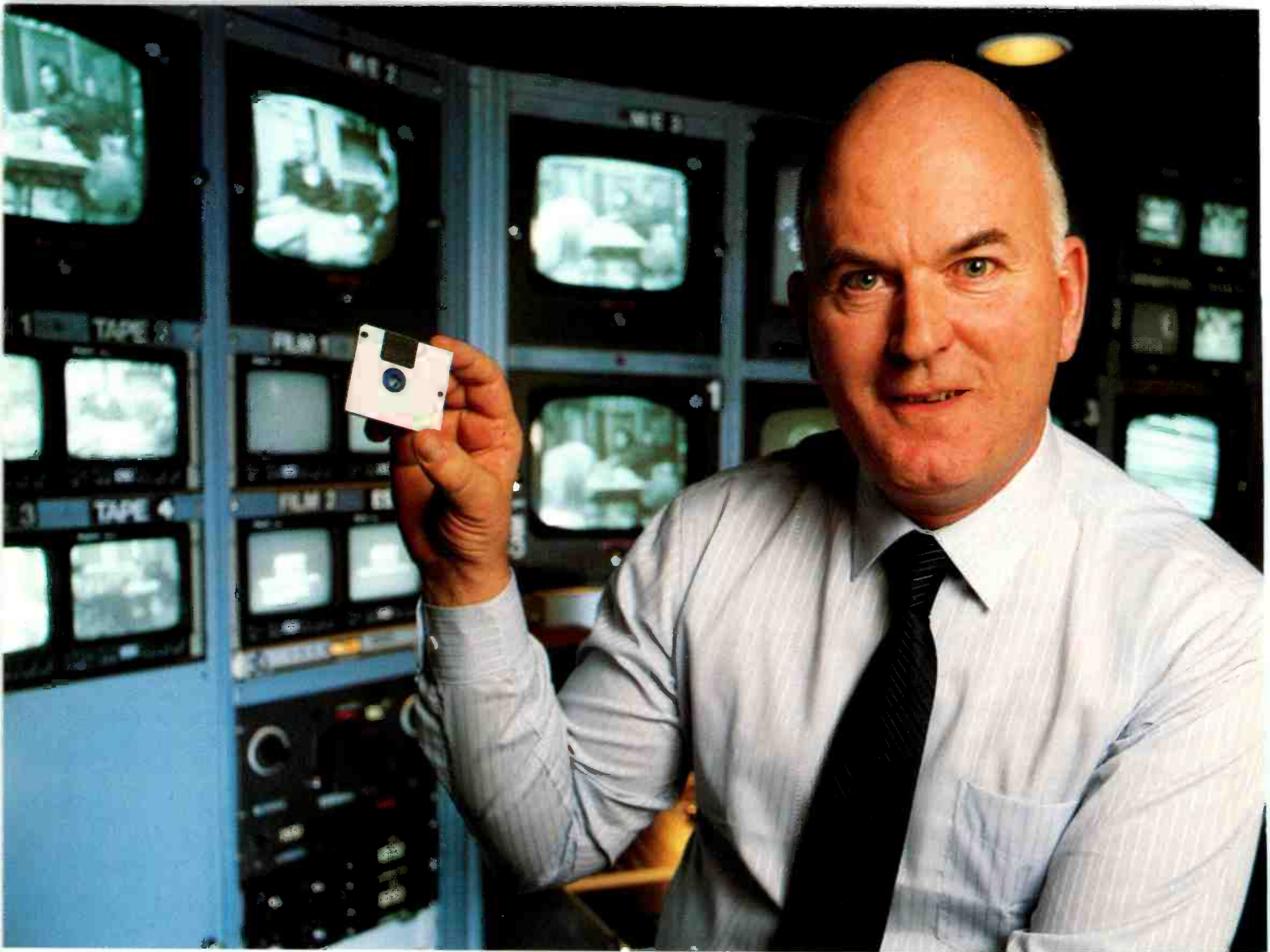
These networks frequently have links, or "gateways," to other networks. NSFNET links with ARPANET and several NASA laboratories; both ARPANET and BITNET have links with USENET, an informal network of several thousand UNIX-based computers located primarily at university computer science departments and computer-industry companies.

Such inter-network links represent a first step toward a true nationwide computer network. But they remain at a fairly primitive level, despite the sophistication of the computers and users they connect.

One of the basic problems the computer networks face is incompatibility. On the most basic level, each network uses different hardware, and data transfer rates vary. Each network also has its own protocol to define who has access to the system and how messages get to each system user. Because the protocols differ, a



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researcher who uses more than one network must remember a different access code for each system.

Furthermore, each site on a network has its own address and may not be directly connected to each other site, even within the same network. On USENET, for example, only a few sites serve as "major backbones" that receive and transfer the bulk of the messages that pass through the system. Other sites are connected to each other via complicated "paths" that travel through one or more of the major backbones. To send a message to a user located at another USENET site, a user must know not only the other user's logon name and site, but a path that links the two sites.

The problems inherent in such a system are obvious: inefficient and slow contact, especially between sites linked only by complex paths. Some work is underway on standardizing methods of systems interconnection, but this work is still at an early stage. And if one computer goes down at a crucial point in the path, communications may be severely disrupted.

Despite the problems that face a national computer network for the scientific community, some efforts are underway. NSFNET is now operated by Merit, Inc., a Michigan-wide research network based in Ann Arbor. Merit has a five-year contract to manage and improve NSFNET in conjunction with IBM and MCI Communications; one of the first projects is to increase the net's data transmission rate to 45 Mb/s by early in the next decade.

At the same time, however, other networks are faring less well. ARPANET, which achieved wide use during the 1970s, is now being dismantled due to government cutbacks.

What, then, are the prospects for a nationwide computer network for broadcast engineers? Most engineers working at broadcast stations and teleproduction facilities do not have access to the minicomputers and mainframes that make up networks such as NSFNET and USENET. Fur-

CompuServe, the commercial computer information network, hosts a Broadcast Professionals Forum as one of its many special-interest discussion areas.

thermore, these systems are presently organized around the needs of research scientists, not broadcast engineers.

Those prospects aside, one computerized link for broadcasters already exists. CompuServe, the commercial computer information network, hosts a Broadcast Professionals Forum as one of its many special-interest discussion areas. Like other CompuServe forums, the Broadcast Professionals Forum provides discussion areas and data libraries, each subdivided according to topic. Discussion section topics include television,

CATV, technical issues, audio and FCC issues. In addition, a manufacturers' section allows equipment manufacturers to post the latest information about their services and products.

Of particular interest to engineers, the SBE and AES each have sections—SBENET and AESNET, respectively—devoted to issues of interest to their members. Newsletters of SBE regional chapters are frequently posted to the SBENET data library. Other Forum data libraries contain, among other things, useful computer programs contributed by members and "threads" of particularly interesting discussions that have taken place on the Forum.

In contrast to USENET or NSFNET, CompuServe is accessible to anyone with a computer or terminal of any kind and an inexpensive modem. It is not free, however; users must pay a sign-up fee, and all time on-line is charged by the minute. Its data library and electronic mail systems accept binary files as well as text, but limits on message size may restrict the system's usefulness for lengthy or complex discussion. ■

Computer Industry Group Urges Standardization

The dream of nationwide—or even worldwide—computer networks edged closer late last month as eight major players in the worldwide computer and telecommunications fields joined to urge further standardization.

The companies—Amdahl Corp., AT&T, British Telecom, Hewlett-Packard, Northern Telecom, Telecom Canada, STC PLC and Unisys Networks—have formed the OSI/Network Management Forum to facilitate adoption of the Open Systems Interconnection (OSI) international standards model.

Forum members have pledged to implement existing OSI standards and contribute to the further development of those standards. A spokesman for the group, Brian Hewat of Telecom Canada, stated, "The principle task of the Forum will be to supply the specific implementation information, such as protocol options and message sets, that designers need now to develop products that fit together with those of other vendors."

The Forum's first effort will be to formulate a set of network management options within each of the several layers of the OSI model.



TOUGH TIMES, TOUGH CALLS

If you're like many broadcast and teleproduction CEs, the month of August brings out mixed emotions. On the one hand, there are thoughts of fun and relaxation. On the other is the realization that, at any moment, you will need to begin formulating plans for next year's capital budget. And more and more these days, engineering is being asked to describe how each equipment purchase will fit into the station or facility's long-range goals.

This task is particularly difficult now that those who are running broadcast organizations—almost exclusively accounting and financial people—may not only lack knowledge of engineering needs but also may have little understanding of the broadcast environment. Every decision made by engineering is being scrutinized in light of its contributions to the bottom line.

A crystal ball would be nice—perhaps it can be

built into next year's purchase plans. Meanwhile, we offer the following thoughts on equipment trends with the aim of providing an insight on how *BME* views the marketplace.

1. CAMERAS AND RECORDERS

Most stations are not expanding or adding new production studio capability this year, nor is there currently a rush to acquire new studio cameras. This is balanced by an overall lack of development in studio camera systems from manufacturers.

Instead, everyone is concentrating on ENG and EFP, with many stations feeling the immediate need to replace field acquisition units.

In ENG/EFP cameras, the trend toward CCDs is increasingly apparent. The question is no longer whether to select a CCD camera, but which CCD camera to select. The introduction of

*Engineers responsible
for strategic
planning and budgeting
face some difficult
formulating decisions in
intermediate
and long-range goals.*

BY ROBERT RIVLIN

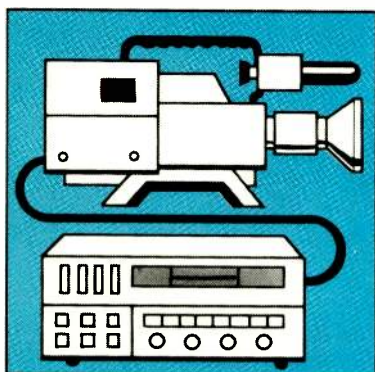


TOUGH TIMES, TOUGH CALLS

CCDs with horizontal resolution as high as 700 lines has prompted even holdouts such as Ikegami to offer broadcast-quality, CCD-based ENG/EFP cameras that few engineers will find fault with.

While Sony is trying valiantly to protect its market share in the 3/4-inch arena with the introduction of U-Matic SP, the format has had only limited success. Meanwhile, both MII and Betacam/Betacam SP (the former will slowly phase out in favor of the SP variety) continue to compete for the half-inch market. MII is still having its share of marketing problems, but the Panasonic and JVC organizations are remaining steadfast in their commitment to promoting it as "the shoe that fits all feet"—meaning that it can be used for not only field acquisition but also post-production as well. On the other hand, Sony and Ampex insist that a variety of formats need to be adopted.

Suffice it to say that this summer's Olympics will have served to convince many of the viability of the MII format, as demonstrated by NBC.



The choice of ENG format is, of course, far more complicated than selecting field recorders and cameras. It involves the entire post-production process, intraplant signal distribution, and even satellite operations. It does appear, however, that the component analog video (CAV) formats have become well enough established that there should be no fear of converting to Betacam or MII and finding them replaced within a year or two. Except for "digital MII"—the new system coming from Matsushita that promises to record PCM digital video using an MII-like recorder or camcorder—the ENG market appears relatively stable. Even with D-2 about to make a huge impact on station operations, Ampex says that it recommends acquiring footage using the Betacam, then post-producing on D-2.

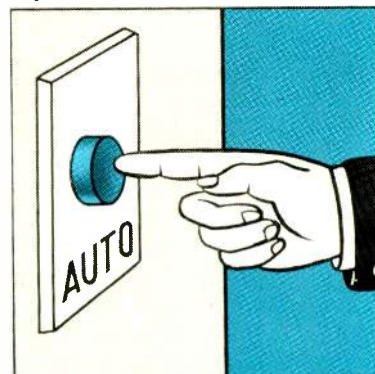
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2. STATION AUTOMATION

Because of the potential it offers for lower operating costs (a reduced labor requirement) and improved operating efficiency (fewer missed spots),

on-air playback automation combined with automated MC switching is coming under increased station engineering scrutiny.

The robotics systems that roll prerecorded tapes to air or can be programmed to record incoming signals have now evolved to the point of being relatively stable technologies. The systems differ primarily in the types of tape transport used (some can take multiple formats) and the design of the robotics system that transports tapes from the storage bins to the playback decks.



Where the technology is evolving, however, is toward large-scale station automation systems that also encompass production automation (robotic cameras) and newsroom automation as well. The dream of the not-too-distant future is of a completely automated newscast in which the producer not only writes up the copy on-line, but preprograms camera angles, tape shuttling, teleprompter cues, and about every other necessity on the same system.


How soon that dream will become reality is still a topic for much discussion. The half-million-dollar-and-up pricetags on the largest library management systems make them a capital expenditure few stations will be able to budget in the next year or two. Robotic camera control systems, while promising on many levels, still have to prove themselves in rigorous service (and, in some areas, overcome union opposition) before they gain widespread acceptance.

Although financial constraints continue to define the radio industry, whole-station automation is also a goal for large market and/or format operations. Many stations are also examining digital mass storage technologies for production, archiving and use in on-air broadcast. Touchscreen control is also available for radio use, where it is being considered favorably for on-air and newsroom LAN interface.

3. FIBER OPTICS

When contemplating expansion or new plant construction, one of the major questions faced by station planners is whether to use conventional wir-

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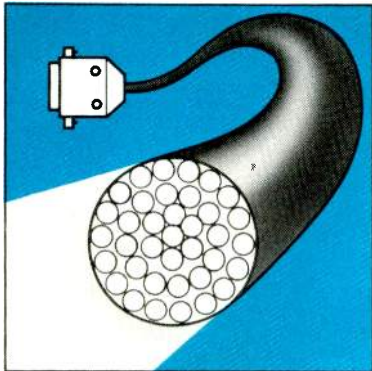
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Circle 113 on Reader Service Card Page 91

TOUGH TIMES, TOUGH CALLS

ing or fiber optics systems.

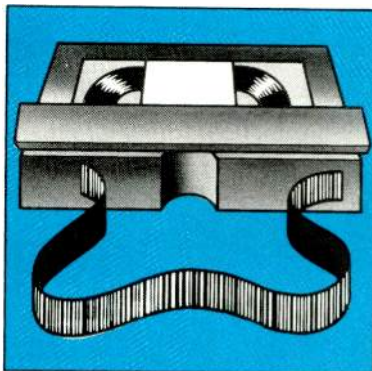
Until a year or two ago, the decision was purely one of economics, with fiber almost always losing out to copper. Escalating copper prices (due in part to the continuing strike at Arizona copper mines) and a decrease in the cost of fiber optic cable and assemblies are beginning to bring fiber optics into its own. And engineers



are using fiber cable today that can supply the bandwidth needed to meet increasing demands from digital video and audio, RGB component systems, multilevel distribution of components of the video signal such as keys and fills, and so forth.

Again, the technology that was "out somewhere in the future" until fairly recently has now matured, with multiple vendors ensuring that the station will get a fair price and reliable service on the system selected.

Fiber optics, being used extensively this summer for TV coverage of the Democratic and Republican conventions, is also being eyed by station engineering as a reliable replacement for existing microwave STLs. With frequencies jammed and subject to interference, the fiber optic link offers a relatively inexpensive alternative (considering that it is carrying a station's prime on-air signal).



4. DIGITAL RECORDING

Is it necessary for you to go digital in the near future, and if so in what format?

For broadcast stations, the answers are fairly simple. There will be occasional islands of digital recording

in the plant—perhaps a D-2 on-air playback system or a network delay operation. And, eventually, D-2 will replace the existing installed base of Type C machines. But unless small-format dig-

ital VCRs (such as the proposed Matsushita MII-based system) come into widespread use, the lack of a clear economic advantage to digital video recording will make its widespread acceptance in broadcast a very long-range possibility. (It should be remembered that it took over 10 years for Type C to be adopted by broadcasters, and that quad VTRs are still the mainstay of many station operations.)

On the other hand, the decisions faced by post-production facilities are a lot more difficult. In the first place, digital recording is almost a must for facilities doing work on program production or TV commercials. This as much a necessity of the type of work done by the facilities—involving a large amount of multilayering and compositing and multigeneration editing—as it is the result of competitive pressure to be the first in the neighborhood with digital (or at least not to be left behind).

But which format, D-1 or D-2? When D-2 was first announced by Ampex, it appears that the company had in mind only relatively isolated digital islands such as an on-air playback system. As time has gone on, however, and with Sony entering the D-2 arena, it now seems as though D-2 is being promoted as a total production and post-production system—a general replacement for the thousands of Type C machines in use at facilities.

D-1 will come to be used as a "specialty" format for high-resolution graphics and for applications where compositing a signal into NTSC would not be appropriate, such as when doing extensive multilayering. Otherwise, say proponents of D-2, there is no reason to go to the expense and bother of installing digital component VTRs—a process that involves extensive wiring changes, new routing, distribution and signal processing systems, a new production switcher and several other pieces of new equipment besides the VTR.

Major post-production facilities have already responded to this logic, placing orders for hundreds of D-2 machines at NAB. "When our work is highly complex, we'll use an Abekas component recorder," they point out. But for routine editing tasks, the D-2 recorders will prevail.

5. DIGITAL AUDIO WORKSTATIONS

Of all the technologies being developed for use by radio, none is more exciting than digital audio workstations. There is the promise that



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Any way you look at it, this was no easy assignment for National Video Center Recording Studios: two nights of Carly Simon in concert had to be edited down to a one-hour HBO special. The schedule was tight; there was no room for error. That's why EASTMAN EVT-2000 Broadcast Video Tape was chosen for this assignment by senior colorist Bill Willig and editor Chris Hengeveld.

Bill: "The hard part was matching colors. The concert was filmed at dusk, with big arc lights for keys. And we had lots of reds, the toughest color in video. But our Eastman tape held up fine. Actually, we went to four generations with this tape. Film transfer, editing, master, then dubbing. The quality was amazing. A technical person might see the generation differences. But you couldn't see it on the broadcast."

Chris: "Some tapes have tremendous dropouts. Especially saturated color. But when we use Eastman tape for a job, we never have those problems. Our clients love the color."

Bill: "We were really pushing to get it done. HBO was running promos, and actually had it in the program guide before it was shot. That kind of schedule called for Eastman tape reliability."

Chris: "We've been using it for two years for a lot of different jobs. It's one of the many tapes we use that's never let us down. We trust it."

Find out how EASTMAN EVT-2000 Broadcast Video Tape can star in your next production. For information call 1 800 44KODAK, Ext 814 (1 800 445-6325, Ext 814).



Senior colorist Bill Willig (left) and editor Chris Hengeveld.

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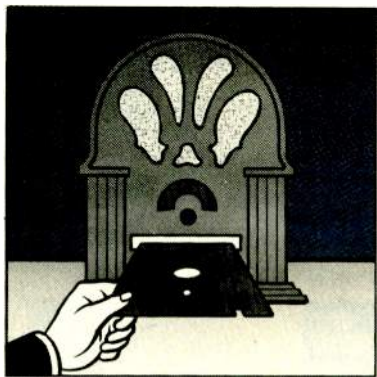
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workstations will not only take over the functions of console and mixer in productions, but that their reach can be expanded to include both on-air mixing and on-air playback of both spots and program material.

Radio, in general, tends to be quite conservative when it

comes to new technologies. And while New England Digital has brought the system price below \$100,000, it is unlikely that many stations will be able to buy into the new technology very quickly.

The first and most obvious place they will impact is in the area of cart playback. Using replacable media such as removable hard disks, or massive solid-state memories, they promise to both streamline the on-air playback operation as well as giving radio digital audio sound quality. Manufacturers of conventional cart systems are going to fight hard, claiming that no digital system has the reliability of the functionable, servicable NAB cart. But the digital systems are already proving themselves to be both reliable and cost-effective.

Currently digital compact disk players are serving as on-air playback devices or providing digital playback for transfer to cart or SFX or music beds in the production studio. New rotating head R-DAT digital audio tape recorders are receiving limited support as high-quality field acquisition units, downlinks for satellite music feeds and as a transport medium that maintains programming in the digital domain. Fragility, expense and the current lack of edit capability inhibits the acceptance of R-DAT in radio production or general field use, while lengthy cue time and the complexity of programmability make R-DAT difficult to use on-air in its current form.

Compact disk players can be sensitive to user mistreatment and are not praised for durability or reliability. Further, in their current nonrecordable form they do not allow for easy customization of material. Thus the industry is often forced to cart CD-sourced material, diluting many of the audio benefits of digital sound, and finds itself looking for a playback medium that combines "the sound and signal manipulation capabilities of digital with the convenience of cart."

Thus also the radio industry's interest in hybrid equipment such as Denon's CD Cart unit for on-air use and the digital audio workstation for whole-station applications.

6. HDTV

There is no doubt that some form of advanced television system is coming into the U.S. broadcast market, and probably within the next five years. But since no one is clear at this point about what form it will take—full-fledged 1125/60 HDTV, completely compatible NTSC transmitted within current 6 MHz allocations, NTSC-compatible with extra picture information carried in as-yet-unallocated land mobile or UHF spectrum, DBS service, or any of the more than one dozen proposed systems—planning now for the future is almost impossible.

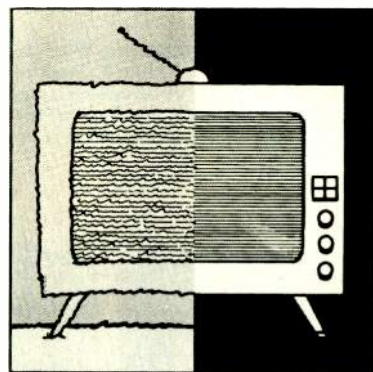
No matter what system is finally selected, it will almost certainly require extra bandwidth somewhere in the production and/or signal processing chain. It is therefore critical to examine the bandwidth of any large-scale signal routing, timing or distribution systems with an eye towards upward compatibility. The same care should go into the selection of an STL system.

Meanwhile, as the battles over proposed HDTV transmission and studio production standards rage, broadcasters are being offered the change to clean up the NTSC signal. Sophisticated encoders and decoders promise to eliminate the cross color and cross luminance artifacts that have plagued NTSC from its inception.

One thing that does seem clear is that American broadcasters are alarmed that they do not have a viable

standard for HDTV yet, and they are demanding that one be established, something considerably better than current NTSC. The efforts of improved and enhanced NTSC proponents notwithstanding, the industry seems ready to make a break into the type of service that will be immediately noticeable to the public. ■

Rivlin is BME's editor-in-chief.

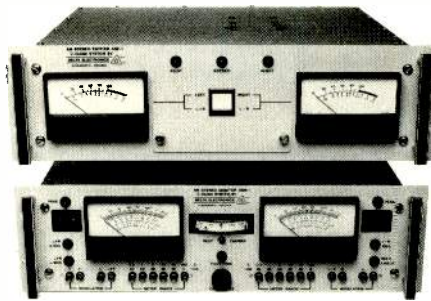


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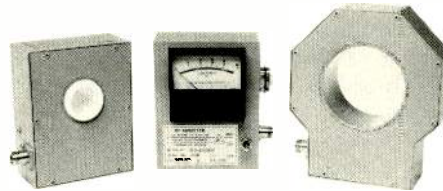
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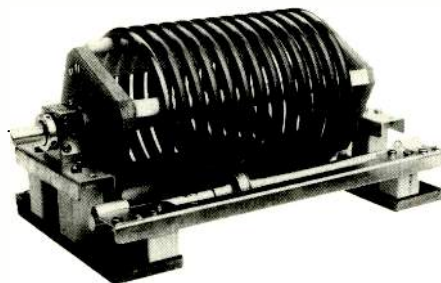
Coaxial Transfer Switches—These 1 1/8" and 3 1/8" motorized four port switches are designed to switch between antennas, transmitters, or dummy loads both quickly and efficiently. The switches can also be operated manually and are fully interlocked.



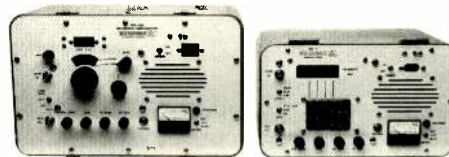
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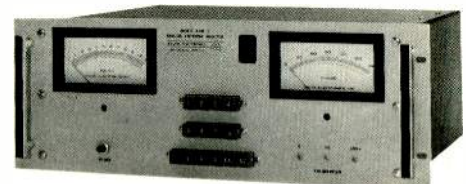
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PAYING FOR COMPLIANCE

Broadcast engineers can offset some costs of mandated change if they look to the IRS

By Mark E. Battersby

In addition to many state and local governments, Uncle Sam is making increasing demands on the broadcasting industry in the name of environmental protection and employee health, welfare and safety. But the lawmakers rarely provide the funds the broadcaster needs to comply with mandated changes, improvements or reporting requirements.

If the broadcaster knows where to look, however, the Federal income tax law can provide at least partial relief from the added financial burden. Plus, the same tax rules also provide tax deductions for expenses incurred

in fighting the new regulations, or toward the fines which often result if the new laws are ignored.

First, any broadcasting operation may face the need to make substantial expenditures relating to the health and safety of its employees. Although the expenditure may be required by law, it is not immediately tax deductible if it can be labeled a capital expenditure.

Whether a particular expenditure for health or safety is currently deductible depends on the nature of the expenditure. Engineering management should note that if an expenditure is a repair it is currently deduct-



ible. If, however, it is a capital expenditure, it must generally be recovered through depreciation.

The tax laws are extremely complex, so it is difficult to state a general principle by which current business expenses are distinguished from capital expenditures. But normally a capital expenditure is an outlay which results in:

The creation or acquisition of a new asset with a life of more than one year;

An increase in the value of an existing asset or a prolongation of its useful life; or

The fitting of an existing asset to a different use.

Obviously if engineering takes the second point above literally, for instance, it could be argued that the fitting of a safety device to a machine rarely increases its value or prolongs its useful life. Indeed, the result is all-too-often a loss of operating efficiency. However, in one case that involved safety devices on elevators, the U.S. Tax Court stated "(It) is not necessary that the monetary value be increased or that the life of the asset is prolonged...., a betterment of operating conditions, whether voluntary or involuntary, is a sufficient reason for capitalization."

In other words, the attitude of the courts appears to be this: The fact that the expenditure relates to another asset and doesn't increase its value or its life is irrelevant. The expenditure was made to protect workers, customers or the public from injury. It results in an asset—the safety device itself—with a useful life of more than one year, and it must therefore be treated as capital.

Note too that some incidental repairs which don't materially add to the value of station property or appreciably prolong its life may be tax deductible. Provided the cost of acquisition or production, or its basis or book value, is not increased as a result, repairs mandated by the government which keep stations in ordinarily efficient operating condition may qualify as tax deductions.

In one case, the repairs necessary to bring one broadcaster's station into compliance with a city building code were deemed capital expenditures even though the repairs did not actually prolong the life of the building.

The reason? The compliance increased the value of the property.

To sum up, the characterization of each expense as capital or current depends upon the circumstances surrounding its occurrence, regardless of whether an expenditure was made to comply with a governmental order. One rule of thumb is that an item with a useful life in excess of one year is a capital expenditure and not a repair expense.

Special assessments and levies are, however, treated differently for tax purposes. Assessments and levies which tend to increase the value of the property—that is, improvements such as paving, sewers, sidewalks and drainage—are generally not deductible. They are, however, capital expenditures which must be added to the cost of the land. They are not recoverable through depreciation and are not tax deductible, even though the value of the property was not, in fact, increased.

Other special assessments must also be treated with caution. For example, a special assessment levied against commercial properties in a central business district to provide parking facilities on the edges of the district cannot be deducted as a business expense even when an appreciable business benefit is expected. On the other hand, assessments levied by a city against business property owners for their share of the expense of converting a downtown city street into an enclosed pedestrian mall are capital expenditures subject to depreciation over the period in which the mall is expected to provide a business advantage. In addition, the portion of payments made to meet interest charges on city bonds issued to finance such a project is also deductible as taxes.

Compliance with government regulations can, of course, mean large expenditures of cash for capital improvements—broadcasters should know that a portion of such expense can be treated as a current deduction under two special provisions. These are "barrier removal for the handicapped" and "Code Section 179" expenses.

"Barrier removal" works like this: broadcasters can deduct the cost of removing certain existing architectural and transportation barriers to aid the handicapped or elderly. For instance, the cost of constructing a ramp for

Whether
a current or a
depreciable expense,
compliance is usually
tax deductible.

PAYING FOR COMPLIANCE

wheelchair users to remove the barrier posed by steps falls into this category. The deduction is taken in the year when the fees are paid or incurred rather than treating the costs as capital to be depreciated or recovered over the life of the asset. Note the maximum deduction allowed each year is \$35,000.

Second, Code Section 179 of the Internal Revenue Code (our basic tax law) accommodates more flexible treatment of some expenditures. This section permits up to \$10,000 of the cost of qualified property as an expense rather than a capital expenditure. The principal limitation reduces the \$10,000 annual deduction dollar-for-dollar as total equipment acquisitions exceed \$200,000 per year.

Also be aware that repairs and costs incurred in meeting increased reporting requirements for bodies ranging from OSHA (Occupational Health and Safety Administration) to the Internal Revenue Service are immediately deductible. But what about serious compliance?

If you need to engage an attorney—or any professional service—to explain, implement or fight any government mandate, the expense is usually tax deductible as long as it relates to your business. If the legal expense corresponds to an expenditure for acquiring or improving a capital asset, however, it too is treated as a capital expenditure.

In other words, compliance is usually tax deductible, either as a current or as a depreciable expense. But regardless of how tempting such a treatment might be, bribes, kickbacks and other illegal payments are never deductible. This also applies to any illegal payment to a public official or any government employee.

Other payments which cannot be deducted as business expenses include fines and penalties paid to the government for the violation of any law. Fines which are not by nature penalties are, on the other hand, usually tax deductible.

For example, the IRS and the courts have allowed tax deductions for National Labor Relations Board awards for liquidated damages under the Fair Labor Standards Act and penalties under the Federal Water Pollution Control Act for oil spills. Liquidated damages paid under the Walsh-Healey Act are deductible if made on

account of minimum wage and overtime violations, but not for child labor violations.

Probably the most important tax deduction of all is that for so-called “lobbying expenses”. The Federal tax law permits an income tax deduction for certain expenses related to appearances before and communications with a legislative body, a legislative committee or even an individual legislator.

In order to qualify as a tax deduction, the lobbying activity must be about a matter that is of direct interest to your broadcast operation. It's not enough that an existing or proposed law, rule or regulation will affect business in general. Meeting the direct interest test includes legislation or proposed legislation increasing or decreasing taxes applicable to the broadcasting business, increasing or decreasing operating costs or earnings of the trade or business and increasing or decreasing administrative burdens connected with the broadcasting operation.

Two limitations are imposed on lobbying activities. First, no tax deduction is allowed for any amount paid or incurred by participating or intervening in any political campaign. Second, no deduction is allowed for expenditures made to influence the general public with respect to any specific legislative proposal, election or referendum. Finally, neither direct or indirect contributions to political candidates or parties are tax deductible as business expenses.

In conclusion, the burdens placed on broadcasters in the name of the environment, employee health and safety and the general good all have tax consequences. By closely adhering to the rules from initiation through implementation and enforcement, the average broadcaster should find those mandated expenditures at least partially offset by income tax deductions. Legal, accounting and other professional fees incurred to understand and comply with regulations are all deductible—but left unaddressed is the larger issue that the bills for tax deductible, mandated health and safety equipment and related reporting need to be met by increased profits from the broadcast operation itself. ■

Battersby is a financial advisor and tax consultant

Regardless
of temptation,
bribes, kickbacks and
illegal payments are
never deductible.

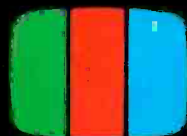
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All to keep our standing—as number one in the world of the pro.

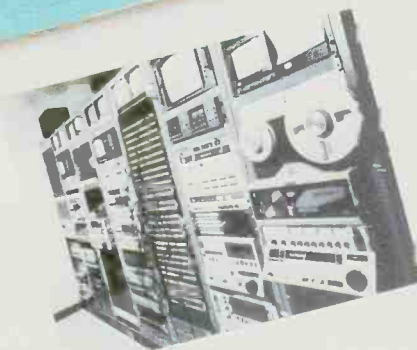
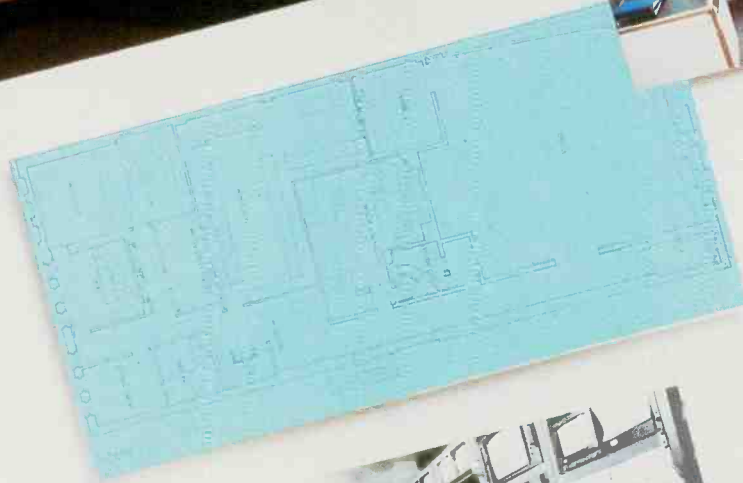
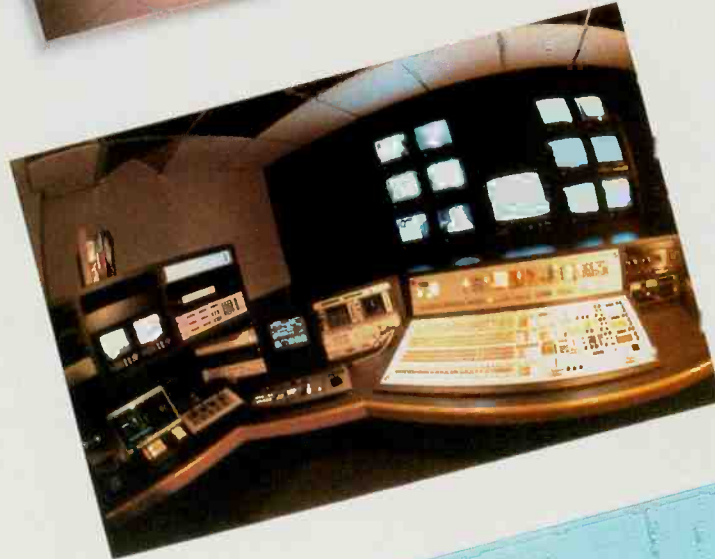
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STRATEGIC PLANNING
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BY MICHAEL A. RIVLIN

APPLYING THE ENGINEERING YARDSTICK



The prepurchase engineering evaluation is the moment of truth that can reveal engineering excellence or neglect.

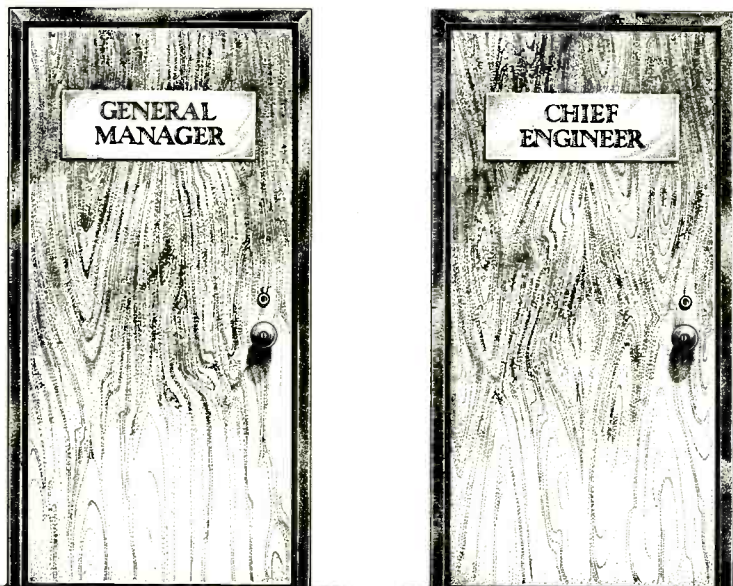
For many a proud broadcast engineer—especially one at a station owned by investors who know nothing about broadcasting and where engineering budgets have been slashed—the engineering evaluation of his property must be like having a social worker come into his home, take his children into another room and ask where they received all their bruises. Given an inadequate budget, a station will suffer under the stewardship of even the most intense engineering perfectionist if he's unable to pay anyone to mow the field where his tower sits, replace outworn equipment or purchase a new piece of test gear. How can he possibly justify purchase of a new waveform monitor to ownership that can't tell the difference?

Observes Jerry Plemmons, VP of engineering for Rhode Island's Outlet Communications, "If an investor goes home, turns on his TV, and there's a picture there he figures, 'That's close enough. Why spend any money on anything else?'"

Problems resulting from engineer-

ing neglect by management with short-term outlooks are perhaps most clearly revealed during the engineering evaluation of a broadcast property by a group's engineering director or consultant prior to acquisition. It is at this point that the mistake of running a property for short-term gains rather

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than long-term profitability is most clearly demonstrated. Such an engineering evaluation, more than anything else, is a report on how much it will cost to make a station competitive in the marketplace—and being competitive in the long run demands among other things, engineering excellence.



Outlet Communications' VP-engineering, Gerald T. Plemmons.

Jules Cohen, the well-known Washington-based engineering consultant whose firm provides station evaluations as part of its range of services, has frequently observed station management whose eye is strictly on the short-term. "There are too many fast-buck types who are interested only in getting the maximum amount of profit out," he comments, "and since they don't intend to hold onto the station indefinitely they do this by letting maintenance slide. So long as a station can stay on the air with a fairly good picture they won't spend a nickel on maintenance and they'll cut the engineering staff right back to the bone."

Engineering directors suffer from this neglect as much as their stations. George Parnicza, who recently conducted several evaluations in his role as corporate chief engineer for Act III Broadcasting, found engineers at these stations to be depressed. Their attitude, he said, was "this is all I have. I'm doing the best I can to make pictures, but I wish I could do better."

"They're depressed because they can't do what the rest of the stations do," Parnicza comments. "They read

Circle Number 117 on Reader Service Card Page 91

ENGINEERING YARDSTICK

all about what's out in the world and all the fine things people are doing and they see what they have. And since utilizing new equipment is one of the primary ways engineers learn, lacking it keeps them in the Dark Ages."

Engineering neglect is especially common at UHF stations, many of which have been rushed into existence by investment groups who fancied they'd make a killing in broadcasting. The problem was intensified when the FCC dropped the three-year holding rule, further encouraging leveraged buyouts by investment groups with perhaps no more knowledge of broadcasting than the adage, "Owning a station is a license for printing money."

Plemmons has traveled around the country for Outlet to evaluate some of the stations that resulted. After a company incurs the high debt of a leveraged buyout, he observes, "the first thing to go is the capital budget." Plemmons visited one such UHF station in Durham, NC, on the market for \$14 million, where he estimated that Outlet would have to spend another \$10 million over the next 10 years to get it competitive and keep it competitive. It was one acquisition his group never pursued further.

But that's the exception. As a rule, engineering evaluations rarely influence the decision of whether or not to proceed with the acquisition (especially in the case of a TV station), though they do play a small role in negotiating the price. "What you really pay for is a license and network affiliation," points out Frank Hardman, VP of engineering for American Family Corporation's Broadcast Division.

Instead, what a visiting engineer is appraising as he walks through master control and out to the transmitter and tower isn't so much the value of the engineering the station currently owns (which in the case of a VHF station fetching a price of \$60 million or more may represent only a small fraction of the asking price), but a financial projection of what it will take to make and keep that station as competitive as it can be.

"My job isn't so much evaluating what's good but looking with an eye

towards what needs to be done to make it better," explains Hardman. "My boss wants to know, 'What's it going to take to fix the station up to be competitive in the market?'"

The engineering evaluation can take place at any point between initial handshake and final consummation of the deal, but if employees of

the station are being kept in the dark about the impending sale in order to keep morale high, the visiting engineer may visit anonymously or in disguise. "As soon as someone goes in with a checklist and taking pictures, the staff immediately knows the station is for sale and morale goes in the tank," observes Plemmons, who's

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ENGINEERING YARDSTICK

been known to do a walk through disguised as a sales rep for Katz.

"Someone like the general sales manager will take me through talking sales figures," he reveals. "Mean-

while, I'm marking down all the equipment in the place in my mind."

In those situations, he explains, he has to ask his questions as subtly as possible, admittedly difficult when

you're inquiring about antenna modulation. "Sometimes I'll ask questions about a modulating system, and the transmitter guys immediately know I'm more than a salesman, that I know something about engineering. They can smell a rat very quickly." After he's through, says Plemmons, "I jump in a car, drive two blocks down the street into a supermarket parking lot, and before I forget everything write it all down."

An engineer who flies in to a city to do an evaluation will typically spend no more than a day doing his on-site evaluation, devoting half his time to the facility and half to the transmitter, tower and antenna. With these limitations on his time, he can't possibly examine every corner of the building or piece of equipment in detail. He relies instead on some broad indicators of engineering standards.

The first is simply outward appearance—demonstration that there's an order and intelligence at work. "If that place was clean and had good insides, if it was kept up," reveals Dick Anderson, who retired in June as Fox Television Stations' Director of Engineering, "that told me the people had an interest and respect for that facility, and it also told me that they had respect for what they were doing."

Fred Steurer, vice president of engineering for Pulitzer Broadcasting, subscribes to the same theory. "I have a rule of thumb," he says. "If it looks good on the outside it's probably pretty good on the inside. If the equipment is just wired in haphazardly, the same thought processes might lead them to think, 'This particular thing isn't working today, but we can get around it.' And when tomorrow comes, 'Well, we've been getting around it, we can get around it another day or two.' If things are neat and the wires are straight and labeled, folks care."

So as he walks through master control, the engineer must notice not just the age and condition of equipment, but whether it is configured in a productive fashion, with wires neatly bundled and labeled and the floors swept. Engineers who routinely perform these evaluations say that a haphazard environment is one of the surer signs that engineering quality is

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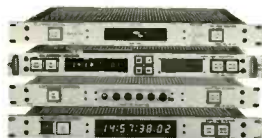
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low.

For example, while tape format has become of increasing importance, a station using the newest format doesn't necessarily impress a visiting



If employees are being kept in the dark about the impending sale in order to keep morale high, the engineer may visit anonymously.

engineer. Of more concern is whether it's been integrated into a total system.

"They'll replace two-inch with one-inch or half-inch," notes Hardman, "but all they do is slide the two-inch out and roll the new format in. It becomes just another format, without any thought to reorganization of the floor."

As an indication of engineering's role in purchasing decisions in a TV station, some engineers pay special attention to the ratio of "glamorous" production equipment such as effects generators to the unglamorous guts of master control.

"If they have a go-o-o-d routing switcher and terminal equipment, you know the engineers have had a lot of input," confirms Hardman. "If it's mostly glitz, like a lot of graphics equipment, then you know the production people have been the big guys. An ADO or big switcher is the type of thing a production guy will look for. An engineer will look for a good distribution system. In a well-run station, if he looks after that someone else will look after the other."

According to Pulitzer Broadcasting's Steurer, "when the black boxes and the racks are age-old and there's a brand-new switcher and graphics, you know that the news department is buying and engineering isn't real strong." It's a problem he doesn't find at stations where engineering has more power. "A good en-

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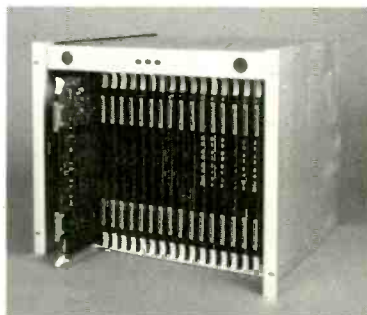
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Circle Number 122 on Reader Service Card Page 91

BME August 1988 47

ENGINEERING YARDSTICK

gineer will be watchful for all the times, not just some of them," notes Steurer.

The typical examination also includes a cursory look at the structural integrity of the building itself, including the condition of the roof and of the heating and cooling systems. And ever since it was identified as an environmental hazard, engineers have been looking for signs of asbestos in buildings constructed before 1975; its presence makes remodeling difficult and expensive. Some have been known to gouge out small pieces of wall to bring back for examination. Because of the extremely carcinogenic properties of asbestos, such examinations should be approached with caution.

In a process designed to map a station's potential competitive strength in the market and project capital needs for at least the next 12 to 18 months, it is understandable that a



Frank Hardman, director of engineering for American Family Broadcast Group (right), with Bill Comeaux, CE for member station WAFB.

station's transmitter should occupy a disproportionate amount of attention in the evaluation. Each of the two to three power tubes in a transmitter costs approximately \$45,000 and has a lifespan of just two to three years. Should a TV station need a com-

pletely new transmitter, it will set the new owner back one to three million dollars—clearly a capital item ownership needs to plan ahead for.

Just as the state of a routing switcher quickly signals the engineering status of a TV station, obvious clues like rusty guywires and unmowed fields are good indicators of neglected radio stations. "It's surprising how you can go out to some AM antenna sites and find them completely overgrown with trees which obviously have been growing for 15 years," comments Cohen. "It's one of several indicators that management has not been paying much attention to keeping the station in tip-top condition."

Evaluation at the transmitter site may include measurements to determine transmitter efficiency, especially with the new generation of tubes. Parnicza, whose duties also include engineering WVAH-TV, Charleston, is paying more attention to efficiency ever since his station switched from UHF to VHF and saw its electricity bill jump from \$2,000 to \$11,000.

Evaluating AM station directional antennas is a special concern. "Even some of the better technicians who are fine as far as the studio is concerned don't feel comfortable checking out directional antennas," confirms Cohen, who says it is in the maintenance of AM directional antennas that he most frequently encounters sloppy engineering, including run-down equipment and license violations. In an evaluation, an engineer will read an-

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tenna monitors and check base currents, as well as measuring monitor points in the field to determine whether the field strengths are within the limits set by the license.

Above all, whether for radio or television, the engineering survey is performed with an eye to the station's competitors. For example, the evaluation of transmitter and tower is as much a determination of current conditions as it is a predictor of how signal strength might be improved. Therefore, in addition to a description of the antenna's and processor's age and condition, a report from engineers like Al Warmus, president of Carl E. Smith, Consulting Engineers, (an engineering survey firm specializing in radio properties) also includes any recommendations for a new antenna, processor or tower location which would make the station more competitive.

"If you're looking at the number two or number three station, you look at what the number one station is doing," notes Steurer.

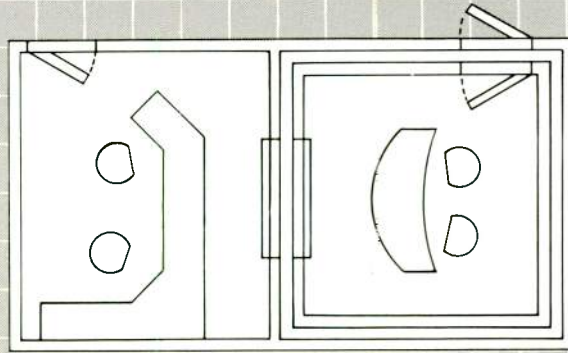
The engineering evaluation may start before the engineer arrives at the station with an examination of public FCC files, frequently by consultants like Cohen or Warmus, alerting the prospective buyer to a history of license violations and equipment problems. Included in the files may be requests for temporary authority to operate outside license parameters, indicating that some equipment may have been malfunctioning; and notices sent by the station to the FCC that equipment had gone back to the



Fred Steurer, VP engineering, Pulitzer Broadcasting Co.

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ENGINEERING YARDSTICK

manufacturer for repair.

According to Warmus, missing files may also point to problems. "We'll ask about this file and that file. They'll say, 'The director of engineering didn't think we had to do it.'"

Because it tends to be a scrappier business, and because the cost of engineering represents a far greater per-

centage of the station cost in radio than it does in television, the engineering evaluation of a radio station seems at times to be a more hostile piece of detective work. Did the station misrepresent itself? Is its signal in compliance with its FCC charter?

"We always find deficiencies with every station, there's always a way to

get the bill down," boasts Warmus. Despite the secrecy and unhappiness that surrounds the sale of many broadcast properties, visiting engineers report they receive a warm welcome—especially at stations where engineering has been neglected—since it gives the engineering director a chance to talk to a sympathetic ear. For these station engineers, news of a potential sale can promise a larger budget and a chance to raise the station's engineering standards. Rather than make excuses, TV station engineers are for the most part quick to acknowledge their stations' deficiencies.

"We find that, in general, the engineers and operators of stations are quite open and unlikely to hide anything," confirms Cohen. "They realize that certain technical practices are inappropriate, and they complain, 'I haven't been able to get the money to hire somebody to go out and cut down the grass in the field. I haven't been able to get the money for test equipment. I haven't been able to get the money for new cart machines.'"

Anderson, who served as director of engineering at Metromedia for 16 years before joining Fox, recalls the reaction he received from engineering directors as generally very good. Metromedia's strategy was to seek out under-achieving stations in a market with an eye to improving them, and as a result the engineer visited a large number of poorly maintained facilities. "They were hopeful that the sale would be consummated because Metromedia was a very well-respected operation in the industry," Anderson recalls.

Parnicza, who's been looking over similarly "disadvantaged" stations, finds a comparable response. "They were looking to us to come in, upgrade their station and give them the equipment they need to do a good job. And basically that's what we end up doing: making them something they can be proud of. In the end, some of them welcome the change. They know what's missing and they're looking to us to bring them up to speed." ■

Michael A. Rivlin is a New York City-based freelance writer who specializes in the communications field.

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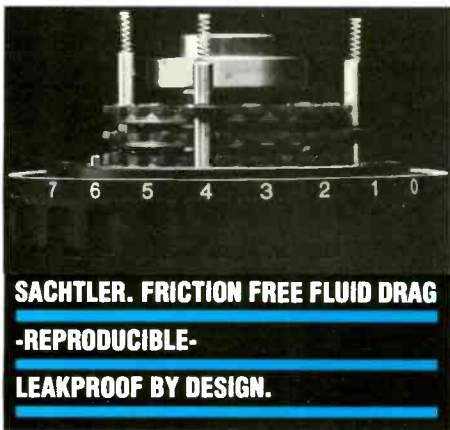
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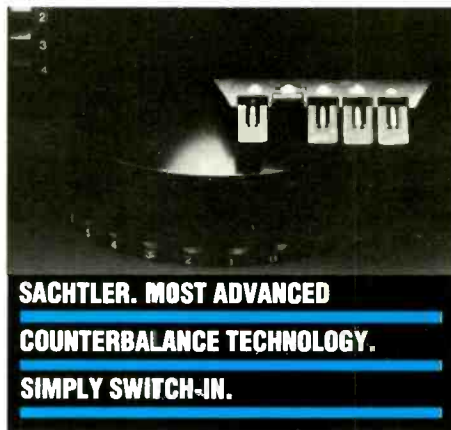
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1988 Capital Expenses Request

Department	Project	Station W111	Description of Required Materials/Equipment	Vendor	Price
TECHNICAL	SATELLITE DEMODULATOR/DOWNCONVERTER/LNA		NEW FENCE AROUND TOWER 20 FEET DISTANCE ON ALL SIDES FOR SKW. NEW STAIRS FOR ACCESS INTO DOGHOUSE WILL ALLOW RECEPTION OF WESTAR 4 TRANSPONDER AFTER PRESENT EQUIP GOES BACK TO MULTICOMM		
TECHNICAL	DELAY SYSTEM		EVENTIDE DIGITAL DELAY UNIT TO REPLACE OLD EVENTIDE UNIT NO LONGER SUPPORTED		
TECHNICAL	AIR CONDITIONING-STUDIO		TO REPLACE 10-YEAR-OLD AIR CONDITIONER COMPRESSOR AND ALTER AIR HANDLING SYSTEM THAT CONDITIONS AIR IN NEWSROOM, AM CONTROL, GRNS CONTROL, AND PROD. STUDIO		

PROGRAM	MUTUAL SATELLITE SYSTEM		SCIENTIFIC-ATLANTA DIGITAL ELECTRONICS FOR MUTUAL RECEPTION ON SATCOM 1R-T3 THEY WILL MOVE THERE MARCH 1988 CURRENT SYSTEM WILL BE GONE		
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PROGRAM	DIGITAL TELEPHONE BRIDGE		GENTNER TELEMIX 10 CONSISTING OF CONTROL UNIT/2 DIGITAL HYBRIDS/2 CALL DIRECTORS/WILL HANDLE 18 INCOMING LINES SIMILAR TO PRESENT ANALOG SYSTEM. TO REPLACE TELEMIX 9 USE #9 AS A BACKUP		
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PROGRAM	PRODUCTION STUDIO REBUILD CONSOLE: TOTAL 3 SECTIONS		TO REBUILD 10-YEAR-OLD PRODUCTION STUDIO CONTAINING: CONSOLE MAINFRAME MONO INPUT MODULES (20) STEREO INPUT MODULES (4) BLANK PANELS (2) MONO EQ (3) STEREO EQ (1) TEST OSC MODULE (1) TELEPHONE INTERFACE (1) TELEPHONE LINE SELECTOR (4) DIGITAL TIMER KIT (1)		
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PROGRAM	PRODUCTION ROOM REBUILD OTHER		CONTROL RM MONITOR MOD. POWER SUPPLY (1)		
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PROGRAM	PRODUCTION ROOM REBUILD OTHER		OTARI MTR-12-I 4 TRACK REEL-TO-REEL BROADCAST ELECTRONICS CART PB 3100 (2) FIDELIPAC DYNAMAX CART YAMAHA SPX-90 HARMONIZER YAMAHA REV-5 REVERB THOMPSON VOCAL ELIMINATOR AUDIOMETRICS TMA 3 MIKE STAND STANTON 310B PREAMP SYNTERTEX 220 TONEARM STANTON 681-A CARTRIDGE JBL 4410 SPEAKERS (2) SONEX 356 4X4 BLUE (2) REPLACEMENT OF WORN OUT CARPET STUDIO FURNITURE MISC. (WIRE, CONNECTORS, ETC)		
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TOTAL MATERIALS
Installation
Sales Tax
Shipping
Other
TOTAL

CAPITAL EXPENSES REQUEST:
Stations request and propose specific capital expenditures/projects. Timing: Late Fall of preceding year.

NOTE: Individual expenditures exceeding \$1,000 require two bids.



ENGINEERING BUDGETS

Sample Forms

Good documentation can expedite capital planning and implementation. Here's a template of forms that work.

If your station goes through a comprehensive strategic planning process—and, especially if it doesn't—you may find the following samples of budgeting paperwork useful. The forms below were developed by Jacor Communications Inc. (five AM, seven FM), Cincinnati, OH. They cover each step in the planning process, and their implementation can aid station management in short-term and long-range organization, direction and control. This paperwork was originally prepared for radio stations, but the matrix is equally applicable to television. ■

Date: March, 1988
Subject: Regular 1988 Capital Budget

To: General Manager/K111
From: Director of Group Engineering

After considerable deliberation, tentative approval has been given to the 1988 capital expenditures budget.

Attached you will find a list of projects that have been approved for your location during 1988. Included is also the maximum amount allowed for each individual project. Please review this list and verify that it still addresses your needs.

1988 REGULAR STATION CAPITAL EXPENDITURES: STATION: K111
PROPOSED FOR STATION REVIEW
DATE: February, 1988 PAGE: 1 of 1

PROJECT DESCRIPTION:	AMOUNT:
1 Weather Printer/processor	
2 800 MHz Police Monitors	
3 Five-channel console	
4 Studio A/C improvements	
5 Electronics to receive Westar 4 (utility)	
6 Traffic Computer System AM News Service	
7 Printer for above	

TOTAL THIS PAGE:

REGULAR CAPITAL BUDGET: Requests are reviewed, reconstructed, and repropoed to stations for comment and suggestions. Timing: Early Spring of current year.

ENGINEERING BUDGETS

Date: March, 1988
Subject: Regular 1988
Capital Budget

To: General Manager/W111
From: Director of Group Engineering

Attached is the final copy of the 1988 capital expenditures authorized for your location. These are divided by station or office.

You will note that the expenditures are enumerated by "project" description as condensed from your original request. Each item has a ceiling amount that cannot be exceeded. All of these expenditures, other than those that are marked with double asterisk, should be accomplished locally under your direction. Two quotations should be obtained for most expenditures over \$1000. After each expenditure is completed, approve the invoice and forward it to this office for processing.

* * * * *

1988 REGULAR STATION CAPITAL EXPENDITURES: STATION: W111

PROPOSED FOR STATION REVIEW

DATE: 2/25/88 PAGE: 1 of 1

PROJECT DESCRIPTION: News Service AMOUNT:

- 1 Rebuild uplink TWT
- 2 Buyout of downlink sites**
- 3 Spare downconverters/demodulators

TOTAL THIS PAGE:

**to be acquired through the corp. office

CAPITAL PURCHASES BUDGET: Final budget. Contains instructions as to what purchases stations will make locally and what corporate will obtain to utilize economies of scale. Two quotes are required for local purchases. Corporate purchases are bid out. Timing: Late Spring of current year.

MASTER BUDGET FORM
 1988 Regular Capital Expenditures Budget
 Summary Page: As of 21 Jun '88

	CITY A W111/NEWS SERVICE	CITY B W222	CITY C K111	ALL STATIONS
Total Budgeted				
Total Invoiced (Budgeted)				
Total Invoiced (Unbudgeted)				
Total Expenditure Total Invoiced (Budgeted) plus the Total Invoiced (Unbudgeted)				
Total Variance (Total Budgeted minus the Total Expenditure)				
Projected expenditures (Total budgeted plus total Invoiced (unbudgeted))				

BUDGET FORM/ BREAKOUT BY STATION
 1988 Regular Capital Expenditures Budget
 7/21/88

STATION: New Service/W111

Total Budgeted
 Total Invoiced
 (Budgeted)
 Total Invoiced
 (Unbudgeted)

Total Variance

Project Description: Corp or local
 expenditures 1

Total Expenditures

Invoiced Amt.
 Budgeted Amt.
 Date: Budgeted/
 Unbudgeted Variance 3

News Service:

Rebuild Uplink TWT TBD
 Buyout Downlinks local
 Spare downconverters local

Apr-88 2

special carveout
 special carveout

STATION: W222

Prod. Rm Upgrade corp
 Studio ATR corp
 Extender corp
 CD player

STATION: K111

Weather prntr/procser local
 800 MHz police monitors local
 Five channel console corp
 Studio A/C improvements local
 Westar & Electronics local
 Traffic computer system local
 Printer for above local

Apr-88

1. Who is responsible for expenditure charges to vendor name after invoice is received and processed.
 2. Date indicates "Invoiced and Completed"
 3. Variance is "Budgeted" amount less "Invoiced" amount can be positive or negative. Unbudgeted expenditures will have a totally negative variance.

REGULAR CAPITAL EXPENDITURES BUDGET: Expenditures are tracked and entered in-voice by invoice. Forms include individual station tracking and summary sheet above. Timing: Weekly/current year.

BREAKOUT BY STATION: Used to make up the summary sheet. Shows the approved expenditures of each station/project with tracking information.

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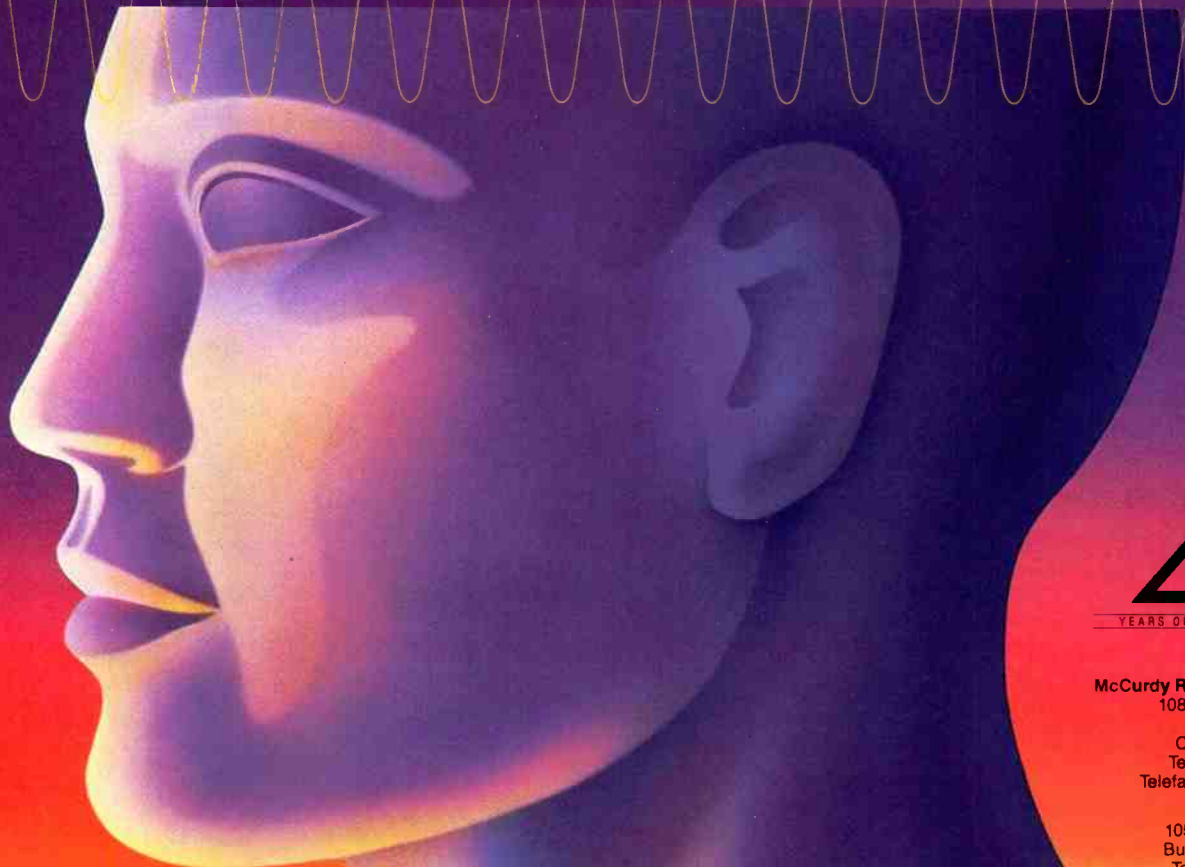
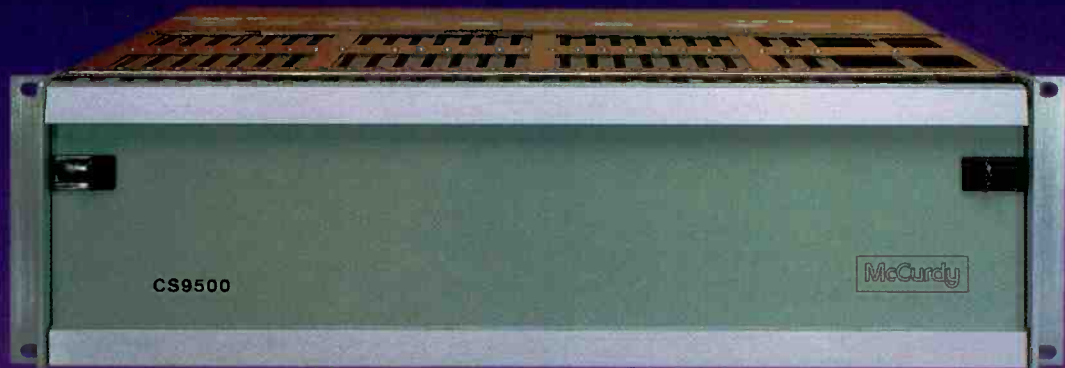
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- 2-way radio interface • Telephone interface

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YEARS OF EXCELLENCE

McCurdy Radio Industries
108 Carnforth Road
Toronto, Ontario
Canada M4A 2L4
Tel. (416) 751-6262
Telefax (416) 751-6455
Telex 06-963533

1051 Clinton Street
Buffalo, N.Y. 14026
Tel. (212) 772-0719

THE SOURCE

Welcome to the 1988 edition of The Source, BME's annual directory of the companies that supply and service the broadcasting industry. This year's streamlined directory is designed to give you, the engineer, quick and accurate access to the information you need to put your engineering plans into practice. The 1988 Source consists of two sections, a category-by-category equipment guide broken into video, audio, and RF/general sections and an alphabetical listing of manufacturers. To find out who manufactures a particular piece of equipment, turn first to the broad category and then scan down the alphabetical list of product types until you find what you're looking for. ■

PRODUCT GUIDE 59

VIDEO 59

CAMCORDERS
CAMERAS: ENG/EFP
CAMERAS: STUDIO
CAMERA SUPPORT
EQUIPMENT
CHARACTER
GENERATORS
DIGITAL DISK
RECORDERS
DIGITAL EFFECTS
DEVICES
ELECTRONIC STILL
STORES
FRAME SYNCHRONIZERS
GRAPHICS SYSTEMS: 2D
LENSES

LIGHTING EQUIPMENT
MASTER CONTROL
SWITCHERS
MERPS DECKS
MULTISOURCE VIDEO
EDITORS
PRODUCTION
SWITCHERS
REMOTE MOTION
CONTROL SYSTEMS
SWITCHING
AUTOMATION
SYNC AND PULSE
GENERATORS/PROCESSORS
TAPE SYNCHRONIZERS
TELECINES
3D MODELING AND

ANIMATION SYSTEMS
TIME BASE CORRECTORS
TIME CODE EQUIPMENT
VIDEO PROCESSORS
VIDEO ROUTING
SWITCHERS, DAs
VIDEOTAPE
VIDEO TEST EQUIPMENT
VTR
EDITOR/CONTROLLERS
VTRs: ONE-INCH
VTRs: 3/4- AND 1/2-INCH
WEATHER
RADAR/GRAPHICS
OTHER VIDEO
EQUIPMENT

AUDIO 64

ATR SYNCHRONIZERS
ATRs: FIELD
ATRs: STUDIO
AUDIO MONITORING
EQUIPMENT
AUDIO PROCESSORS
AUDIO ROUTING
SWITCHERS, DAs
AUDIO TAPE, CARTS
AUDIO TEST EQUIPMENT
CART DECKS
COMPACT DISK
EQUIPMENT

DIGITAL ATRs
DIGITAL PRODUCTION
SYSTEMS
INTERCOMS
MICROPHONES,
ACCESSORIES
NOISE REDUCTION
EQUIPMENT
ON-AIR CONSOLES,
MIXERS
POST-PRODUCTION
CONSOLES
REMOTE PICKUP, RENG

SYSTEMS
REVERB. SPECIAL EFX
STUDIO AUTOMATION
EQUIPMENT
TELCO INTERFACE
EQUIPMENT
TIME COMPRESSION
SYSTEMS
TURNTABLES
OTHER AUDIO
EQUIPMENT

RF, GENERAL 66

AM STEREO EQUIPMENT
ANTENNAS, TOWERS
BUSINESS AUTOMATION
SYSTEMS
ENG/EFP VEHICLES
FIBEROPTIC SYSTEMS
MDS, SMATV SYSTEMS
MICROWAVE FOR ENG
MOBILE PRODUCTION
UNITS
MTS EQUIPMENT

NEWSROOM COMPUTERS
POWER SUPPLIES,
BATTERIES
REMOTE CONTROL
SYSTEMS
REMOTE MONITORING
SYSTEMS
SATELLITE EARTH
STATIONS
SCA EQUIPMENT
SNG SYSTEMS

STLs, TSLs
TAPE STORAGE SYSTEMS
TELETEXT EQUIPMENT
TRANSMITTERS, POWER
TUBES
TRANSMITTERS: RADIO
TRANSMITTERS: TV
WIRE, CABLE
OTHER RF, GENERAL
EQUIPMENT

ALPHABETICAL LISTING OF MANUFACTURERS 72



In the E-Series E is for Excellence.



Audio professionals everywhere are turning to the Fostex E-Series recorders for their production and post-production needs. So much so, you hear the results of their work nearly every day — in movie soundtracks, commercial and cable television shows, industrial and educational films and videos and, of course, hit records.

The E-Series features gapless "punching" so there's no blank space after the punch-out point. Only recorders which are much more expensive offer this sophisticated function. But since you can't run a fully automated system without it, Fostex includes gapless punch-in/out as standard equipment on the E-Series.

Also standard is a synchronizer port which will interface with all SMPTE time code based systems. When used with the Fostex synchronizer, Model 4030, you can then use our software program to perform sophisticated audio assembly editing.

Models E-8 and E-16 are multitrack recorders with built-in noise reduction.

Models E-2 and E-22 (not shown) are 2-track master recorders with a third, center channel for SMPTE time code control. This is a standard feature, not an option. You will have complete compatibility with existing 2-track tapes, plus the ability to run computer derived edit decision lists and full automation.

Servo control of the reels in the edit mode will help you pinpoint cues and spot erase. When the pitch control is engaged, the exact percentage of speed deviation is displayed so that when you need to re-set the controls, you can do so precisely, and the real-time counter features search-to-zero even from the negative domain.

The E-2 uses 1/4" tape at 7-1/2 & 15 ips (15 & 30 ips speeds are optional); the E-22 uses 1/2" tape at 15 & 30 ips.

When an E-Series recorder is used with Fostex Model 4050 — autolocator and SMPTE to MIDI controller — you have programmable punch-in/out, 100-point autolocate capability, 10 programmable edits, a SMPTE time code generator / reader (all four formats), plus the ability to locate to the bar and beat.

So if you're looking for a professional recording instrument, there's a Fostex E-Series recorder that can help you with two important "E" words: Efficiency and Effectiveness. The E-Series can also help you achieve the most important "E" word of all: Excellence.

Fostex®

15431 Blackburn Ave., Norwalk, CA 90650
(213) 921-1112

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PRODUCT GUIDE

VIDEO

CAMCORDERS

AMPEX
BTS/BROADCAST TELEVISION SYSTEMS
IKEGAMI ELECTRONICS
MARTI ELECTRONICS
NEC AMERICA, BROADCAST EQUIPMENT DIV.
PANASONIC BROADCAST CO.
SHARP ELECTRONICS CORP., BROADCAST GROUP
SONY BROADCAST PRODUCTS DIV.
SONY COMMUNICATIONS PRODUCTS
SONY PRO VIDEO DIV.

CAMERAS: ENG/FP

AMPEX
BTS/BROADCAST TELEVISION SYSTEMS
CAMERA MART
CENTRO
HITACHI DENSHI AMERICA
IKEGAMI ELECTRONICS
JVC CO. OF AMERICA, PROFESSIONAL VIDEO COMM. DIV.
NEC AMERICA, BROADCAST EQUIPMENT DIV.
PANASONIC BROADCAST CO.
RCA NEW PRODUCTS & CCTV DIV., TUBE OPERATIONS
SHARP ELECTRONICS CORP., BROADCAST GROUP
SONY BROADCAST PRODUCTS DIV.
SONY COMMUNICATIONS PRODUCTS
SONY PRO VIDEO DIV.
THOMSON VIDEO EQUIPMENT
TOSHIBA AMERICA

CAMERAS: STUDIO

BTS/BROADCAST TELEVISION SYSTEMS
CENTRO
COMPREHENSIVE VIDEO SUPPLY
HITACHI DENSHI AMERICA
IKEGAMI ELECTRONICS
JVC CO. OF AMERICA, PROFESSIONAL VIDEO COMM. DIV.
MATCO
PANASONIC BROADCAST CO.
SHARP ELECTRONICS CORP., BROADCAST GROUP
SONY BROADCAST PRODUCTS DIV.
SONY COMMUNICATIONS PRODUCTS
TOSHIBA AMERICA

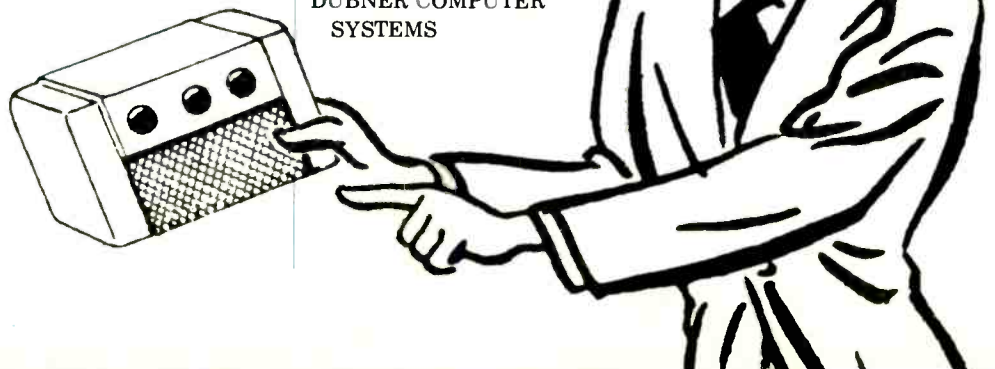
CAMERA SUPPORT EQUIPMENT

ARBEN DESIGN
ARRIFLEX CORP.
BENCHER
BOGEN PHOTO CORP.
BUSH & MILLIMAKI
CAM-LOK
CANARE CABLE
CANON USA
CINEMA PRODUCTS CORP.
COMPREHENSIVE VIDEO SUPPLY
COOL-LUX LIGHTING IND.
ELICON
ALAN GORDON
ENTERPRISES
KARL HEITZ, INC.

ITE/INNOVATIVE TELEVISION EQUIPMENT
JENSEN TOOLS
KANGAROO VIDEO PRODUCTS
LEE LIGHTING AMERICA
LTM CORP. OF AMERICA
MATTHEWS STUDIO EQUIPMENT
MILLER FLUID HEADS
MILLER PROFESSIONAL EQUIPMENT
NALPACK VIDEO
O'CONNOR ENGINEERING LABS
PHOTOGRAPHIC EQUIPMENT SERVICES
QUICK-SET
REDLAKE CORP.
SACHTLER CORP. OF AMERICA
TSM/TOTAL SPECTRUM MANUFACTURING
TYLER CAMERA SYSTEMS
ULTIMATE SUPPORT SYSTEMS
VIDEO SERVICES UNLIMITED
VINTEN EQUIPMENT
WHEELIT

CHARACTER GENERATORS

ABEKAS VIDEO SYSTEMS
ASTON ELECTRONICS
BLOCK RIVER VIDEO
BTS/BROADCAST TELEVISION SYSTEMS
CENTRO
CHOICE ELECTRONICS
CHYRON
COMPREHENSIVE VIDEO SUPPLY
COMPUTER GRAPHICS LABS
DUBNER COMPUTER SYSTEMS



EVERTZ MICROSYSTEMS
FOR-A CORP. OF AMERICA
FOSTEX
THE GRASS VALLEY
GROUP
KNOX VIDEO PRODUCTS
LAIRD TELEMEDIA
LISTEC VIDEO CORP.
3M BROADCASTING & RE-
LATED PRODUCTS DIV.
MPB TECHNOLOGIES
MULTIDYNE
ELECTRONICS
MYCRO-TEK
PESA AMERICA
QUANTA CORP.
QUANTEL
VIDEO AIDS OF
COLORADO
VIDEO DATA SYSTEMS

DIGITAL DISK RECORDERS

ABEKAS VIDEO SYSTEMS
ASACA/SHIBASOKU CORP
COMREX CORP.
DIGITAL SERVICES
CORP./DSC
QUANTEL
SONY INFORMATION SYS-
TEMS DIV.

DIGITAL EFFECTS DEVICES

ABEKAS VIDEO SYSTEMS
AMPEX
BTS/BROADCAST TELEVI-
SION SYSTEMS
CEL ELECTRONICS
CROSSPOINT LATCH
CORP.
DIGITAL SERVICES
CORP./DSC
FAIRLIGHT INSTRUMENTS
FOR-A CORP. OF AMERICA
GML AMERICA
THE GRASS VALLEY
GROUP
JAMES GRUNDER
ASSOCIATES
HARRIS CORP., BROAD-
CAST DIV.
HARRIS CORP., VIDEO
SYSTEMS DIV.
MICROTIME
NEC AMERICA, BROAD-
CAST EQUIPMENT DIV.
PINNACLE SYSTEMS
PRIME IMAGE

QUANTEL
SHINTRON CO.
THOMSON VIDEO
EQUIPMENT
TOSHIBA AMERICA

ELECTRONIC STILL STORES

ABEKAS VIDEO SYSTEMS
ALTA GROUP
AMPEX
APERT-HERZOG CORP.
ASACA/SHIBASOKU CORP
BTS/BROADCAST TELEVI-
SION SYSTEMS
GENIGRAPHICS
HARRIS CORP., BROAD-
CAST DIV.
HARRIS CORP., VIDEO
SYSTEMS DIV.
INTERAND CORP.
LEITCH VIDEO
OKTEL CORP.
PINNACLE SYSTEMS
POLAROID CORP.
QUANTEL
RANK CINTEL
SHINTRON CO.
SONY INFORMATION SYS-
TEMS DIV.

FRAME SYNCHRONIZERS

ALTA GROUP
APERT-HERZOG CORP.
AUDIO KINETICS
CEL ELECTRONICS
CIPHER DIGITAL
DIGITAL
PROCESSING
SYSTEMS
EIGEN VIDEO
FOR-A CORP. OF AMERICA
GML AMERICA
HARRIS CORP., BROAD-
CAST DIV.
HARRIS CORP., VIDEO
SYSTEMS DIV.
HOTRONIC
LEITCH VIDEO
MICROTIME
NOVA SYSTEMS
TEKTRONIX
TOSHIBA AMERICA
VIDEOTEK

GRAPHICS SYSTEMS: 2D

ACCU-WEATHER
AMPEX
ASTON ELECTRONICS
AURORA SYSTEMS

BTS/BROADCAST TELEVI-
SION SYSTEMS
CHYRON
COLORGRAPHICS
SYSTEMS
COMPUTER GRAPHICS
LABS
CUBICOMP
DIGITAL ARTS
DUBNER COMPUTER
SYSTEMS
GENIGRAPHICS
THE GRASS VALLEY
GROUP
HARRIS CORP., VIDEO
SYSTEMS DIV.
INTERAND CORP.
3M BROADCASTING & RE-
LATED PRODUCTS DIV.
PINNACLE SYSTEMS
QUANTA CORP.
QUANTEL
SYMBOLICS
THOMSON VIDEO
EQUIPMENT
VISAGE
WAVEFRONT
TECHNOLOGIES
XIPHAS

LENSES

ANGENIEUX
ARRIFLEX CORP.
CAMERA MART
CANON USA
CENTRO
CENTURY PRECISION
OPTICS
CMC LTD.
COMPREHENSIVE VIDEO
SUPPLY
FILM/VIDEO EQUIPMENT
SERVICE
FUJINON
MARTI ELECTRONICS
SCHNEIDER CORP. OF
AMERICA
SCHWEM TECHNOLOGY
WARREN R. SMITH, INC.
TIFFEN MFG. CO.

LIGHTING EQUIPMENT

AMX
ANTON/BAUER
ANVIL CASES
APOLLO AUDIO VISUAL
ARBEN DESIGN
ARRIFLEX CORP.
AVAB AMERICA

AVANTEK
BARBIZON
BARDWELL & McALLISTER
BOGEN PHOTO CORP.
WALTER S. BREWER CO.
CINE 60
CINEMILLS CORP.
COLORTRAN
COMPREHENSIVE VIDEO
SUPPLY
COOL-LUX LIGHTING IND.
DESISTI
LIGHTING/DESMAR
CORP.
DYNAMIC TECHNOLOGY
ELECTRO CONTROLS
ELECTRONICS
DIVERSIFIED
FANTASEE LIGHTING
GENERAL ELECTRIC CO.,
LIGHTING BUSINESS
GROUP
GTE/SYLVANIA
HOFFEND & SONS
KLIIEGL BROS.
LEE LIGHTING AMERICA
LIGHTING METHODS
LOWEL-LIGHT MFG.
LTM CORP. OF AMERICA
MATTHEWS STUDIO
EQUIPMENT
MODULITE/ BARDWELL
MOLE-RICHARDSON CO.
OLESEN
OSRAM CORP.
PACKAGED LIGHTING
SYSTEMS
PEP
CONSTANTINE N. POLITES
& CO.
PRO BATTERY CO.
ROSCO LABS
STRAND LIGHTING
TEATRONICS
THEATRE SERVICE &
SUPPLY
THEATRE VISION
THOMAS ENGINEERING
TWR LIGHTING
UNION CONNECTOR CO.

MASTER CONTROL SWITCHERS

BTS/BROADCAST TELEVI-
SION SYSTEMS
CCI
CENTRAL DYNAMICS
CROSSPOINT LATCH
CORP.
THE GRASS VALLEY
GROUP
INTERGROUP
TECHNOLOGIES

INTERNATIONAL NUCLEAR CORP.
KAITRONICS CORP.
3M BROADCASTING & RELATED PRODUCTS DIV.
OMICRON VIDEO
SIERRA VIDEO SYSTEMS
TORPEY CONTROLS & ENGINEERING
UTAH SCIENTIFIC
VITAL INDUSTRIES

MERPS DECKS

AMPEX
LAKE SYSTEMS CORP.
ODETICS/ BROADCAST SALES
PANASONIC BROADCAST CO.
SONY BROADCAST PRODUCTS DIV.

MULTISOURCE VIDEO EDITORS

AMPEX
BHP
CALAWAY ENGINEERING, DIV. QUANTA CORP.
CMX CORP.
EDITRON USA
EECO/CONVERGENCE
THE GRASS VALLEY GROUP
LYON LAMB VIDEO ANIMATION
MARTI ELECTRONICS
MONTAGE GROUP
PALTEX
QUANTEL
SONY BROADCAST PRODUCTS DIV.
SONY COMMUNICATIONS PRODUCTS
UNITED MEDIA
VIDEOMEDIA/SED

PRODUCTION SWITCHERS

ALTA GROUP
AMPEX
CENTRAL DYNAMICS
CENTRO
COMAD COMMUNICATIONS
CROSSPOINT LATCH CORP.
ECHOLAB
THE GRASS VALLEY GROUP
INTERGROUP TECHNOLOGIES
KAITRONICS CORP.

MATCO
MATRIX SYSTEMS CORP.
QUALITY VIDEO SUPPLY
QUANTEL
ROSS VIDEO
SHINTRON CO.
THOMSON VIDEO EQUIPMENT
TOSHIBA AMERICA
VIDEOTEK

REMOTE MOTION CONTROL SYSTEMS

A.F. ASSOCIATES
ALAMAR USA
ANDREW CORP.
INTERACTIVE MOTION CONTROL
J-LAB
WARREN R. SMITH, INC.
VINTEN EQUIPMENT
FRANK WOOLLEY & CO.

SWITCHING AUTOMATION

ALAMAR USA
AMHERST ELECTRONIC INSTRUMENTS
ANDREW CORP.
BTS/BROADCAST TELEVISION SYSTEMS
CCI
CHANNELMATIC
COMREX CORP.
CONNOLLY SYSTEMS
DYNAMIC TECHNOLOGY
ELECTRIC WORKS
THE GRASS VALLEY GROUP
ISS ENGINEERING
3M BROADCASTING & RELATED PRODUCTS DIV.
MERLIN ENGINEERING WORKS
RATIONAL BROADCAST SYSTEMS
RCA NEW PRODUCTS & CCTV DIV., TUBE OPERATIONS
REAL WORLD TECHNOLOGIES GROUP
TECH ELECTRONICS
UTAH SCIENTIFIC
VIDEO DATA SYSTEMS
VIDEOMEDIA/SED
VITAL INDUSTRIES

SYNC AND PULSE GENERATOR/PROCESSORS

ANRITSU AMERICA
BLOCK RIVER VIDEO
BTS/BROADCAST TELEVISION SYSTEMS
CAMERA MART
CCI
DIGITAL PROCESSING SYSTEMS
INTERNATIONAL NUCLEAR CORP.
LEADER INSTRUMENTS
LEITCH VIDEO
LENCO ELECTRONICS
3M BROADCASTING & RELATED PRODUCTS DIV.
MULTIDYNE ELECTRONICS
NEWTON ELECTRONICS
OPAMP LABS
OPTICAL ELECTRONICS
PESA AMERICA
PHILIPS TEST & MEASURING INSTRUMENTS
QSI SYSTEMS
SHINTRON CO.
SIGMA ELECTRONICS
SONY PRO AUDIO DIV.
TECHNOV INDUSTRIES
TELCOM RESEARCH
THOMSON VIDEO EQUIPMENT
VIDEO ACCESSORY CORP.
VIDEO AIDS OF COLORADO
VIDEOTEK

TAPE SYNCHRONIZERS

AMTEL SYSTEMS
EDITRON USA
MULTI-TRACK MAGNETICS, DIV. MATRIX CORP.
UNITED MEDIA

TELECINES

A.F. ASSOCIATES
APERT-HERZOG CORP.
BROADCAST VIDEO SYSTEMS
BTS/BROADCAST TELEVISION SYSTEMS
IKEGAMI ELECTRONICS
L-W INTERNATIONAL
LAIRD TELEMEDIA
MAGNA-TECH ELEC-

TRONIC CO.
MULTI-TRACK MAGNETICS, DIV. MATRIX CORP.
RANGERTONE RESEARCH
RANK CINTEL
STEADI-FILM
STEENBECK
THOMSON VIDEO EQUIPMENT

3D MODELING & ANIMATION SYSTEMS

ALIAS RESEARCH
AMHERST ELECTRONIC INSTRUMENTS
AMP PRODUCTS CORP.
AT&T COMMUNICATIONS
AURORA SYSTEMS
BTS/BROADCAST TELEVISION SYSTEMS
CIRCUIT STUDIOS
COLORGRAPHICS SYSTEMS
CUBICOMP
DIGITAL ARTS
DUBNER COMPUTER SYSTEMS
ELICON
FOROX CORP.
GENIGRAPHICS
THE GRASS VALLEY GROUP
KAVOURAS
3M BROADCASTING & RELATED PRODUCTS DIV.
MICROTIME
PINNACLE SYSTEMS
QUANTA CORP.
QUANTEL
SONO-MAG CORP.
SYMBOLICS
WAVEFRONT TECHNOLOGIES

TIME BASE CORRECTORS

ALTA GROUP
AMPEX
AMX
CENTRO
CROSSPOINT LATCH CORP.
DIGITAL PROCESSING SYSTEMS
FOR-A CORP. OF AMERICA
FORTEL
GML AMERICA
JAMES GRUNDER ASSOCIATES

HARRIS CORP., BROADCAST DIV.
HARRIS CORP., VIDEO SYSTEMS DIV.
HOTRONIC
MICROTIME
NOVA SYSTEMS
OKTEL CORP.
PRIME IMAGE
THOMSON VIDEO EQUIPMENT

TIME CODE EQUIPMENT

ADAMS-SMITH
ALPHA VIDEO & ELECTRONICS
AMHERST ELECTRONIC INSTRUMENTS
AMP PRODUCTS CORP.
AMTEL SYSTEMS
CAMERA MART
CIPHER DIGITAL
COHERENT COMMUNICATIONS
COMPREHENSIVE VIDEO SUPPLY
DATUM
EECO/ CONVERGENCE
ELECTRIC WORKS
ESE
EVERTZ MICROSYSTEMS
FOSTEX
GRAY ENGINEERING LABS
KINEMATICS/ TRUETIME
MAGNA-TECH ELECTRONIC CO.
MULTIDYNE ELECTRONICS
SKOTEL CORP.
SONY BROADCAST PRODUCTS DIV.
SONY COMMUNICATIONS PRODUCTS
TIMELINE
UNITED MEDIA
VID VIDEO

VIDEO PROCESSORS

ACCOM
AMHERST ELECTRONIC INSTRUMENTS
AMP PRODUCTS CORP.
AMPEX
APERT-HERZOG CORP.
BLOCK RIVER VIDEO
BROADCAST VIDEO

SYSTEMS
BTS/BROADCAST TELEVISION SYSTEMS
CENTRAL DYNAMICS
COMPUTER LABS, DIV. ANALOG DEVICES
COTTONWOOD
DOLBY LABORATORIES
EIGEN VIDEO
FAROUDJA LABS
FOR-A CORP. OF AMERICA
FORTEL
HARRIS CORP., VIDEO SYSTEMS DIV.
IKEGAMI ELECTRONICS
LAIRD TELEMEDIA
LEITCH VIDEO
LENCO ELECTRONICS
MAGNI SYSTEMS
OPTICAL ELECTRONICS
QSI SYSTEMS
QUANTEL
SHINTRON CO.
SIERRA VIDEO SYSTEMS
TAMRON INDUSTRIES
THOMSON VIDEO EQUIPMENT
TTE
VISAGE
YAMASHITA ENGINEERING MANUFACTURE

VIDEO ROUTING SWITCHERS, DAs

ABP SYSTEMS
ALTA GROUP
AMX
AUBURN INSTRUMENTS
BSM BROADCAST SYSTEMS
BTS/BROADCAST TELEVISION SYSTEMS
CAM-LOK
CCI
CEL ELECTRONICS
CENTRAL DYNAMICS
CENTRO
CHANNELMATIC
COMAD COMMUNICATIONS
COMPREHENSIVE VIDEO SUPPLY
DATATEK CORP.
DI-TECH
DYNAIR ELECTRONICS
DYNAMIC TECHNOLOGY
ESE
FOR-A CORP. OF AMERICA
GRAHAM-PATTEN SYSTEMS

THE GRASS VALLEY GROUP
JAMES GRUNDER ASSOCIATES
HEDCO (SUBSIDIARY OF LEITCH VIDEO)
IMAGE VIDEO
INTERNATIONAL NU-CLEAR CORP.
J-LAB
KAITRONICS CORP.
LAIRD TELEMEDIA
LEITCH VIDEO
LENCO ELECTRONICS
3M BROADCASTING & RELATED PRODUCTS DIV.
MATRIX SYSTEMS CORP.
MULTIDYNE ELECTRONICS
MYCOMP TECHNOLOGIES CORP.
OMICRON VIDEO
OPAMP LABS
PESA AMERICA
SCHMID TELECOM
SHINTRON CO.
SIERRA VIDEO SYSTEMS
SIGMA ELECTRONICS
SONY COMMUNICATIONS PRODUCTS
TECHNOV INDUSTRIES
TELEMET, DIV. GEOTEL
TELEMETRICS
THOMSON VIDEO EQUIPMENT
TORPEY CONTROLS & ENGINEERING
UTAH SCIENTIFIC
VIDEO ACCESSORY CORP.
VIDEO AIDS OF COLORADO
VIDEOTEK

VIDEOTAPE

AGFA-GEVAERT
AMERICAN MAGNETIC MEDIA
AMPEX
AMPEX CORP., MAGNETIC TAPE DIV.
BASF SYSTEMS CORP.
CALICO VIDEO CO.
COMPREHENSIVE VIDEO SUPPLY
EASTMAN KODAK
FUJI PHOTO FILM
KEYSTONE VIDEO CORP.
3M MAGNETIC MEDIA DIV.
MAXELL CORP. OF AMERICA
RAKS
SONY COMMUNICATIONS

PRODUCTS
SONY MAGNETIC PRODUCTS
TDK ELECTRONICS CORP.

VIDEO TEST EQUIPMENT

ANDREW CORP.
ANRITSU AMERICA
ASACA/SHIBASOKU CORP
AVCOM OF VIRGINIA
B&K PRECISION/ DYNASCAN
BARCO
BROADCAST VIDEO SYSTEMS
BTS/BROADCAST TELEVISION SYSTEMS
CAMERA MART
CENTRO
CONRAC CORP., DISPLAY PROD.
DIGITAL
PROCESSING SYSTEMS
ELECTROHOME
HALLIKAINEN & FRIENDS
HEDCO (SUBSIDIARY OF LEITCH VIDEO)
HITACHI DENSHI AMERICA
HOLADAY INDUSTRIES
IKEGAMI ELECTRONICS
JENSEN TOOLS
LEADER INSTRUMENTS
LEITCH VIDEO
LENCO ELECTRONICS
MAGNI SYSTEMS
MARCONI INSTRUMENTS
MINOLTA CORP.
MONITOR CORP.
MULTIDYNE ELECTRONICS
NALPACK VIDEO
NARDA MICROWAVE
NEWTON ELECTRONICS
OPTICAL DISC CORP.
PANASONIC BROADCAST CO.
PESA AMERICA
PHILIPS TEST & MEASURING INSTRUMENTS
PORTA-PATTERN
RE INSTRUMENTS CORP.
ROHDE & SCHWARZ/POLARAD
SHARP ELECTRONICS CORP., BROADCAST GROUP
SIGMA ELECTRONICS
SONY BROADCAST PRODUCTS DIV.

TEKTRONIX
TELEMET, DIV. GEOTEL
TENTEL CORP.
THOMSON VIDEO
EQUIPMENT
VIDEO ACCESSORY CORP.
VIDEOTEK
VISUAL INFORMATION
INSTITUTE

VTR EDITOR/ CONTROLLERS

ALPHA VIDEO &
ELECTRONICS
AMHERST ELECTRONIC
INSTRUMENTS
AMP PRODUCTS CORP.
ANDREW CORP.
AUDIO KINETICS
BTS/BROADCAST TELEVI-
SION SYSTEMS
CALAWAY ENGINEERING,
DIV. QUANTA CORP.
CEL ELECTRONICS
CENTRO
CMX CORP.
COMPREHENSIVE VIDEO
SUPPLY
EDITRON USA
EECO/ CONVERGENCE
FUTUREVIDEO PRODUCTS
JAMES GRUNDER
ASSOCIATES
JVC CO. OF AMERICA,
PROFESSIONAL VIDEO
COMM. DIV.
PANASONIC BROADCAST
CO.
PEP
QUANTA CORP.
SONY BROADCAST PROD-
UCTS DIV.
SONY COMMUNICATIONS
PRODUCTS
SONY PRO VIDEO DIV.
TECHNOV INDUSTRIES
UNITED MEDIA
VIDEOMEDIA/SED

VTRs: ONE-INCH

AMPEX
BTS/BROADCAST TELEVI-
SION SYSTEMS
CENTRO
LYON LAMB VIDEO
ANIMATION
MARTI ELECTRONICS
SONY BROADCAST PROD-
UCTS DIV.
SONY COMMUNICATIONS
PRODUCTS

VTRs: 3/4 & 1/2- INCH

ALPHA VIDEO &
ELECTRONICS
AMPEX
BTS/BROADCAST TELEVI-
SION SYSTEMS
CAMERA MART
CENTRO
EIGEN VIDEO
JVC CO. OF AMERICA,
PROFESSIONAL VIDEO
COMM. DIV.
PANASONIC BROADCAST
CO.
SHARP ELECTRONICS
CORP., BROADCAST
GROUP
SONY BROADCAST PROD-
UCTS DIV.
SONY COMMUNICATIONS
PRODUCTS
SONY PRO VIDEO DIV.

WEATHER RADAR/GRAPHICS

ACCU-WEATHER
ADVANCED DESIGNS
ADVANCED MICRO-
DYNAMICS
ALDEN ELECTRONICS
COLORGRAPHICS
SYSTEMS
DUBNER COMPUTER
SYSTEMS
ENTERPRISE
ELECTRONICS
ESD
ISS ENGINEERING
KAVOURAS
3M STORMSCOPE
WEATHER MAPPING
SYSTEMS
OKTEL CORP.
R*SCAN CORP.
TEXAS ELECTRONICS
WEATHERBANK
WEATHERCONNECT
WSI CORP.

OTHER VIDEO EQUIPMENT

ADC TELECOMMUNICA-
TIONS
AEG BAYLY
ALLEN AVIONICS
ALLSOP
ALPHA VIDEO &
ELECTRONICS
AMPEREX ELECTRONICS
AMTEL SYSTEMS

R.B. ANNIS CO.
APOLLO AUDIO VISUAL
AUDICO
AUDIO ACCESSORIES
AUDIOLAB ELECTRONICS
BEAVERONICS
BENCHER
BOONTON ELECTRONICS
CORP.
BOWEN BROADCAST
SERVICE
BTS/BROADCAST TELEVI-
SION SYSTEMS
CALVERT ELECTRONICS
CALZONE CASE CO.
CASCOM
CASES, INC.
DWIGHT CAVENDISH
CECO COMMUNICATIONS
CEL ELECTRONICS
CHOICE ELECTRONICS
CHRISTIE ELECTRIC
CMC TECHNOLOGY, DIV.
OF DATATAPE
COLORADO VIDEO
COLORGRAPHICS
SYSTEMS
COMPRESSION LABS
COMPU = PROMPT
COMPUTER PROMPTING
CORP.
CONNOLLY SYSTEMS
CONTROL CONCEPTS
CORPORATE COMMUNICA-
TIONS CONSULTANTS
DUBNER COMPUTER
SYSTEMS
EECO/ CONVERGENCE
EEV
ELCON ASSOCIATES
EMCOR/CRENLO
ESC ELECTRONICS
GARNER INDUSTRIES
GENERAL ELECTRIC CO.,
PROJECTION DISPLAY
OPERATION
GENEVA GROUP
GRAHAM-PATTEN
SYSTEMS
INTERACTIVE MOTION
CONTROL
INTERNATIONAL MICRO-
WAVE CORP.
J-LAB
JVC CO. OF AMERICA,
PROFESSIONAL VIDEO
COMM. DIV.
K & H PRODUCTS/
PORTABRACE
KAMAN SCIENCES

KANGAROO VIDEO
PRODUCTS
KING INSTRUMENT CORP.
LAKE SYSTEMS CORP.
LANDY ASSOCIATES
LEE LIGHTING AMERICA
LISTEC VIDEO CORP.
LUXOR
LYON LAMB VIDEO
ANIMATION
MEDIA COMPUTING
MICROSONICS
MICROTRAN CO.
MILLER FLUID HEADS
NALPACK VIDEO
NEC AMERICA, BROAD-
CAST EQUIPMENT DIV.
NYTONE ELECTRONIC
OKI TELECOM
OPTICAL DISC CORP.
PEERLESS SALES
PEP
PHILIPS TEST & MEASUR-
ING INSTRUMENTS
PHOTOGRAPHIC EQUIP-
MENT SERVICES
PINZONE
COMMUNICATIONS
PLASTIC REEL CORP. OF
AMERICA
POLAROID CORP.
Q-TV
QSI SYSTEMS
QUALITY VIDEO SUPPLY
QUANTEL
RECORTEC
RICHARDSON
ELECTRONICS
ROCKWELL
INTERNATIONAL
SAKI MAGNETICS
SCHNEIDER CORP. OF
AMERICA
SOLUTEC
SONAR RADIO CORP.
SONY COMMUNICATIONS
PRODUCTS
SONY INFORMATION SYS-
TEMS DIV.
SPRAGUE MAGNETICS
STANTRON/UNIT OF ZERO
CORP.
STAR CASE
SYMBOLICS
TABER MANUFACTURING
& ENGINEERING
TAMRON INDUSTRIES
TEKSKIL INDUSTRIES
TELEMETRICS
TELESCRIPT
TELESCRIPT
TELEVISION EQUIPMENT
ASSOC.
TORPEY CONTROLS &
ENGINEERING

TSM/TOTAL SPECTRUM
MANUFACTURING
TTE
ULTIMATE CORP.
VIDEO ACCESSORY CORP.
VIDEO ASSOCIATES LABS
VIDEO INTERNATIONAL
VIDEOPLEX
VIKING CASES
WIDE RANGTRONICS
CORP.
WINSTED CORP.
ZAXCOM VIDEO

AUDIO

ATR SYNCHRONIZERS

ADAMS-SMITH
AMTEL SYSTEMS
EDITRON USA
EVERTZ MICROSYSTEMS
FOSTEX
OTARI CORP.
SOLID STATE LOGIC
SONY PRO AUDIO DIV.
SOUNDMASTER INTER-
NATIONAL
STUDER REVOX AMERICA
TIMELINE

ATRs: FIELD

ENERTEC SCHLUMBER-
GER/ PROFESSIONAL
AUDIO
NAGRA MAGNETIC
RECORDERS
OTARI CORP.
SONY COMMUNICATIONS
PRODUCTS
SONY PRO AUDIO DIV.
STUDER REVOX AMERICA
UHER OF AMERICA

ATRs: STUDIO

AEG BAYLY
ENERTEC SCHLUMBER-
GER/ PROFESSIONAL
AUDIO
MITSUBISHI PRO AUDIO
NAKAMICHI USA CORP.
OLD DOMINION BROAD-
CAST ENGINEERING
SVCE.
OTARI CORP.
L.J. SCULLY MFG. CORP.
SONY COMMUNICATIONS
PRODUCTS
SONY PRO AUDIO DIV.
SOUNDCRAFT
ELECTRONICS
STUDER REVOX AMERICA

TEAC/ TASCAM PRO AU-
DIO DIV.
TECHNICS/ PANASONIC
TELECTRO SYSTEMS
CORP.
UHER OF AMERICA
UNITED RESEARCH LAB

AUDIO MONITOR- ING EQUIPMENT

ACOUSTIC RESEARCH
AKG ACOUSTICS
ALTEC LANSING
ANCHOR AUDIO
ANDREW CORP.
ATLAS/ SOUNDOLIER
AUERNHEIMER LAB & CO.
AURATONE CORP.
B&B SYSTEMS
B.E.S.
BELAR ELECTRONICS
LABORATORY
BEYER DYNAMIC
BGW SYSTEMS
BOGEN
COMMUNICATIONS
CARVIN MFG. CORP.
CENTRO
CETEC GAUSS
CHOICE ELECTRONICS
COMPREHENSIVE VIDEO
SUPPLY
DELTA ELECTRONICS
ELECTRO-VOICE
HALLIKAINEN & FRIENDS
HEDCO (SUBSIDIARY OF
LEITCH VIDEO)
INOVONICS
KINTEK
McMARTIN INDUSTRIES
MOTOROLA, INC., AM
STEREO
PANASONIC INDUSTRIAL
CO.
RAM BROADCAST
SYSTEMS
RAMSA/ PANASONIC PRO
AUDIO
ROH/ DIV. ANCHOR AUDIO
SESCOM
SHURE BROTHERS
SOLUTEK
SONY PRO AUDIO DIV.
SOUNDOLIER
SPECTRA SONICS
STUDER REVOX AMERICA
TANNOY NORTH AMERICA
TECHNICS/ PANASONIC
TEKTRONIX

TELECTRO SYSTEMS
CORP.
TELEDYNE ACOUSTIC
RESEARCH
TELEMET, DIV. GEOTEL
TELEX COMMUNICATIONS
TFT
VIDEOTEK
WESTLAKE AUDIO
YAMAHA MUSIC

AUDIO PROCESSORS

AMS CALREC
APHEX SYSTEMS
ATI-AUDIO
TECHNOLOGIES
BARCUS-BERRY
ELECTRONICS
BOGEN
COMMUNICATIONS
BROADCAST AUDIO CORP.
CETEC IVIE
COMPREHENSIVE VIDEO
SUPPLY
DATUM
dbx
DELTA ELECTRONICS
DOLBY LABORATORIES
DORROUGH ELECTRONICS
EVENTIDE
EXR
FOSTEX
HARRISON SYSTEMS
HOWE TECHNOLOGIES
INOVONICS
JBL PROFESSIONAL
KAHN COMMUNICATIONS
KINTEK
LEAMING INDUSTRIES
LEXICON
MARSHALL ELECTRONICS
McCURDY RADIO
McMARTIN INDUSTRIES
MODULAR AUDIO
PRODUCTS
MODULATION SCIENCES
OPAMP LABS
ORBAN ASSOC.
PROTECH AUDIO CORP.
SESCOM
SHURE BROTHERS
SONY PRO AUDIO DIV.
SPECTRA SONICS
STANDARD COMMUNICA-
TIONS CORP.
STUDIO TECHNOLOGIES
SYMETRIX
TECTAN
TEXAR
VALLEY INTERNATIONAL
WARD-BECK SYSTEMS
LTD.

WHEATSTONE CORP.
WHITE INSTRUMENTS,
DIV OF C VAN R, INC.
YAMAHA MUSIC

AUDIO ROUTING SWITCHERS, DAs

AMX
ATI-AUDIO
TECHNOLOGIES
AUDITRONICS
BSM BROADCAST
SYSTEMS
BTS/ BROADCAST TELEVI-
SION SYSTEMS
CENTRO
CHANNELMATIC
COMAD
COMMUNICATIONS
CONEX
DATATEK CORP.
DI-TECH
DYNAIR ELECTRONICS
ENERTEC SCHLUMBER-
GER/ PROFESSIONAL
AUDIO
FARRTRONICS
FOR-A CORP. OF AMERICA
GENTNER ENGINEERING
CO.
THE GRASS VALLEY
GROUP
HARRISON SYSTEMS
IMAGE VIDEO
IMS/ INTEGRATED MEDIA
SYSTEMS
INTERNATIONAL NU-
CLEAR CORP.
INTERNATIONAL TAPE-
TRONICS CORP./ 3M
LEITCH VIDEO
LENCO ELECTRONICS
LOGITEK
LPB
McCURDY RADIO
MICRO-TRAK CORP.
MODULAR AUDIO
PRODUCTS
MOSELEY ASSOCIATES
OPAMP LABS
PACIFIC RECORDERS &
ENGINEERING
PESA AMERICA
PROTECH AUDIO CORP.
RAMKO RESEARCH
RICHMOND SOUND
DESIGN
ROH/ DIV. ANCHOR AUDIO
RTS SYSTEMS
SHURE BROTHERS

SIERRA VIDEO SYSTEMS
SOLUTEC
SOUND TECHNOLOGY
SPECTRA SONICS
TECHNOV INDUSTRIES
TELEMET, DIV. GEOTEL
TORPEY CONTROLS &
ENGINEERING
UTAH SCIENTIFIC
VIDEO AIDS OF
COLORADO
WARD-BECK SYSTEMS
LTD.

AUDIO TAPE, CARTRIDGES

AGFA-GEVAERT
AMPEX CORP., MAGNETIC
TAPE DIV.
ANTON/ BAUER
ARISTOCART, DIV. WEST-
ERN INTL.
BASF SYSTEMS CORP.
CAPITOL MAGNETIC
PRODUCTS
ENERTEC SCHLUMBER-
GER/ PROFESSIONAL
AUDIO
FIDELIPAC
INTERNATIONAL TAPE-
TRONICS CORP./ 3M
3M MAGNETIC MEDIA DIV.
MARATHON PRODUCTS
MAXELL CORP. OF
AMERICA
SONY MAGNETIC
PRODUCTS
TDK ELECTRONICS CORP.

AUDIO TEST EQUIPMENT

AMBER ELECTRO DESIGN
ANDREW CORP.
AUDIO PRECISION
B&K PRECISION/
DYNASCAN
BALD MOUNTAIN LAB
BOONTON ELECTRONICS
CORP.
BRUEL & KJAER
INSTRUMENTS
CETEC IVIE
COMPREHENSIVE VIDEO
SUPPLY
CROWN INTERNATIONAL
dbx
DORROUGH ELECTRONICS
HEDCO (SUBSIDIARY OF
LEITCH VIDEO)
HEWLETT-PACKARD CO.
JASONI ELECTRONICS
JENSEN TOOLS
KAY ELEMETRICS CORP.

KINTEK
LEADER INSTRUMENTS
MAGNETIC REFERENCE
LAB
McCURDY RADIO
MIKROLAB
MODULAR AUDIO
PRODUCTS
NARDA MICROWAVE
POTOMAC INSTRUMENTS
RAM BROADCAST
SYSTEMS
RE INSTRUMENTS CORP.
SELCO/ SIFAM
SESCOM
SOUND TECHNOLOGY
SPECTRA SONICS
TECHNICAL PROJECTS
TECHRON
TEKTRONIX
TENTEL CORP.
WARD-BECK SYSTEMS
LTD.
WHITE INSTRUMENTS,
DIV OF C VAN R, INC.
WIREWORKS CORP.

CART DECKS

AUDI-CORD
BROADCAST
ELECTRONICS
CONTINENTAL ELEC-
TRONIC/ CONTEL
ENERTEC SCHLUMBER-
GER/ PROFESSIONAL
AUDIO
FIDELIPAC
IGM COMMUNICATIONS
INTERNATIONAL TAPE-
TRONICS CORP./ 3M
MACKENZIE
LABORATORIES
MITSUBISHI PRO AUDIO
OTARI CORP.
PACIFIC RECORDERS &
ENGINEERING
RAMKO RESEARCH
ULTRA AUDIO PIXTEC,
DIV. AUDIO INTL.
WESTERN INTL. COMM./
ARISTOCRAT DIV.

COMPACT DISC EQUIPMENT

dbx
SHURE BROTHERS
SONO-MAG CORP.
SONY COMMUNICATIONS
PRODUCTS

SONY PRO AUDIO DIV.
STOREEL CORP.
STRAIGHTWIRE AUDIO
STUDER REVOX AMERICA
TEAC/ TASCAM PRO AU-
DIO DIV.
TECHNICS/ PANASONIC
WESTERN INTL. COMM./
ARISTOCRAT DIV.

DIGITAL ATRs

CONCEPT PRODUCTIONS
FOR-A CORP. OF AMERICA
MITSUBISHI PRO AUDIO
OTARI CORP.
SHARP ELECTRONICS
CORP., BROADCAST
GROUP
SONY COMMUNICATIONS
PRODUCTS
SONY PRO AUDIO DIV.
STUDER REVOX AMERICA
SYSTEMATION
YAMAHA MUSIC

DIGITAL PRODUC- TION SYSTEMS

ADVANCED MUSIC
SYSTEMS
AMS CALREC
CEL ELECTRONICS
COMPUSONICS
CONCEPT PRODUCTIONS
DIGITAL AUDIO
RESEARCH
FAIRLIGHT INSTRUMENTS
IMAGE VIDEO
LEXICON
NEW ENGLAND DIGITAL
SOLID STATE LOGIC
SONY COMMUNICATIONS
PRODUCTS
STUDER REVOX AMERICA
SYSTEMATION
WAVEFRAME CORP.
YAMAHA MUSIC

INTERCOMS

ANCHOR AUDIO
ATLAS/ SOUNDOLIER
BOGEN
COMMUNICATIONS
CENTRO
CETEC VEGA
CIRCUIT DEVELOPMENT
CO.
DAVID CLARK CO.
ENERTEC SCHLUMBER-
GER/ PROFESSIONAL
AUDIO
FISHER BERKELEY CORP.

HM ELECTRONICS
McCURDY RADIO
MOBILE-CAM PRODUCTS
MOTOROLA C&E
OLD DOMINION BROAD-
CAST ENGINEERING
SVCE.
PESA AMERICA
PROTECH AUDIO CORP.
QUANTEL
R-COLUMBIA PRODUCTS
REACH ELECTRONICS
ROH/ DIV. ANCHOR AUDIO
RTS SYSTEMS
SOUNDOLIER
TECHNICAL PROJECTS
TELECTRO SYSTEMS
CORP.
TELEX COMMUNICATIONS
VIDEO AIDS OF
COLORADO
WARD-BECK SYSTEMS
LTD.

MICROPHONES, ACCESSORIES

ACO PACIFIC
AKG ACOUSTICS
ALTEC LANSING
AMS CALREC
ANCHOR AUDIO
ASTATIC
ATLAS/ SOUNDOLIER
AUDIO-TECHNICA U.S.
BEYER DYNAMIC
BOGEN
COMMUNICATIONS
BRUEL & KJAER
INSTRUMENTS
CARVIN MFG. CORP.
CENTRO
CETEC IVIE
CETEC VEGA
CHESTER CABLE/
ALCATEL
COHERENT
COMMUNICATIONS
COMPREHENSIVE VIDEO
SUPPLY
COMTEK
COUNTRYMAN
ASSOCIATES
CROWN INTERNATIONAL
EDCOR
ELECTRO-VOICE
FOSTEX
ALAN GORDON
ENTERPRISES
KARL HEITZ, INC.
HM ELECTRONICS
LECTROSONICS
LTM CORP. OF AMERICA

MICRON AUDIO
PRODUCTS
NADY SYSTEMS
PANASONIC INDUSTRIAL
CO.
R-COLUMBIA PRODUCTS
RAMSA/ PANASONIC PRO
AUDIO
SAMSON TECHNOLOGIES
CORP.
SANKEN MICROPHONES
SENNHEISER ELEC. CORP.
SESCOM
SHURE BROTHERS
SONY COMMUNICATIONS
PRODUCTS
SONY PRO AUDIO DIV.
SWITCHCRAFT
TELEX COMMUNICATIONS
ULTIMATE SUPPORT
SYSTEMS
VALLEY INTERNATIONAL
WIREWORKS CORP.
YAMAHA MUSIC

NOISE REDUCTION EQUIPMENT

ANT TELECOMMUNI-
CATIONS
CIRCUIT RESEARCH LABS
COMPREHENSIVE VIDEO
SUPPLY
dbx
DOLBY LABORATORIES
JBL PROFESSIONAL
RAM BROADCAST
SYSTEMS
SYMETRIX
VALLEY INTERNATIONAL

ON-AIR CONSOLES, MIXERS

ADM TECHNOLOGY
ALLEN & HEATH
BRENELL USA LTD.
ATI-AUDIO
TECHNOLOGIES
AUDIO-TECHNICA U.S.
AUDITRONICS
AUTOGRAM
BIAMP SYSTEMS
BROADCAST AUDIO CORP.
BROADCAST
ELECTRONICS
CARVIN MFG. CORP.
CETEC IVIE
COHERENT
COMMUNICATIONS
CONNECTRONICS CORP.
DAX AUDIO GROUP
DORROUGH ELECTRONICS

ENERTEC SCHLUMBER-
GER/ PROFESSIONAL
AUDIO
ESL
HARRISON SYSTEMS
HOWE TECHNOLOGIES
IKEGAMI ELECTRONICS
INDUSTRIAL RESEARCH
PRODUCTS
JBL PROFESSIONAL
KAITRONICS CORP.
LOGITEK
LPB
McCURDY RADIO
McMARTIN INDUSTRIES
MICRO-TRAK CORP.
MITSUBISHI PRO AUDIO
NEOTEK
OPAMP LABS
ORION RESEARCH
PACIFIC RECORDERS &
ENGINEERING
PANASONIC INDUSTRIAL
CO.
PRECISION DESIGN
PROTECH AUDIO CORP.
RAM BROADCAST
SYSTEMS
RAMKO RESEARCH
RAMSA/ PANASONIC PRO
AUDIO
RICHMOND SOUND
DESIGN
RUSSCO ELECTRONICS
MFG.
SESCOM
SHURE BROTHERS
SOLID STATE LOGIC
SONY COMMUNICATIONS
PRODUCTS
SONY PRO AUDIO DIV.
SOUNDCRAFT
ELECTRONICS
SPECTRA SONICS
STUDER REVOX AMERICA
STUDIO TECHNOLOGIES
TEAC/ TASCAM PRO AU-
DIO DIV.
ULTRA AUDIO PIXTEC,
DIV. AUDIO INTL.
WARD-BECK SYSTEMS
LTD.
WHEATSTONE CORP.

POST-PRODUC- TION CONSOLES

ADM TECHNOLOGY
ALLEN & HEATH
BRENELL USA LTD.
AMEK CONSOLES
AMS CALREC
ARRAKIS SYSTEMS
AUDITRONICS
BROADCAST AUDIO CORP.

CONNECTRONICS CORP.
ELECTRO-VOICE
ENERTEC SCHLUMBER-
GER/ PROFESSIONAL
AUDIO
FAIRLIGHT INSTRUMENTS
GRAHAM-PATTEN
SYSTEMS
THE GRASS VALLEY
GROUP
HALLIKAINEN & FRIENDS
HARRISON SYSTEMS
HOWE TECHNOLOGIES
JBL PROFESSIONAL
KAITRONICS CORP.
LOGITEK
MICRO-TRAK CORP.
MITSUBISHI PRO AUDIO
NEOTEK
RUPERT NEVE
OPAMP LABS
ORION RESEARCH
PACIFIC RECORDERS &
ENGINEERING
PANASONIC INDUSTRIAL
CO.
RAMKO RESEARCH
RAMSA/ PANASONIC PRO
AUDIO
RICHMOND SOUND
DESIGN
SESCOM
SOLID STATE LOGIC
SONY COMMUNICATIONS
PRODUCTS
SONY PRO AUDIO DIV.
SOUNDCRAFT
ELECTRONICS
SPECTRA SONICS
STUDER REVOX AMERICA
TEAC/ TASCAM PRO AU-
DIO DIV.
TRIDENT AUDIO
ULTRA AUDIO PIXTEC,
DIV. AUDIO INTL.
WARD-BECK SYSTEMS
LTD.
WHEATSTONE CORP.
YAMAHA MUSIC

REMOTE PICKUP, RENG SYSTEMS

KAHN COMMUNICATIONS
TELEMETRICS
TFT

REVERB, SPECIAL EFX

ADVANCED MUSIC
SYSTEMS
AKG ACOUSTICS

AMS CALREC
ART/ APPLIED RESEARCH
& TECHNOLOGY
BIAMP SYSTEMS
EVENTIDE
FOSTEX
LEXICON
MARSHALL ELECTRONICS
YAMAHA MUSIC

STUDIO AUTOMA- TION EQUIPMENT

AMS CALREC
ANDREW CORP.
BROADCAST
ELECTRONICS
CONCEPT PRODUCTIONS
DIGITAL CREATIONS
ENERTEC SCHLUMBER-
GER/ PROFESSIONAL
AUDIO
GENERIC COMPUTER
SYSTEMS
IGM COMMUNICATIONS
RICHMOND SOUND
DESIGN
ROH/ DIV. ANCHOR AUDIO
SCHAFFER WORLD COMMU-
NICATIONS
SOLID STATE LOGIC
SYSTEMATION

TELCO INTERFACE EQUIPMENT

ESE
GENTNER ENGINEERING
CO.
KAHN COMMUNICATIONS
R-COLUMBIA PRODUCTS
ROH/ DIV. ANCHOR AUDIO
SHURE BROTHERS
SYMETRIX
SYSTEMATION
TELEX COMMUNICATIONS
TELNOX

TIME COMPRES- SION SYSTEMS

ADVANCED MUSIC
SYSTEMS
CMX CORP.
EVENTIDE
LEXICON

TURNTABLES

ACOUSTIC RESEARCH
AEG BAYLY
BAF COMMUNICATIONS
CORP.
BROADCAST
ELECTRONICS

IGM COMMUNICATIONS
MICRO-TRAK CORP.
RUSSCO ELECTRONICS
MFG.
TECHNICS/ PANASONIC
TELEDYNE ACOUSTIC
RESEARCH

OTHER AUDIO EQUIPMENT

ACOUSTIC SYSTEMS
ADAMS-SMITH
ADM TECHNOLOGY
AKG ACOUSTICS
ALLIED BROADCAST SYS-
TEMS/ SONO-MAG
ALPHA AUDIO
ALTEC LANSING
R.B. ANNIS CO.
ANVIL CASES
ASACA/ SHIBASOKU CORP
AUDICO
ASSOCIATED
PRODUCTION
MUSIC
AUDIO ACCESSORIES
THE AUDIO BROADCAST
GROUP
AUDIO/ DIGITAL
AUDIOLAB ELECTRONICS
B&B SYSTEMS
BRYSTON LTD.
CANARE CABLE
CETEC GAUSS
CHOICE ELECTRONICS
CHRISTIE ELECTRIC
CIPHER DIGITAL
COMPREHENSIVE VIDEO
SUPPLY
COMPRESSION LABS
CROWN INTERNATIONAL
PETER W. DAHL
DeWOLF MUSIC LIBRARY
DICTAPHONE CORP.
DIGITAL CREATIONS
EDCOR
ELECTRO-SOUND
EMCOR/ CRENLO
ENERTEC SCHLUMBER-
GER/ PROFESSIONAL
AUDIO
FIRSTCOM BROADCAST
SERVICES
GARNER INDUSTRIES
GENEVA GROUP
GOTHAM AUDIO
INDUSTRIAL RESEARCH
PRODUCTS
INOVONICS
INTERNATIONAL MICRO-
WAVE CORP.

INTERNATIONAL TAPE-
TRONICS CORP./ 3M
ITI ELECTRONICS
JBL PROFESSIONAL
JENSEN TRANSFORMERS
KAMAN SCIENCES
LAKE SYSTEMS CORP.
LANDY ASSOCIATES
LUXOR
MARATHON PRODUCTS
MEDIA GENERAL BROAD-
CAST SERVICE
MIKROLAB
MODULAR AUDIO
PRODUCTS
MOTOROLA, INC., AM
STEREO
NEUMADE PRODUCTS
CORP.
NORTRONICS CO.
OMNIMUSIC

RF, GENERAL

AM STEREO EQUIPMENT

BROADCAST
ELECTRONICS
CONTINENTAL ELEC-
TRONICS/ VARIAN
DELTA ELECTRONICS
KAHN COMMUNICATIONS
LEADER INSTRUMENTS
MODULATION SCIENCES
MOTOROLA C&E
MOTOROLA, INC., AM
STEREO

ANTENNAS, TOWERS

ADELPHON
ADVANCED DESIGNS
ALLIED TOWER CO.
ANDREW CORP.
BOGNER BROADCAST
EQUIPMENT
BROADCAST
ELECTRONICS
CABLEWAVE SYSTEMS
CELWAVE
CENTRAL TOWER
COMAD
COMMUNICATIONS
COMTECH ANTENNA
CORP.
DIELECTRIC
COMMUNICATIONS
ELECTRONICS RESEARCH
ELLIS TOWER CO.
EMCEE BROADCAST
PRODUCTS

FORT WORTH TOWER
GABRIEL ELECTRONICS
HARRIS CORP., BROAD-
CAST MICROWAVE
HARRIS CORP., BUSINESS
COMMUNICATIONS DIV.
JAMPRO ANTENNAS
KLINE IRON & STEEL CO.
L&R COMMUNICATIONS
LTD.
LARCAN COMMUNICA-
TIONS EQUIPMENT
LDL COMMUNICATIONS
MAGNUM TOWERS
MICRO COMMUNICATIONS
MICRODYNE CORP.
MICROFLECT CO.
MICROWAVE RADIO
MOTOROLA C&E
FRED A. NUDD CORP.
NURAD
ALLEN OSBORNE ASSOC.
PINZONE
COMMUNICATIONS
RF TECHNOLOGY
ROHN
SCIENTIFIC ATLANTA
SHIVELY LABS
SIMPLICITY TOOL CO.
STAINLESS
SWAGER
COMMUNICATIONS
SWR
TELEX COMMUNICATIONS
TENNAPLEX SYSTEMS
THOMSON-LGT
TOWNSEND/ BROADCAST
SYSTEMS
TRANSMISSION STRUC-
TURES LTD.
TRI-EX TOWER CORP.
UNITED ROPEWORKS
(USA)
UTILITY TOWER CO.
VALMONT INDUSTRIES
THE WILL-BURT CO.
WORLD TOWER CO.

BUSINESS AUTO- MATION SYSTEMS

APPLELOG
AT&T COMMUNICATIONS
AUTOMATED BROADCAST
CONTROLS
CBSI
COLUMBINE SYSTEMS
COMPUTER CONCEPTS
CORP.
DATACOUNT
GRUMMAN ELECTRONICS
SYSTEMS

JEFFERSON PILOT DATA
SYSTEMS
MATCO
REGISTER DATA SYSTEMS

ENG/ EFP VEHICLES

ALPHA VIDEO &
ELECTRONICS
BTS/ BROADCAST TELEVI-
SION SYSTEMS
CENTROC
CHAMPION
GRAY COMMUNICATIONS
CONSULTANTS
LIERO ELECTRICAL CORP.
MIDWEST COMMUNICA-
TIONS CORP.
MOBILE-CAM PRODUCTS
PEIRCE-PHELPS, AUDIO/
VIDEO SYSTEMS DIV.
REAL WORLD TECHNOL-
OGIES GROUP
SHOOK ELECTRONICS
ENTERPRISES
SPECIALTY VEHICLES
TELEVISION ENGINEER-
ING CORP.
WOLF COACH

FIBEROPTIC SYSTEMS

ARTEL COMMUNICATIONS
CORP.
AVANTEK
CATEL TELECOMMUNI-
CATIONS
COMPREHENSIVE VIDEO
SUPPLY
DYNAIR ELECTRONICS
THE GRASS VALLEY
GROUP
GTE COMMUNICATIONS
SYSTEMS CORP.
RICHARD HIRSCHMANN
OF AMERICA
JENSEN TOOLS
MIDWEST COMMUNICA-
TIONS CORP.
PIRELLI COMMUNICATION
SYSTEMS
RCA NEW PRODUCTS &
CCTV DIV., TUBE
OPERATIONS
RE INSTRUMENTS CORP.
ROCKWELL
INTERNATIONAL
SELCO/ SIFAM
SIECOR
TELEMET, DIV. GEOTEL

MDS, SMATV SYSTEMS

ANDREW CORP.
COMWAVE
CONIFER
EMCEE BROADCAST PRODUCTS
ITS CORP.
MICRO COMMUNICATIONS
STANDARD COMMUNICATIONS CORP.

MICROWAVE FOR ENG

ADELPHON
ANDREW CORP.
BROADCAST MICROWAVE SERVICES
CONIFER
CONTINENTAL ELECTRONICS/ VARIAN
HARRIS CORP., BROADCAST MICROWAVE
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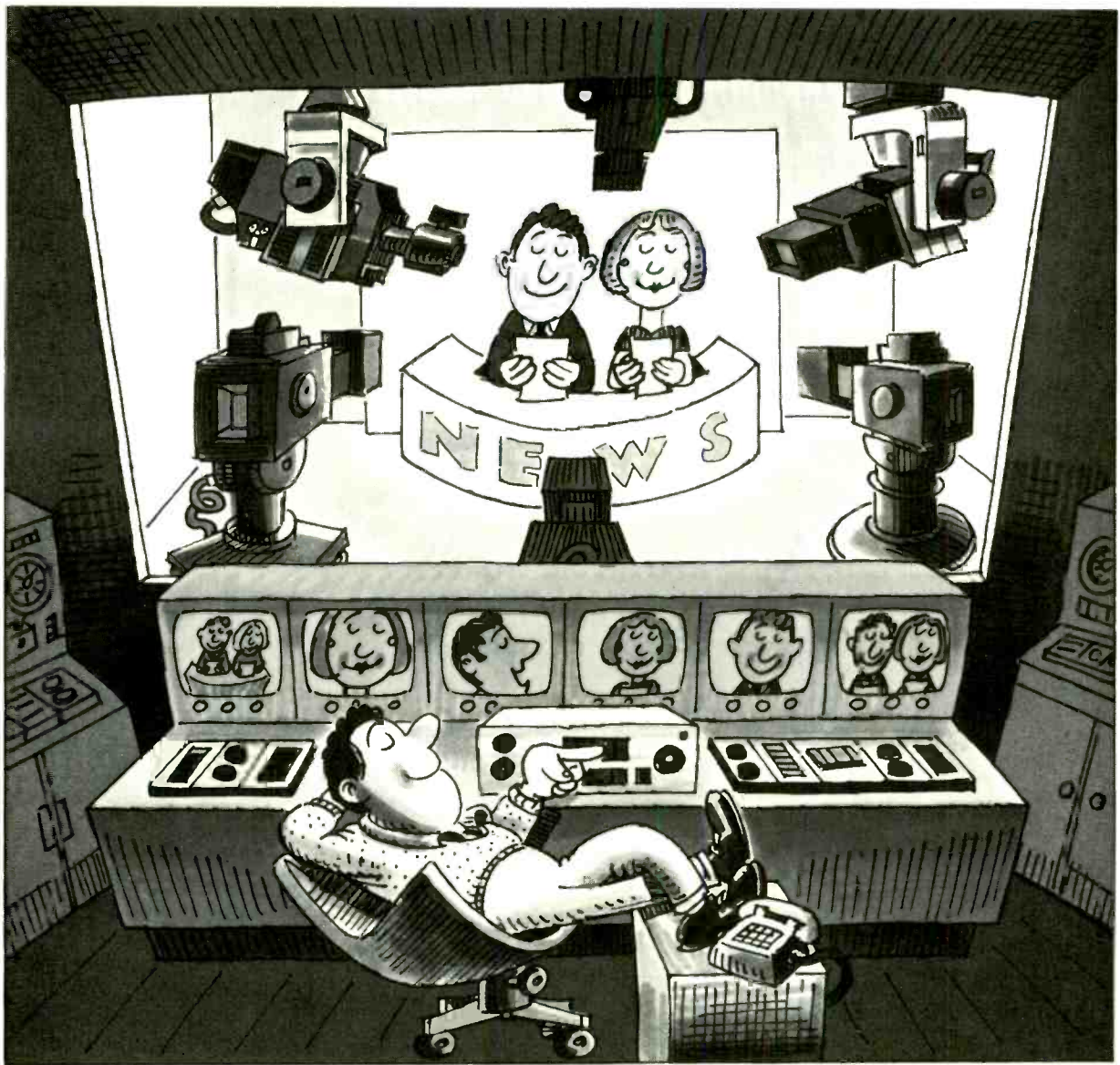
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San Francisco, CA 94103
415 421-3562

AVANTEK

3175 Bowers Ave.,
Santa Clara, CA 95054
408 727-0700

AVCOM OF VIRGINIA

500 Southlake Blvd.,
Richmond, VA 23236
804 794-2500
See ad on pg. 114

B

**BAF COMMUNICA-
TIONS CORP.**

17 Everberg Rd.,
Woburn, MA 01801
617 932-3223
HOTLINE: 800 633-8223

WILLIAM BAL CORP.

Box 875,
947 Newark Ave.,
Elizabeth, NJ 07207
201 354-9625
800 354-9625

**BALD MOUNTAIN
LAB**

230 Bellevue Rd.,
Troy, NY 12180
518 279-9753

**BALLY ENGINEERED
STRUCTURES**

Box 98, Bally, PA 19503
215 845-2311

BARBIZON

426 W. 55 St.,
New York, NY 10019
212 586-1620

BARCO

170 Knowles Dr. #212,
Los Gatos, CA 95003
408 370-3721

**BARCUS-BERRY
ELECTRONICS**

5500 Bolsa Ave. #245,
Huntington Beach, CA
92649
714 897-6766

**BARDWELL &
McALLISTER**

2621 Empire Ave.,
Burbank, CA 91504
213 849-5533
HOTLINE: 800 843-3198

**BASF SYSTEMS
CORP.**

35 Crosby Dr.,
Bedford, MA 01730
617 271-4000

BASYS

900 Stierlin Rd.,
Mountain View, CA 94043
415 969-9810

B&B SYSTEMS

28111 N. Ave. Stanford,
Valencia, CA 91355
805 257-4853
HOTLINE: 800 345-1056

BEAVERONICS

8 Haven Ave.,
Port Washington, NY
11050
516 883-4414

**BELAR ELECTRONICS
LABORATORY**

119 Lancaster Ave.
Box 76, Devon, PA 19333
215 687-5550
See ad on pg. 70

**BELDEN
COMMUNICATIONS**

See LEE LIGHTING

**BELDEN ELECTRONIC
WIRE & CABLE**

Box 1980, Richmond, IN
47375
317 983-5200
HOTLINE: 800 235-3362

BENCHER

333 W. Lake St.,
Chicago, IL 60606
312 263-1808

B.E.S.

12753 Moore St.,
Cerritos, CA 90701
HOTLINE: 800 592-4644

BEXT, INC.

739 Fifth Ave. #7A,
San Diego, CA 92101
619 339-8462

BEYER DYNAMIC

5-05 Burns Ave.,
Hicksville, NY 11801
516 935-8000

BGW SYSTEMS

13130 S. Yukon,
Hawthorne, CA 90250
213 973-8090
HOTLINE: 800 252-4800

BHP

1800 Winnemac Ave.,
Chicago, IL 60640
312 989-2140

BIAMP SYSTEMS

Box 2160, Portland, OR
97208-2160
503 641-7287

BIRD ELECTRONICS CORP.

30303 Aurora Rd.,
Solon, OH 44139
216 248-1200

**B&K PRECISION/
DYNASCAN**

6460 W. Cortland,
Chicago, IL 60635
312 889-8870

BLOCK RIVER VIDEO

641-14 Amphitheater Dr.,
Rockford, IL 61107
815 399-3102

**BLONDER-TONGUE
LABS**

1 Jake Brown Rd.,
Old Bridge, NJ 08857
201 679-4000

**BOGEN
COMMUNICATIONS**

50 Spring St., Box 575,
Ramsey, NJ 07446
201 934-8500

**BOGEN PHOTO
CORP.**

17-20 Willow St.,
Fair Lawn, NJ 04714
201 794-6500

**BOGNER BROAD-
CAST EQUIPMENT**

603 Cantiague Rock Rd.,
Westbury, NY 11590
516 997-7800

**BOONTON ELEC-
TRONICS CORP.**

791 Rte. 10, Randolph, NJ
07869
201 584-1077

**BOWEN BROADCAST
SERVICE**

8343 Lynn Haven Ave.,
El Paso, TX 79907
915 598-5556

**WALTER S. BREWER
CO.**

Box 35746, Tulsa, OK
74153-0746
918 493-7323
HOTLINE: 800 255-9458

BRINTEC CORP.

1600 W. Main St.,
Willimantic, CT 06226-
1128
203 456-8000

**BROADCAST AUDIO
CORP.**

11306 Sunco Dr.,
Rancho Cordova, CA
95670
916 635-1048

**BROADCAST
ELECTRONICS**

Box 3606, Quincy, IL
62305
217 224-9600

**BROADCAST MICRO-
WAVE SERVICES**

7322 Connvoy Ct.,
San Diego, CA 92111
619 560-8601

**BROADCAST
SUPPLY
WEST (BSW)**

7012 27 St. W.,
Tacoma, WA 98466
206 565-2301
800 426-8434

**BROADCAST
TECHNOLOGY**

Box 1310, Gunnison, CO
81230
303 641-5503

**BROADCAST
VIDEO SYSTEMS**

40 W. Wilmont St.,
Richmond Hills, Ont.,
Canada L4B 1H8
416 764-1584

**BRUEL & KJAER
INSTRUMENTS**

185 Forest St.,
Marlborough,
MA 01752-3093
617 481-7000

BRYSTON LTD.

57 Westmore Dr., Rexdale,
Ont., Canada M9V 3Y6
406 746-1800

**BSM BROADCAST
SYSTEMS**

Box 19007, Spokane, WA
99219
509 838-0110

**BTS/BROADCAST
TELEVISION
SYSTEMS**

Box 30816, 2300 S.W.,
Salt Lake City, UT
84130-0816
801 972-8000

BUSH & MILLIMAKI

80002 Arcadia Dr.,
Huntsville, AL 35801
205 533-9274

C**CABLEWAVE
SYSTEMS**

60 Dodge Ave.,
North Haven, CT 06473
203 239-3311

**CALAWAY ENGI-
NEERING, DIV.
QUANTA CORP.**

49 Baldwin Ave.,
Sierra Madre, CA 90024
818 355-2049

**CALHOUN SATELLITE
COMMUNICATIONS**

14871 NE 20th Ave.,
N. Miami, FL 33181
305 945-3737

CALICO VIDEO CO.

8955 Thorton Rd.,
Stockton, CA 95209
209 952-3333

**CALVERT
ELECTRONICS**

1 Branca Rd.,
E. Rutherford, NJ 07073
800 526-6362

CALZONE CASE CO.

225 Black Rock Ave.,
Bridgeport, CT 06605
203 367-5766
HOTLINE: 800 243-5152

CAM-LOK

10540 Chester Rd.,
Cincinnati, OH 45215-
0888
513 771-3171

**CAMBRIDGE
PRODUCTS**

244 Woodland Ave.,
Bloomfield, CT 06002
800 243-8814

CAMERA MART

456 W. 55 St.
New York, NY 10019
212 757-6977
See ad on pg. 50

CANARE CABLE

832 N. Victory Blvd.,
Burbank CA 91502
818 840-0993

CANON USA

One Canon Plaza,
Lake Success, NY 11042
516 488-6700

**CAPITOL MAGNETIC
PRODUCTS**

6920 Sunset Blvd.,
Hollywood, CA 90028
213 461-2701

CARVIN MFG. CORP.

1155 Industrial Ave.,
Escondido, CA 920251
619 747-1710
HOTLINE: 800 854-2235

CASCOM

707 18 Ave. S.,
Nashville, TN 37203
615 329-4112

CASES, INC.

447 E. Gardena Blvd.,
Gardena, CA 90248
213 770-4444

CAT SYSTEMS

401 E. 74 St.,
New York, NY 10021
212 988-8988

**CATEL TELECOM-
MUNICATIONS**

4050 Technology Pl.,
Fremont, CA 94537-5122
415 659-8988

DWIGHT CAVENDISH

2117 Chestnut Ave.,
Wilmette, IL 60091
312 256-0937

CBSI

Box 67, Reedsport, OR
97467
503 271-3681

CCI

7353 Lee Hwy.,
Chattanooga, TN 37421
615 894-2580

**CECO
COMMUNICATIONS**

2115 Ave. X,
Brooklyn, NY 11235
718 646-6300
HOTLINE: 800 221-0860

CEL ELECTRONICS

Chroma House, Shire Hill,
Saffron Walden, Essex,
UK CB11 3AQ
447 992-3817

CELWAVE

Rte. 79 Ryan Road.,
Marlboro, NJ 07746
201 462-1880

CENTRAL DYNAMICS

147 Hymus Blvd.,
Pointe Claire, Que.,
Canada H9R 1G1
514 597-0810

CENTRAL TOWER

Box 530, Newburgh, IN
47630
812 853-0595

CENTRO

369 Billy Mitchell Rd.,
Salt Lake City, UT 84116
801 537-7779
HOTLINE: 800 877-7779

**CENTURY
PRECISION
OPTICS**

10713 Burbank Blvd.,
N.Hollywood, CA 91601
818 766-3715

CETEC GAUSS

9130 Glen Oaks Blvd.,
Sun Valley, CA 91352
818 763-4323

CETEC IVIE

1366 W. Center, Orem, UT
84057
801 224-1800

CETEC VEGA

9900 Baldwin Pl.,
El Monte, CA 91731-2204
818 442-0782

CHANNELMATIC

821 Tavern Rd.,
Alpine, CA 92001
619 445-2691

**CHAMPION MOTOR
COACH**

5573 North St.
Dryden, MI 48428
313 796-2211

**CHOICE
ELECTRONICS**

Box 1475, Gainesville, FL
32602
904 375-4434

CHRISTIE ELECTRIC

20665 Manhattan Pl.,
Torrance, CA 90501
213 320-0808

CHRONO-LOG CORP.

2 W. Park Rd.,
Havertown, PA 19083
215 853-1130
HOTLINE: 800 247-6665

CHYRON

265 Spagnoli Rd.,
Melville, NY 11747
516 845-2027

CINE 60

630 Ninth Ave.,
New York, NY 10036
212 586-8782

**CINEMA PRODUCTS
CORP.**

3211 S. La Cienega Blvd.,
Los Angeles, CA 90016
213 836-7991

CINEMILLS CORP.

3500 W. Magnolia Blvd.,
Burbank, CA 91505
818 843-4560
HOTLINE: 800 325-7674

CIPHER DIGITAL

Box 170, Frederick, MD
21701
301 695-0200
HOTLINE: 800 331-9066

**CIRCUIT DEVELOP-
MENT CO.**

50 20 St., Brooklyn, NY
11232
718 768-4555

**CIRCUIT RESEARCH
LABS**

2522 W. Geneva Dr.,
Tempe, AZ 85282
602 438-0888
HOTLINE: 800 535-7648

CIRCUIT STUDIOS

5420 Butler Rd.,
Bethesda, MD 20816
301 656-5918

DAVID CLARK CO.

Box 15054, Worcester, MA
01615-0054
617 756-6216

CLEAR-COM

1111 17 St.,
San Francisco, CA 94107
415 861-6666

CMC LTD.

601 Chestnut Ridge,
Chestnut Ridge, NY 10977
914 356-5300

**CMC TECHNOLOGY,
DIV. OF DATATAPE**

2650 Lafayette St.,
Santa Clara, CA 95050
408 980-9800

CMX CORP.

2230 Martin Ave.,
Santa Clara, CA 95050
408 988-2000

COASTCOM

2312 Stanwell Dr., Box
27068, Concord, CA 94527
415 825-7500

COAXIAL DYNAMICS

15210 Industrial Pky.,
Cleveland, OH 44135
216 267-2233
HOTLINE: 800 COAXIAL

**COHERENT
COMMUNICATIONS**

13756 Glenoaks Blvd.,
Sylmar, CA 91342
818 362-9393

COLORADO VIDEO

Box 928, Boulder, CO
80306
303 530-9580

**COLORGRAPHICS
SYSTEMS**

6400 Enterprise Rd.,
Madison, WI 53719
608 274-5786
HOTLINE: 800 248-1050

COLORTRAN

1015 Chestnut St.,
Burbank, CA 91506
818 843-1200

**COLUMBINE
SYSTEMS**

1707 Pull Blvd.,
Golden, CO 80401
303 237-4000

**COMAD
COMMUNICATIONS**

1435 Bonhill Rd., Unit 34,
Mississauga, Ont., Canada
L5T 1M1
416 676-9171

**COMARK COMMUNI-
CATIONS, DIV. OF
THOMPSON-CSF**

Box 506, Colmar, PA
18915
215 822-0777
See ad on pg. 10

**COMPREHENSIVE
VIDEO SUPPLY**

148 Veteran Dr.,
Northvale, NJ 07647
201 767-7990

COMPRESSION LABS

2860 Junction Ave.,
San Jose, CA 95131
408 435-3000

COMPU = PROMPT

746 N. Cahuenga Blvd.,
Los Angeles, CA 90038
213 461-3113

COMPUSONICS

2345 Yale St., Palo Alto,
CA 94306
415 494-1184

COMPUTER CONCEPTS CORP.

8375 Melrose Dr.,
Lenexa, KS 66214
913 541-0900
HOTLINE: 800 255-6350

COMPUTER GRAPHICS LABS

4 Expressway Plaza,
Roslyn Heights, NY 11577
516 484-1944

COMPUTER LABS, DIV. ANALOG DEVICES

7910 Triad Ctr. Dr.,
Greensboro, NC 27409
919 668-9511

COMPUTER PROMPTING CORP.

3408 Wisconsin Ave N.W.,
#201, Washington, DC
20016
202 966-0980

COMREX CORP.

65 Nonset Path,
Acton, MA 01720
617 263-1800
800 237-1776

COMTECH ANTENNA CORP.

3100 Communications Rd.,
St. Cloud, FL 32769
305 892-6111

COMTEK

357 W. 2700 S.,
Salt Lake City, UT 84115
801 466-3463

COMWAVE

Box 69, 7 N. Main St.,
Mountaintop, PA
18707
717 474-6751

CONCEPT PRODUCTIONS

1224 Coloma Way,
Roseville, CA 95661
916 782-7754
800 348-4800

CONEX ELECTRO-SYSTEMS

Box 1342, Bellingham, WA
98227
206 734-43232
See ad on pg. 46

CONIFER

Box 1025, 1400 N. Roosevelt,
Birmingham, IA
52601

CONNECT-AIR INTL.

50 37 St. NE, Auburn, WA
98002
206 939-4800
HOTLINE: 800 247-1978

CONNECTRONICS CORP.

652 Glenbrook Rd.,
Stamford, CT 06906
203 324-2889
HOTLINE: 800 322-2537

CONNOLLY SYSTEMS

Unit 7, Intec 2, Wade Rd.,
Basingstoke, Hants, UK
RG24 ONE
256-470474

CONRAC CORP., DISPLAY PROD.

600 N. Rimsdale Ave.,
Covina, CA 91722
818 966-3511

CONTINENTAL ELECTRONIC/CONTEL

1620 W. 32 Pl.,
Hialeah, FL 33012
305 822-1421

CONTINENTAL ELECTRONICS/ VARIAN

4212 S. Buckner Blvd.,
Box 270879, Dallas, TX
75227
214 381-7161

CONTROL CONCEPTS

328 Water St., Box 1380,
Binghamton, NY 13902-
13800
607 724-2484

CONUS COMMUNICATIONS

3415 University Ave.,
Minneapolis, MN 55414
612 642-4645

COOL-LUX LIGHTING IND.

5723 Auckland Ave.,
N.Hollywood, CA 91601
818 761-6116

CORPORATE COMMUNICATIONS CONSULTANTS

64 Clinton Rd.,
Fairfield, NJ 07006
201 226-5938

COTTONWOOD COMMUNICATIONS

774 Main St., Box 526
Los Alamos, CA 93440
805 344-3335

COUNTRYMAN ASSOCIATES

417 Stanford Ave.,
Redwood City, CA 94063
415 364-9988

CROSSPOINT LATCH CORP.

95 Progress St., Union, NJ
07083
201 688-1510

CROWN INTERNATIONAL

1718 W. Mishawaka Rd.,
Elkhart, IN 46517
219 294-8000

CUBICOMP

21325 Cabot Blvd.,
Hayward, CA 94545
415 887-1300

CURRENT TECHNOLOGY

1400 S. Sherman, #202,
1279 Richardson, TX 75801
1280214 238-5300
See ad on pg. 44

D**DABURN ELECTRONICS & CABLE CORP.**

70 Oak St., Norwood, NJ
07648
201 768-5400

PETER W. DAHL

5869 Waycross Ave.,
El Paso, TX 79924
915 751-2300

DALSAT SATELLITE COMMUNICATIONS

1701 Summit Ave.,
Plano, TX 75074
214 578-7561

DATA PRECISION CORP.

Electronics Ave.,
Danvers, MA 01923
617 246-1600

DATACOUNT

Box 3078, Opelika, AL
36803-3078
205 749-5641

DATATEK CORP.

1121 Bristol Rd.,
Mountainside, NJ 07092
201 654-8100
800 882-9100

DATAWORLD

Box 30730,
4827 Rugby Ave, #200,
Bethesda, MD
20814
301 652-8822
800 368-5754

DATUM

1363 S. State College
Blvd., Anaheim, CA 92806
714 533-6333

DAX AUDIO GROUP

1231 S.E. Gideon,
Portland, OR 97202
503 232-4445

dbx

71 Chapel St.,
Newton, MA 02195
617 964-3210

DELTA ELECTRONICS

5730 Gen. Washington Dr.,
Alexandria, VA 22312
703 354-3350
See ad on pg. 36

DESISTI LIGHTING/DESMAR CORP.

1109 Grand Ave.,
N. Bergen, NJ 07047
201 792-4980

DeWOLF MUSIC LIBRARY

25 W. 45 St.,
New York, NY 11036
212 382-0220

DI-TECH

48 Jefryn Blvd.,
Deer Park, NY 11729
516 667-6300
800 595-1012

DIALIGHT CORP.

1913 Atlantic Ave.,
Manasquan, NJ 08736
201 223-9400

DICTAPHONE CORP.

120 Old Post Rd.,
Rye, NY 10580
914 967-7300

DIELECTRIC COMMUNICATIONS

Tower Hill Rd.,
Raymond,
ME 04071
207 655-4555

DIGITAL ARTS

7370-Q Opportunity Rd.,
San Diego, CA 92111-2225
619 541-2055

DIGITAL AUDIO RESEARCH

Box 275, Rheem Valley,
CA 94570
415 376-2760

DIGITAL CREATIONS

50 Werman Ct.,
Plainview, NY 11803
516 756-9620

DIGITAL PROCESSING SYSTEMS

55 Nugget Ave., Unit 10
Scarborough, ON M15 3L1
416 754-8090

DIGITAL SERVICES CORP./DSC

3622 N.E. 4 St.,
Gainesville, FL 32609
904 377-8013

DOLBY LABORATORIES

100 Potrero Ave.,
San Francisco, CA 94103
415 558-0200
See ad on pg. 12

DORROUGH ELECTRONICS

5221 Collier Pl.,
Woodland Hills, CA 91364
818 999-1132

DUBNER COMPUTER SYSTEMS

6 Forest Ave.,
Paramus, NJ 07652
201 845-8900

DX COMMUNICATIONS

10 Skyline Dr.,
Hawthorne, NY 10532
914 347-4040

DYNAIR ELECTRONICS

5275 Market St.,
San Diego, CA 92114
619 263-7711

DYNAMIC TECHNOLOGY

13 Cumberland Ave.,
Park Royal, London, UK
NW107RH
216 267-7700

DYNATECH NEWSTAR

6400 Enterprise Ln.,
Madison, WI 53719
608 274-8686

**EASTMAN KODAK**

343 State St., Rochester,
NY 14650
716 724-4000
See ad on pg. 33

ECHOLAB

175 Bedford Rd.,
Burlington, MA 01803
617 273-1512

ECS COMPOSITES

3560 Rogue River Hwy.,
Box 188, Grants Pass, OR
97526
503 476-8871

EDCOR

Box 17418, Irvine, CA
92713
714 648-0292

EDITRON USA

748 N. Seward St.,
Hollywood, CA 90038
213 464-8723

EECO/CONVERGENCE

1601 E. Chestnut Ave.,
Box 659, Santa Ana, CA
92702
714 835-6000

EEG ENTERPRISES

1 Rome St., Farmingdale,
NY 11735
516 293-7472

EEV

4 Westchester Plaza,
Elmsford, NY 10523
914 592-6050
800 431-1230
See ad on pg. 115

EG&G

35 Congress St.,
Salem, MA 01970
617 745-3200

EIDSON ELECTRONIC CO.

Box 3751, 3409 W. Pecan
Dr., Temple, TX 76501
817 773-3901

EIGEN VIDEO

Box 848, Nevada City, CA
95959
916 265-2020

ELCOM BAUER

6199 Warehouse Way,
Sacramento, CA 95826
916 381-3750

ELCON ASSOCIATES

4700 Chase Ave.,
Lincolnwood, IL 60646
312 677-3000

ELECTRIC WORKS

14925 Waverly, Irvine, CA
92714
714 551-3998

ELECTRO CONTROLS

2975 S. 300 W.,
Salt Lake City, UT 84115
801 487-9861
800 453-7435

ELECTRO IMPULSE LAB

116 Chestnut St., Box 870,
Red Bank, NJ 07701
201 741-0404

ELECTRO-SOUND

160 San Gabriel Dr.,
Sunnyvale, CA 94086
408 245-6600

ELECTRO-VOICE

600 Cecil St., Buchanan,
MI 49107
616 695-6831
See ad on pg. 110

ELECTROHOME

809 Wellington St. N.,
Kitchener, Ont.,
Canada N2G 4J6
519 744-7111

ELECTRONICS DIVERSIFIED

1675 N.W. 216 Ave.,
Hillsboro, OR 97124
503 645-5533

ELECTRONICS RESEARCH

108 Market St.,
Newburgh, IN 47630
812 853-3318

ELICON

940 S. Leslie St.,
La Habra, CA 90631
714 870-6647

ELLIS TOWER CO.

Box 23217, Ft. Lauderdale,
FL 33307
305 566-6432

EMCEE BROADCAST PRODUCTS

Box 68, White Haven, PA
18661
717 443-9575
800 233-6193

EMCOR/CRENLO

1600 Fourth Ave. N.W.,
Rochester, MN 55901
507 289-3371

EMERGENCY ALERT RECEIVER

Box 20629, New York, NY
10025
212 695-4767

ENCLOSURE CORP.

2900 Wharton Rd.,
Briston, PA 19007
215 785-2900

ENERTEC SCHLUMBERGER/ PROFESSIONAL AUDIO

1 Rue Neiuport, 78140
Velizy Villacoublay,
France
1 30703070

E-N-G CORP.

2930 Cloverdale Ave.,
Concord, CA 94520
415 798-4060

ENG HELICOPTER PRODUCTIONS, LTD.

9910 Carter Rd.,
Bethesda, MD 20817
301 469-8109

ENTERPRISE ELECTRONICS

Box 1216, Industrial Park,
Enterprise, AL 36331
205 347-3478

ENVIRONMENTAL TECHNOLOGY

1302 High St.,
South Bend, IN 46618
219 232-1202

ESC ELECTRONICS

534 Bergen Blvd., Palisades Park, NJ 07650
201 947-0400

ESD

5200 Auth Rd.,
Suitland, MD 20746
301 423-2113

ESE

142 Sierra St.,
El Segundo, CA 90245
213 322-2136

ESL

120 S.W. 21 Terrace,
#C104, Ft. Lauderdale,
FL 33312
305 583-0626

EVENTIDE

1 Alsan Way,
Little Ferry,
NJ 07643
201 641-1200

EVERTZ MICROSYSTEMS

3465 Mainway,
Burlington, Ont.,
Canada L7M 1A9
416 335-3700

EXCALIBUR INDUSTRIES

12427 Foothill Blvd.,
Lake View Terrace,
CA 91342
818 899-2547

EXPRESS TOWER CO.

Box 37, Locust Grove, OK
74352
918 479-6484

EXR

3373 Oak Knoll Dr.,
Brighton, MI 48116
313 227-6122

F**FAIRLIGHT INSTRUMENTS**

2945 Westwood Blvd.,
Los Angeles, CA 90064
213 470-6280

FANTASEE LIGHTING

404 N. River,
Ypsilanti, MI 48198
313 482-6565

FAROUDJA LABS

946 Benicia Ave.,
Sunnyvale, CA 94086
408 245-1492

FARRTRONICS

45 Cambell,
Kitchener, Ont., Canada
N2H 4X8
519 741-1010
800 265-2713

FIBERBILT CASES

601 W. 26 St.,
New York, NY 10001
212 675-5820

FIDELIPAC

Box 808, Moorestown, NJ
08057
609 235-3900
*HOTLINE: 800 HOT
TAPE*
See ad on pg. 3

FILM/VIDEO EQUIPMENT SERVICE

800 S. Jason St.,
Denver, CO 80223
303 778-8616

FIRSTCOM BROADCAST SERVICES

13747 Montfort #220,
Dallas, TX 75240
214 934-2222
HOTLINE: 800 858-8880

FISHER BERKELEY CORP.

5800 Christie Ave.,
Emeryville, CA 94608
415 655-9696

FLASH TECHNOLOGY

55 Lake St., Nashua, NH
03060
603 883-6500

FLORICAL SYSTEMS, INC.

2201 NW 24th Ave.,
Gainesville, FL 32605
904 372-8326

JOHN FLUKE MFG. CO.

Box C9090, Everett, WA
98296
800 426-0361

FOR-A CORP. OF AMERICA

320 Nevada St.,
Newton, MA 02160
617 244-3223

FOROX CORP.

393 West Ave.,
Stamford, CT 06902
203 324-7400

FORT WORTH TOWER

Box 8597, Fort Worth, TX
76124-0597
817 457-3060

FORTEL

6420 Atlantic Blvd., #100,
Norcross, GA 30071
404 449-4343

FOSTEX

15431 Blackburn Ave.,
Norwalk, CA 90650
213 921-1112
See ad on pg. 58

FREELAND PRODUCTS CO.

Rt. 7 Box 628,
Covington, LA 70433
504 893-1243
HOTLINE: 800 624-7626

FREZZOLINI ELECTRONICS

5 Valley St.,
Hawthorne, NJ 07506
201 427-1160

FUJI PHOTO FILM

555 Taxter Rd.,
Elmsford, NY 10523
914 789-8100

FUJINON

10 Highpoint Dr.,
Wayne, NJ 07470
201 633-5600

FUTUREVIDEO PRODUCTS

29901 Weatherwood Ave.,
Laguna Niguel, CA 92677
714 495-2621

G**GABRIEL ELECTRONICS**

Box 70, Libby Rd.,
Scarborough, ME 04074
207 883-5161

GARNER INDUSTRIES

4200 N. 48 St.,
Lincoln, NE 68504
402 464-5911

GE BROADCAST SYSTEMS INTEGRATION

701 Ashland Ave.
Folcroft, PA 19032
215 583-68054

GENERAL ELECTRIC CO., LIGHTING BUSINESS GROUP

Nela Pk., Cleveland, OH
44112
216 266-2121
HOTLINE: 800 626-2000

GENERAL ELECTRIC CO., PROJECTION DISPLAY

Electronics Park 6-205,
Syracuse, NY 13221
315 456-2152

GENERAL ELECTRIC/COMBAND

1 College Blvd.,
Portsmouth, VA 23705
804 483-5773

GENERIC COMPUTER SYSTEMS

357 N. Main St.,
Butler, PA 16001
412 283-1500

GENEVA GROUP

9909 S. Shore Dr.,
Plymouth, MN 55441
612 546-5620

GENIGRAPHICS

4806 W. Taft Rd.,
Liverpool, NY 13008
315 452-6600

GENTNER ENGINEERING CO.

540 W. 3560 South,
Salt Lake City,
UT 84115
801 268-3400

GENTNER RF PRODS. DIV.

Box 32550, San Jose, CA
95152
408 926-3400
HOTLINE: 800 268-1117

GML AMERICA

8547 Grovemont Cir.,
Gaithersburg, MD 20877
301 670-9696

G&M POWER PRODUCTS

943 N. Orange Dr.,
Los Angeles, CA 90038
213 850-6800
800 621-0849

ALAN GORDON ENTERPRISES

1430 Cahuenga Blvd.,
Hollywood, CA 90078
213 466-3561

GORMAN REDLICH MFG.

257 W. Union St.,
Athens, OH 45701
614 593-3150

GOTHAM AUDIO

1790 Broadway,
New York, NY 10019
212 765-3410

GRAHAM-PATTEN SYSTEMS

Box 1960,
Grass Valley, CA 95945
916 273-8412

THE GRASS VALLEY GROUP

Box 1114,
Grass Valley, CA 95945
916 478-3000
HOTLINE: 800 825-5127

GRAY COMMUNICATIONS CONSULTANTS

Box 3229, Albany, GA
31708
912 883-2121
HOTLINE: 800 472-9266

GRAY ENGINEERING LABS

504 W. Chapman Ave. #P,
Orange, CA 92668
714 997-4151
See ad on pg. 46

GRINNAN FIXTURE CO.

16041 Georgetown St. NE,
Minerva, OH 44657
216 862-2799

GRUMMAN ELECTRONICS SYSTEMS

Sunrise Hwy.,
Great River, NY 11714
516 224-6001

JAMES GRUNDER ASSOCIATES

5925 Beverly,
Mission, KS 66202
913 831-0188

GTE COMMUNICATIONS SYSTEMS CORP.

2500 W. Utopia Rd.,
Phoenix, AZ 85027
602 582-7000

GTE/SYLVANIA

100 Endicott St.,
Danvers, MA 01923
617 777-1900

H**HALLIKAINEN & FRIENDS**

141 Suburban Rd., Bldg.
E4, San Luis Obispo,
CA 93401
805 541-0200

HARDIGG INDUSTRIES

393 N. Main St.,
S. Deerfield, MA 01373
413 665-2163

HARRIS CORP., BROADCAST DIV.

Box 4290, 3200 Wisnann
Ln., Quincy, IL 62305
217 222-8200

HARRIS CORP., BROADCAST MICROWAVE

960 Linda Vista,
Mountain View, CA 94043
415 969-9100

HARRIS CORP., BUSINESS COMMUNICATIONS DIV.

Box 1700,
Melbourne, FL 32901
407 724-3000

HARRIS CORP., VIDEO SYSTEMS DIV.

Box 4290,
Quincy, IL 62305
217 222-8200

HARRISON SYSTEMS

Box 290157,
Nashville, TN 37229
615 834-1184

HEDCO (SUBSIDIARY OF LEITCH VIDEO)

Box 1985,
Grass Valley, CA 95945
916 273-9524
HOTLINE: 800 433-2648
See ad on pg. 48

KARL HEITZ, INC.

Box 427,
Woodside, NY 11377
718 565-0004

HEWLETT-PACKARD CO.

1620 Signal Dr., TAFC-34,
Spokane, WA 99220
509 927-3893

HIPOTRONICS, POWER PRODUCTS DIV.

Rte. 22 & 199, Drawer W,
Millerton, NY 12546
518 789-6464

RICHARD HIRSCHMANN OF AMERICA

Box 229, Riverdale, NJ
07457
201 835-5002

HITACHI DENSHI AMERICA

175 Crossways Park W.,
Woodbury, NY 11797
516 921-7200

HM ELECTRONICS

6675 Mesa Ridge Rd.,
Box 210510,
San Diego, CA 92121
619 535-6000

HOFFEND & SONS

34 E. Main St.,
Honeoye, NY 14471
716 229-5998

HOLADAY INDUSTRIES

14825 Martin Drive.,
Eden Prairie, MN 55344
612 934-4920

HOTRONIC

1875 S. Winchester Blvd.,
Campbell, CA 95008
408 378-3883

HOWE TECHNOLOGIES

2300 Central Ave., #E,
Boulder, CO 80301
303 444-4693

HUBBARD COMMUNICATIONS CORP./HUBCOM

12495 34 St. N.,
St. Petersburg, FL 33716
813 572-7759
HOTLINE: 800 523-2397

**IGM COMMUNICATIONS**

282 W. Kellogg Rd.,
Bellingham, WA 98226
206 733-4577

IKEGAMI ELECTRONICS

37 Brook Ave.,
Maywood, NJ 07607
201 368-9171
HOTLINE: 800 526-5368

IMAGE VIDEO

705 Progress Ave. #46,
Scarborough, Ont., Canada
M1H 2X1
416 438-3940
See ad on pg. 47

IMS/INTEGRATED MEDIA SYSTEMS

1552 Laurel St.,
San Carlos, CA 94070
415 592-8005

INDUSTRIAL RESEARCH PRODUCTS

321 Bond St., Elk Grove
Village, IL 60007
312 439-3600
HOTLINE: 800 255-6993

INMARK CORP.

147 W. Cedar St.,
Norwalk, CT 06854
203 866-8474

INOVONICS

1305 Fair Ave.,
Santa Cruz, CA 95060
408 458-0552

INTERACTIVE MOTION CONTROL

8671 Hayden Pl.,
Culver City, CA 90232
213 559-6146

INTERAND CORP.

3200 W. Peterson Ave.,
Chicago, IL 60659
312 478-1700

INTERGROUP TECHNOLOGIES

2040 N.W. 67 Pl.,
Gainesville, FL 32606
904 335-0901

INTERNATIONAL MICROWAVE CORP.

65 Commerce Rd.,
Stamford, CT 06902
203 323-5599

INTERNATIONAL NUCLEAR CORP.

608 Norris Ave.,
Nashville, TN 37204
615 254-3365

INTERNATIONAL TAPETRONICS CORP./3M

2425 S. Main St., Box 241,
Bloomington, IL 61702
309 828-1381
800 447-0414
See ad on pg. 99

INTERNATIONAL TELETRONICS

Box 738, 1 Airport Dr.,
Williamstown, NJ 08094
609 728-5152

ISS ENGINEERING

104 Constitution #4,
Menlo Park, CA 94025
415 853-0833
HOTLINE: 800 227-6288

ITE/INNOVATIVE TELEVISION EQUIPMENT

Box 681, Woodland Hills,
CA 91365
818 888-9421

ITELCO

1620 W. 32 Pl.,
Hialeah, FL 33012
305 822-1421

ITI ELECTRONICS

12 Kulick Rd.,
Fairfield, NJ 07006
201 882-6405

ITS CORP.

375 Valley Brook Rd.,
McMurray, PA 15317
412 941-1500

ITT JENNINGS

970 McLaughlin Ave.,
San Jose, CA 95122
408 292-4025
HOTLINE: 800 227-8452

J**JAMPRO ANTENNAS**

6939 Power Inn Rd.,
Sacramento, CA 95828
916 383-1177

JASONI ELECTRONICS

2900 E. Charleston Bldg.
#197, Las Vegas, NV
89104
702 384-0081

JBL PROFESSIONAL

8500 Balboa Blvd.,
Northridge, CA 91329
818 893-8411

JEFFERSON PILOT DATA SYSTEMS

501 Archdale Dr.,
Charlotte, NC 28217
704 529-3901

JENSEN TOOLS

7815 S. 46 St.,
Phoenix, AZ 85004
602 968-6241

JENSEN TRANSFORMERS

10735 Burbank Blvd.,
N. Hollywood, CA 91601
213 876-0059

J-LAB

Box 6530, Mailbu, CA
90264
213 457-4090

JOHNSON ELECTRONICS

Box 4728, 4301 Metric Dr.,
Winter Park, FL 32793
305 677-4030

JVC CO. OF AMERICA, PROFESSIONAL VIDEO COMM.

41 Slater Dr.,
Elmwood Park, NJ 07407
201 794-3900

*HOTLINE: 800 582-5825**See ad on pg. 24***K****KAHN COMMUNICATIONS**

425 Merrick Ave.,
Westbury, NY 11590
516 222-2221

KAITRONICS CORP.

890 Cowan Rd.,
Burlingame, CA 94010
415 697-9102

KAMAN SCIENCES

1500 Garden of the Gods
Rd., Colorado Springs, CO
89007
303 599-1470

KANGAROO VIDEO PRODUCTS

10845 Wheatlands Ave.,
Santee, CA 92071
619 273-4197

KAVOURAS

6301 34 Ave. S.,
Minneapolis, MN 55450
612 726-9515

*HOTLINE: 800 328-2278***KAY ELEMETRICS CORP.**

12 Maple Ave.,
Pine Brook, NJ 07058
201 227-2000

KAY INDUSTRIES

604 N. Hill St.,
South Bend, IN 46617
219 234-0171

KELTEC FLORIDA

50 Second St., Box 862,
Shalimar, FL 32579
904 651-9749

KEYSTONE VIDEO CORP.

468 Getty Ave.,
Clifton, NJ 07015
201 546-2800

K&H PRODUCTS/ PORTABRACE

Box 247, N. Bennington,
VT 05257
802 442-8171

KINEMATRICS/ TRUE-TIME

3243 Santa Rose Ave.,
Santa Rose, CA 95407
707 528-1230

KING INSTRUMENT CORP.

80 Turnpike Rd.,
Westboro, MA 01581
617 366-9141

KINGS ELECTRONICS CO.

40 Marbledale Rd.,
Tuckahoe, NY 10707
914 793-5000

KINTEK

224 Calvary St., Box 9143,
Waltham, MA 02254-9143
617 894-6111

KINTRONIC LABS

Box 845, Bristol, TN
37621-0845
615 878-3141

KLIEGL BROS.

5 Aerial Way,
Syosset, NY 11791
516 937-3900

KLINE IRON & STEEL CO.

1225 Huger St., Box 1013,
Columbia, SC 29202
803 251-8000

KNOX VIDEO PRODUCTS

8547 Grovemont Cl.,
Gaithersburg, MD 20877
301 840-5805

L**LAIRD TELEMEDIA**

2424 S. 2570 West,
Salt Lake City, UT 94119
801 972-5900

LAKE SYSTEMS CORP.

287 Grove St.,
Newton, MA 02166
617 244-6881
HOTLINE: 800 848-4840
See ad on pg. 31

LANDY ASSOCIATES

1890 E. Marlton Pike,
Cherry Hill, NJ 08003
609 424-4660
See ad on pg. 45

LARCAN COMMUNICATIONS EQUIPMENT

6520 Northam Dr.,
Mississauga, Ont.,
Canada L4V 1H9
416 678-9970

LDL COMMUNICATIONS

14440 Cherry Ln. Ct.,
#201, Laurel, MD 20707
301 498-2200

LEA DYNATECH

12516 Lakeland Rd.,
Santa Fe Springs, CA
90670
213 944-0916
HOTLINE: 800 654-8087

LEADER INSTRUMENTS

380 Oser Ave.,
Hauppauge, NY 11788
516 231-6900
HOTLINE: 800 645-5140

LEAMING INDUSTRIES

180 McCormick Ave.,
Costa Mesa, CA 92626
714 979-4511

LECTROSONICS

Box 12617,
Albuquerque, NM 87195
505 831-1010
HOTLINE: 800 821-1121

LEE LIGHTING AMERICA

534 W. 25 St.,
New York, NY 10001
212 691-1910

LEITCH VIDEO

825K Greenbrier Cir.,
Chesapeake, VA 23320
804 424-4720
800 231-9673
10 Dyas Rd., Don Mills,
Ont., Canada M3B 1V5
416 445-9640
800 387-0233
See ad on pg. 34

LENCO ELECTRONICS

300 N. Maryland St.,
Jackson, MO 63755
314 243-3147
HOTLINE: 800 325-8494

LERRO ELECTRICAL CORP.

3125 N. Broad St.,
Philadelphia, PA 19132
215 223-8200

LEXICON

100 Beaver St.,
Waltham MA 02154
617 891-6790

LIGHTING METHODS

1099 Jay St.,
Rochester, NY 14611
716 328-1020

LIGHTNING ELIMINATORS & CONSULTANTS

219 S. Jefferson,
Springfield, MO 65806
417 862-5533
800 641-4674

LIPSNER-SMITH CO.

4700 Chase Ave.,
Lincolnwood, IL 60646
312 677-3000
HOTLINE: 800 323-7520

LISTEC VIDEO CORP.

30 Oser Ave.,
Hauppauge, NY 11788
516 273-3020

LNR COMMUNICATIONS

180 Marcus Blvd.,
Hauppauge, NY 11788
516 273-7111

LOGITEK

3320 Bering Dr.,
Houston, TX 77057
713 782-4592
HOTLINE: 800 231-5870
See ad on pg. 114

LOWELL-LIGHT MFG.

475 Tenth Ave.,
New York, NY 10018
212 947-0950

LPB

28 Bacton Hill Rd.,
Frazer, PA 19355
215 644-1123

L&R COMMUNICATIONS LTD.

Box 3807, Sioux City, IA
51102
712 252-4101
HOTLINE: 800 831-0974

LTM CORP. OF AMERICA

11643 Peleton St.,
Sun Valley, CA 91352
213 460-6166

LUXOR

2245 Delaney Rd.,
Waukegan, IL 60085
312 244-1800

L-W INTERNATIONAL

255 E. East St.,
Simi Valley, CA 93065
805 522-3284

LYON LAMB VIDEO ANIMATION

4531 Empire Ave.,
Burbank, CA 91505
818 843-4831

M**3M BROADCASTING & RELATED PRODUCTS DIV.**

3M Center, Bldg., 223-58-
08, St. Paul, MN 55144
612 733-9073

3M MAGNETIC MEDIA DIV.

Bldg. 223-5N, 3M Center,
St. Paul, MN 55144
612 733-8765
See ad on pg. 40-41

3M STORMSCOPE WEATHER MAPPING SYSTEMS

223-3N-01 3M Center,
St. Paul, MN 55144
612 733-8878

MACKENZIE LABORATORIES

5507 N. Peck Rd.,
Arcadia, CA 91006
818 579-0440

M/A-COM MAC

5 Omni Way,
Chelmsford, MA 01824
617 272-3100

M/A-COM TELECOMMUNICATIONS DIV.

11717 Exploration Ln.,
Germantown, MD 20874
301 428-5500

MAGNA-TECH ELECTRONIC CO.

630 Ninth Ave.,
New York, NY 10036
212 586-7240
See ad on pg. 111

MAGNETIC REFERENCE LAB

229 Polaris Ave. #4,
Mountain View, CA 94043
415 965-8187

MAGNI SYSTEMS

9500 SW Gemini Dr.,
Beaverton, OR 97005
503 626-8400
HOTLINE: 800 237-5964
See ad on pg. 101

MAGNUM TOWERS

9370 Elder Creek Rd.,
Sacramento, CA 95829
916 381-5053

MARATHON PRODUCTS

334 W. Boylston St.,
W. Boylston, MA 01583
617 853-0988

MARCOM

Box 66507,
Scotts Valley, CA 95066
408 438-4273

MARCONI INSTRUMENTS

3 Pearl Ct.,
Allendale, NJ 07401
201 934-9050
HOTLINE: 800 233-2955

MARK ANTENNA PRODUCTS

2180 S. Wolf Rd.,
Des Plaines, IL 60018
312 298-9420

MARSHALL ELECTRONICS

Box 438, Brooklandville,
MD 21022
301 484-2220

MARTI ELECTRONICS

Box 661, 1501 N. Main,
Cleburne TX 76031
817 645-9163

MATCO

427 Perrymont Ave.,
San Jose, CA 95125
408 998-1655

MATRIX SYSTEMS CORP.

5177 N. Douglas Fir Rd.,
Calabasas, CA 91302
818 992-6776

MATTHEWS STUDIO EQUIPMENT

2405 Empire Ave.,
Burbank, CA 91504
818 843-6715

MAXELL CORP. OF AMERICA

22-08 Rt. 205 S.,
Fairlawn, NJ 07410
201 794-5900
HOTLINE: 800 533-2836
See ad on pg. 18

McCURDY RADIO

108 Carnforth, Toronto,
Ont., Canada M4A 2L4
416 751-6262
See ad on pg. 56

MCG ELECTRONICS

12 Burt Dr.,
Deer Park, NY 11729
516 586-5125
HOTLINE: 800 851-1508

MCL

501 S. Woodcreek Rd.,
Bolingbrook, IL 60439-
4999
312 759-9500
See ad on pg. 113

McMARTIN INDUSTRIES

201 35 Ave.,
Council Bluffs, IA 51501
402 331-7515

MEDIA COMPUTING

13951 N. Scottsdale Rd.,
#222 Scottsdale, AZ 85254
602 483-9045

MEDIA GENERAL BROADCAST SERVICE

2714 Union Ave. Ext.,
Memphis, TN 38112
901 320-4212

MERLIN ENGINEERING WORKS

2440 Embarcadero Way,
Palo Alto, CA 94303
415 856-0900

MICRO COMMUNICATIONS

Box 4365,
Manchester, NH 03108
603 624-4351

MICRO CONTROLS

Box 728, Burleson, TX
76028
817 295-0965

MICRO-TRAK CORP.

165 Front St.,
Chicopee, MA 01013
413 594-8501
HOTLINE: 800 358-8729

MICRODYNE CORP.

491 Oak Rd.,
Ocala, FL 32672
904 687-4633

MICROFLECT CO.

Box 12985, 3575 25 St.
SE,
Salem, OR 97309
503 363-9267

MICRON AUDIO PRODUCTS

210 Westlake Dr.,
Valhalla, NY 10595
914 761-6520

MICROSONICS

60 Winter St.,
Weymouth, MA 02188-
3336
617 337-4200

MICROTOME

1280 Blue Hills Ave.,
Bloomfield, CT 06002
203 242-4242
HOTLINE: 800 243-1570
See ad on pg. c3

MICROTRAN CO.

145 E. Mineola Ave.,
Box 236, Valley Stream,
NY 11582
516 561-6050

MICROWAVE FILTER CO.

6743 Kinne St.,
E. Syracuse, NY 13057
315 437-3953

MICROWAVE NETWORK

10795 Rockley Rd.,
Houston, TX 77099
713 495-7123

MICROWAVE RADIO

847 Rogers St.,
Lowell, MA 01852
617 459-7655

MIDWEST COMMUNICATIONS CORP.

1 Sperti Dr.,
Edgewood, KY 41017
606 331-8990
HOTLINE: 800 543-1584
See ad on pg. 6

MIKROLAB

4121 Redwood Ave.,
Los Angeles, CA 90066
213 306-0120

MILLER FLUID HEADS

2819 W. Olive Ave.,
Burbank, CA 91505
818 841-6262

MILLER PROFESSIONAL EQUIPMENT

10816 Burbank Blvd.,
N.Hollywood, CA 91601
818 766-9451

MINOLTA CORP.

101 Williams Dr.,
Ramsey, NJ 07446
201 825-4000

MITSUBISHI PRO AUDIO

225 Parkside Dr.,
San Fernando, CA 91340
818 898-2341

MOBILE SYSTEMS

See SPECIALTY
VEHICLES

MOBILE-CAM PRODUCTS

Box A-82108,
San Diego, CA 92138
619 692-3208

MODULAR AUDIO PRODUCTS

50 Orville Dr.,
Bohemia, NY 11716
516 567-9620
HOTLINE: 800 333-7547

MODULATION ASSOCIATES

897 Independence Ave.,
Mountain View, CA 94043
415 962-8000

MODULATION SCIENCES

115 Myrtle Ave.,
Brooklyn, NY 11201
718 625-7333
HOTLINE: 800 826-2603

MODULITE/BARDWELL

2601 Empire Ave.,
Burbank, CA 91504
818 843-6811

MOLE-RICHARDSON CO.

937 N. Sycamore Ave.,
Hollywood, CA 90038-2384
213 851-0111

MONITOR CORP.

5740 Green Circle Dr.,
Minnetonka, MN 55343
612 935-4151

MONROE ELECTRONICS

100 Housel Ave.,
Lyndonville, NY 14098
716 765-2254

MONTAGE GROUP

1 W. 85 St., #3A,
New York, NY 10024
212 362-0892

MOSELEY ASSOCIATES

111 Castilian Dr., Santa Barbara, CA 93117-9093
805 968-9621

MOTOROLA C&E

17-22 Whitestone Expy., Whitestone, NY 11357
718 746-1100

MOTOROLA, INC., AM STEREO

1216 Remington Rd., Schaumburg, IL 60173
312 576-0554

MPB TECHNOLOGIES

1725 N. Service Rd., Transcan. Hwy, Dorval, Que., Canada H9P 1J1
514 683-1490

MU-DEL ELECTRONICS

2426 Linden Ln., Silver Spring, MD 20910
301 587-6087

MULTI-TRACK MAGNETICS, DIV. MATRIX CORP.

115 Roosevelt Ave., Belleville, NJ 071098
201 327-9400

MULTIDYNE ELECTRONICS

Box 528, Locust Valley, NY 11560
516 671-7278

MYCOMP TECHNOLOGIES CORP.

921 Calle Amanecer St., #L, San Clemente, CA 92672
714 545-5111

MYCRO-TEK

9229 E. 37 St. N., Wichita, KS 67226
316 636-5000
HOTLINE: 800 835-2055

MZB & ASSOC.

6221 N. O'Connor, #110, Irving, TX 75039
214 869-4500

N**NADY SYSTEMS**

1145 65 St., Oakland, CA 94608
415 652-2411

NAGRA MAGNETIC RECORDERS

19 W. 44 St., #715, New York, NY 10036
212 840-0999

NAKAMICHI USA CORP.

19701 S. Vermont Ave., Torrance, CA 90502
213 538-8150
HOTLINE: 800 421-2313

NALPACK VIDEO

1937C Friendship Dr., El Cajon, CA 92020
619 258-1200

NARDA MICROWAVE

435 Moreland Rd., Hauppauge, NY 11788-3994
516 231-1700

NAUTEL

201 Target Ind. Cir., Bangor, ME 04401
207 947-8200

NEC AMERICA, BROADCAST EQUIPMENT DIV.

1255 Michael Dr., Wood Dale, IL 60191
312 860-7600
See ad on pg. 22

NEOTEK

1154 W. Belmont Ave., Chicago, IL 60657
312 929-6699

NEUMADE PRODUCTS CORP.

720 White Plains Rd., Scarsdale, NY 10583
914 725-4900

RUPERT NEVE

Berkshire Industrial Park, Bethel, CT 06801
203 744-6230

NEW ENGLAND DIGITAL

49 N. Main St., White River Junct., VT 05001
802 295-5800

NEWTON ELECTRONICS

340 E. Middlefield Rd., Mountain View, CA 94043
415 967-1473

NORMEX/TELNOX

55 Montpelier Blvd., Montreal, Que., Canada H4N, 2G3

NORTHERN MAGNETICS

Box 16409, Minneapolis, MN 55416
612 944-8602

NORTRONICS CO.

8101 10 Ave., N., Minneapolis, MN 55427
612 545-0401
HOTLINE: 800 228-5640

NOVA SYSTEMS

50 Albany Tpke., Canton, CT 06019
203 693-0238
See ad on pg. 47

FRED A. NUDD CORP.

1743 Rt. 104, Box 577, Ontario, NY 14519
315 524-2531

NURAD

2165 Druid Park Dr., Baltimore, MD 21211
301 462-1700

NYTONE ELECTRONIC

2424 S. 900 West, Salt Lake City, UT 84119
801 973-4090

O**O'CONNOR ENGINEERING LABS**

100 Kalmus Dr., Costa Mesa, CA 92626
714 979-3993

ODETICS/ BROADCAST SALES

2907 Manchester, Anaheim, CA 92802
714 774-5000
HOTLINE: 800 243-2001

OKI TELECOM

22-08 Rte. 208, Fairlawn, NJ 07410
201 654-1414

OKTEL CORP.

1220 Page Ave., Fremont, CA 94538
415 490-3100

OLD DOMINION BROADCAST ENGINEERING SVCE.

1101 Front St., Richmond, VA 23222
804 321-4506

OLESEN

1535 Ivar Ave., Hollywood, CA 90028
213 461-4631

OMICRON VIDEO

21822 Lassen St., Unit L, Chatsworth, CA 91311
818 700-0742

OMINMOUNT SYSTEMS

10850 Vanowen St., N.Hollywood, CA 91605-6470
818 766-9000

OMNIMUSIC

52 Main St., Port Washington, NY 11050
516 883-0121

ONAN CORP.

1400 73 Ave. N.E., Minneapolis, MN 55432
612 574-5000
HOTLINE: 800 888-6626

OPAMP LABS

1033 N. Sycamore Ave., Los Angeles, CA 90038
213 934-3566

OPTICAL DISC CORP.

17517H Fabrica Way, Cerritos, CA 90701
714 522-2370

ORBAN ASSOC.

645 Bryant St.,
San Francisco, CA 94107
415 957-1067
HOTLINE: 800 227-4498

ORION RESEARCH

4650 W. 160 St.,
Cleveland, OH 44135
216 267-7700
HOTLINE: 800 822-8346

ALLEN OSBORNE ASSOC.

756 Lakefield Rd., Bldg. J,
Westlake Village, CA
91361
805 495-8420

OSRAM CORP.

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Circle 133 on Reader Service Card Page 91

R

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818 880-4054

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404 448-2116

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SCHAFFER WORLD COMMUNICATIONS

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Reiterstrasse 6, Zurich
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800 358-NTSC

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ME 04009
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SONY INFORMATION SYSTEMS DIV.

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NJ 07656
201 930-1000

See ad on pg. 26

SONY MAGNETIC PRODUCTS

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NJ 07656-8038
201 930-1000

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SONY PRO AUDIO DIV.

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Van Nuys, CA 91406
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800 553-8712

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19454
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STANDARD COMMUNICATIONS CORP.

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CA 90009
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30341
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703 522-7780
HOTLINE: 800 368-2081

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90221
213 637-7500

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914 763-8893

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612 884-4051

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57709
605 343-7200

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Monroeville, PA 15146
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75209
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219 294-8300

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94527
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619 268-8559

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445 Livingston St.,
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89119
702 739-7598

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France F-92102
331 49092828

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Cedex, France 95801
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416 298-7788

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413 568-9581

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HOTLINE: 800 387-3205

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A Compute Disk Menu

By Ronald F. Balonis

A toolbox is only as good as the tools in it and the way in which they are organized. They must be organized so that you can find the right tools when you need them. This also applies, but even more so, to the software tools you have for your computer. As the number of application programs in your collection grows, the capabilities of your computer grow, but so does the difficulty of locating and of using programs when you need them.

For this month's Compute, we've assembled a disk menu program—a simple program that allows you to easily locate and to use the programs printed in *BME* and construct your own "computer toolbox" (see Figure 1).

The disk menu presented here uses only the built-in functions of MS-DOS: batch processing files and files with single-letter names. It works at the operating system level of IBM-compatible PCs.

There are commercially available disk menu systems that put some distance between DOS commands and the user for the sake of user-friendliness. But what this one lacks in slickness, it makes up for in its elegant simplicity and utility.

This batch file disk menu system consists of a related series of batch files (see Figure 2). MENU.TXT is the menu selection screen which lists, and describes, the programs to select. The first batch file's called MENU.BAT. It is the key-stone because it controls the system. Its purpose is to clear the screen and to display MENU.TXT. Then there are the one-letter batch files (A to Z), which give instructions to the computer for each program on the menu. The one-letter batch files have a similar set of instructions: [1] Turn off the printing to the screen, ECHO OFF. [2] Clear the screen, CLS. [3]

Run GWBASIC and the program XXXXXX.BAS. [4] At program termination, return to MENU.BAT for another selection.

Menu selection is done using the operating system at the MS-DOS prompt. Entering a one-letter selection invokes the batch file with that name; it then tells the computer what to do. The last instruction in each single letter (program) batch file is MENU.BAT—that brings up the initial disk menu screen again. For continuity, the STOP instruction in the basic programs must be replaced with the SYSTEM command or else program termination will stop at Basic and not in the operating system.

The directory for your toolbox disk should have all these files: COMMAND.COM, GWBASIC.EXE, EDLIN.COM, FMFLD.BAS, FMSITE.BAS, CH246.IN, CH246.OUT, RES.BAS, CAP.BAS, AFPADS.BAS, MENU.TXT, MENU.BAT, A.BAT, B.BAT, C.BAT, D.BAT, E.DAT, X.DAT.

The step-by-step instructions that follow utilize DOS's EDLIN commands. You type them in exactly as the screens show, hopefully avoiding some of the more cumbersome EDLIN functions.

1.) Start by FORMATTING a system disk. Then, use COPY to put copies of COMMAND.COM, EDLIN.COM, and GWBASIC.EXE (or whatever your Basic's called) on it. Then put copies of the following *BME* Compute programs on it: FMFLD.BAS, (January 1988, p.18); FMSITE.BAS, CH246.IN, CH246.OUT, (March



```
***** BM/E PCs In Engineering Computer Toolbox ***** (6/88)
Select - Program - ----- Application, Function, or Task ----- BM/E
[A] FMFLD.BAS Calculate Distance to 70, 60, & 34 dbu Contours. (1/88)
[B] FMSITE.BAS Do An FM Channel Study For A Transmitter Site. (3/88)
[C] RES.BAS Calculate RESISTOR VALUE from Color Codes. (4/88)
[D] CAP.BAS Calculate CAPACITOR VALUE from Color Codes. (5/88)
[E] CONVERT.BAS Common Unit Conversions for Broadcasting. (7/88)

[X] EXIT TO MS-DOS. Or ENTER: PROMPT

ENTER [A...E or X] : _

PCs in Engineering Disk Menu
```

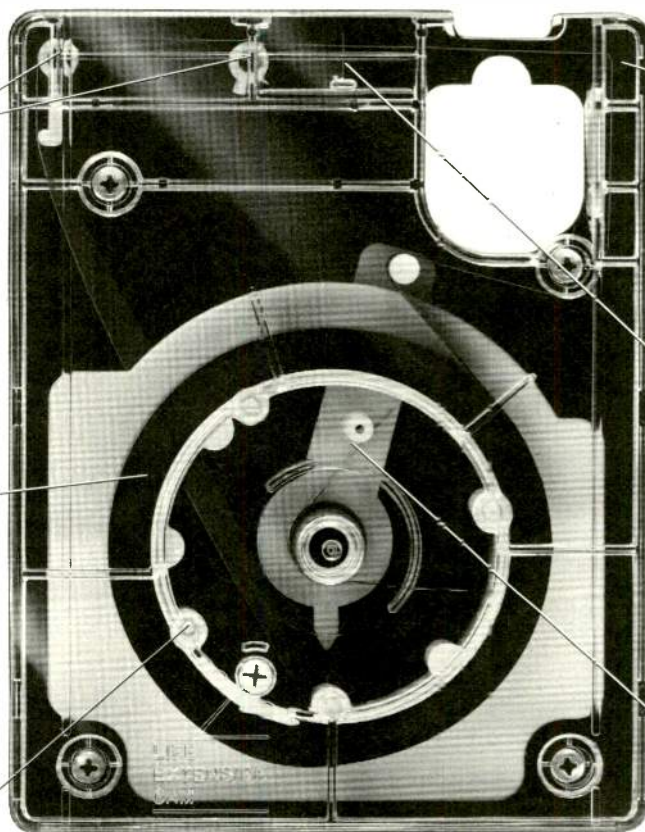
Figure 1: Opening menu screen for the BME Toolbox.

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COMPUTE

Step-By-Step Batch File Screens

```
A>EDLIN MENU.TXT
New File
*I
1:*          ***** BH/E PCs In Engineering Computer Toolbox *****
(6/88)
2:*
3:*  Select - Program - ----- Application, Function, or Task -----
BH/E
4:*
5:*  [A]  FMFLD.BAS   Calculate Distance to 70, 60, & 34 dbu Contours.
(1/88)
6:*  [B]  FMSITE.BAS Do An FM Channel Study For A Transmitter Site.
(3/88)
7:*  [C]  RES.BAS    Calculate RESISTOR VALUE from Color Codes.
(4/88)
8:*  [D]  CAP.BAS   Calculate CAPACITOR VALUE from Color Codes.
(5/88)
9:*  [E]  CONVERT.BAS Common Unit Conversions for Broadcasting.
(7/88)
10:*
11:* [X]  EXIT TO MS-DOS.  Or ENTER: PROMPT
12:*
13:*
14:*^C
```

*E

```
A>EDLIN MENU.BAT
New File
*I
1:*ECHO OFF
2:*CLS
3:*PROMPT ENTER [A...E or X] ;
4:*TYPE MENU.TXT
5:*^C
```

*E

```
A>EDLIN A.BAT
New File
*I
1:*ECHO OFF
2:*CLS
3:*GWBASIC FMFLD.BAS
4:*MENU
5:*^C
```

*E

```
A>EDLIN B.BAT
```

```
New File
*I
1:*ECHO OFF
2:*CLS
3:*GWBASIC FMSITE.BAS
4:*MENU
5:*^C
```

*E

```
A>EDLIN C.BAT
New File
*I
1:*ECHO OFF
2:*CLS
3:*GWBASIC RES.BAS
4:*MENU
5:*^C
```

*E

```
A>EDLIN D.BAT
New File
*I
1:*ECHO OFF
2:*CLS
3:*GWBASIC CAP.BAS
```

```
4:*MENU
5:*^C
```

*E

```
A>EDLIN E.BAT
New File
*I
1:*ECHO OFF
2:*CLS
3:*GWBASIC CONVERT.BAS
4:*MENU
5:*^C
```

*E

```
A>EDLIN X.BAT
New File
*I
1:*PROMPT
2:*^C
```

*E

```
A>
```

Figure 2: Step-by-step instructions for constructing batch files for the toolbox.

1988, p.170); RES.BAS, (April 1988, p.92); CAP.BAS, (May 1988, p.74); and AFPADS.BAS (July 1988, p.76).

2.) Edit each of the programs to replace the STOP statement with SYSTEM:. In FMFLD.BAS, it's at the end of line 55. In FMSITE.BAS, it's at the end of line 115. In RES.BAS, it's at the end of line 210. In CAP.BAS, it's at the end of line 210. And, in AFPADS.BAS it's at the end of line 135.

3.) Refer to Figure 2. You get into EDLIN by typing A> EDLIN FILE-NAME.EXT. The * is the prompt for EDLIN. You type in everything after

it, and your screen should look the same at each step. Unless you make a mistake, the only EDLIN commands that you need to use are I for Insert, E for End edit, and Ctrl-C to get out of EDLIN's Insert mode. Type very carefully, make a character-by-character check before pressing Enter, and it'll go smoothly for you. At the last entry, type and enter MENU to invoke the disk menu system and to check it out. If there are any errors you'll see them, or the computer will tell you.

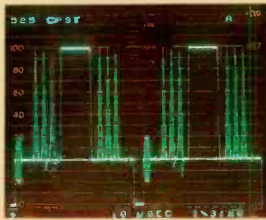
The disk menu system is easy to use. Just type and enter MENU after putting the disk in the default drive,

then enter a selection. The disk menu system changes the MS-DOS prompt in the MENU.BAT file. You can return to the normal default prompt by typing and entering X or PROMPT.

It's an easy system to modify for other program disks. Just change the MENU.TXT file and each of the program names in each of the one-letter .BAT files to suit the new application programs. .COM files can be put on the menu too by just putting the filename on line 3 of its .BAT file. ■

Balonis is chief engineer at WILK-AM, Wilkes-Barre, PA.

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Swaps and Upgrades: Strategic Planning and the FCC

By Harry Cole

With respect to a station's technical operation, the concept of "strategic planning" should extend beyond the obvious questions of what new pieces of equipment to acquire and what old ones are likely to wear out in the foreseeable future. A station's engineering staff should maintain an awareness of matters pending at the FCC which may affect the station in both the short-term and the long-term. You may find the following issues potentially relevant to your strategic plans in the coming months.

If you are a television operator, it's important to know that the Commission is willing to consider intraband channel swaps between commercial and noncommercial stations. That policy, first adopted in 1986, was recently reaffirmed in the face of petitions seeking its reconsideration. In essence, the policy permits a commercial TV licensee to arrange with a noncommercial licensee operating on a lower and, therefore, supposedly preferable channel, to exchange frequencies. For example, let's say there is a noncommercial station on Channel 18 (which is reserved for educational use) and a commercial station on Channel 69. The commercial licensee would obviously prefer to operate on Channel 18, so he or she approaches the licensee of Channel 18 and offers to trade channels. As an incentive, the commercial licensee offers the noncommercial licensee a variety of benefits which could include cash payments, donations of equipment or programming, training sessions and the like. Once the licensees have worked out their deal—but before that deal can be consummated—they lay it out in a request submitted to the FCC, which reviews the details of the transaction and satisfies itself that the deal is in the public interest. If that finding can be reached, the FCC grants the request and the two licensees implement the

requested station changes.

When the policy permitting such swaps was adopted two years ago, the Commission was concerned about the financial state of noncommercial broadcasting. The concept of "channel swapping" then appeared, and continues to appear to provide a potential source of revenue to those fortunate noncommercial licensees who happen to operate on relatively low channel numbers. If they are willing to view their low channel number as an asset which can be sold, they can convert it to basically whatever they can bargain for. That is, the value of the right to operate on a low number channel becomes a matter of private negotiations between a party that has that right and another party which wants to acquire it.

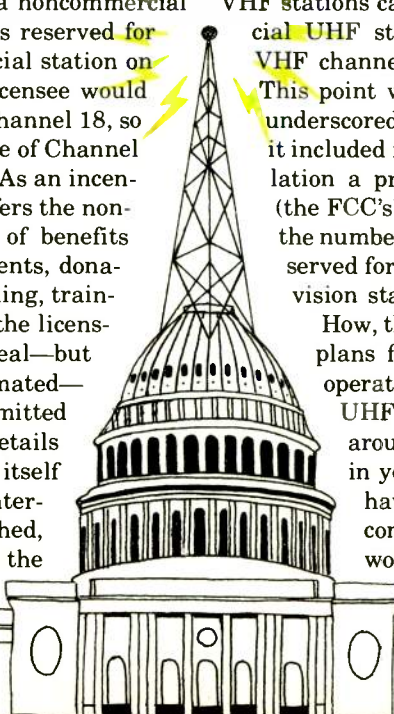
The only major catch to this policy is that any swaps made pursuant to it must be "intraband" swaps. This means that two UHF stations can trade channels and two

VHF stations can trade channels, but a commercial UHF station cannot obtain for itself a VHF channel through the swap mechanism. This point was expressly made in 1986 and underscored by Congress in late 1987, when it included in the FCC's appropriations legislation a provision requiring that "none of (the FCC's) funds...may be used to diminish the number of VHF channel assignments reserved for noncommercial educational television stations...."

How, then, does this policy apply to your plans for the next year or two? If you operate on a relatively high number UHF channel, you might want to look around at the noncommercial stations in your area. Remember, they do not have to be licensed to your specific community. However, in order to work as neatly and cleanly as possible, the noncommercial



Cole is a partner in Bechtel & Cole, a Washington, DC-based law firm.





Ron Gaier, Chief Engineer,
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channel should permit you to continue to deliver the requisite city-grade signal to its community of license.

If you are able to identify one or more channels which would satisfy your requirements, you should then identify any additional projects which might need to be undertaken as part of a channel swap. For example, it might be that you would need to find a new transmitter site in order to use the noncommercial channel in your city. You then should make preliminary inquiries to assure that a suitable alternative transmitter site is available.

These initial projects should also provide a very rough estimate of the costs of a swap in terms of new equipment, new site leases (and buy-outs of existing leases) and new construction etc. Obviously, a swap should make sense from a business perspective. If the initial rough estimates demonstrate that costs outweigh return, the idea should probably be scrapped. In addition, all the initial research usually can be accomplished by one person, which works to maintain an appropriate level of confidentiality.

Once you're reasonably confident that a channel swap could be accomplished from a technical point of view, the next step is to have a representative of the commercial licensee raise the matter with the noncommercial licensee. If both sides are willing, negotiations will ensue and, ideally, a deal can be struck and submitted to the FCC for approval.

A channel swap is pretty drastic medicine, and obviously, should not be undertaken lightly. However, in the increasingly competitive broadcasting environment (and particularly the independent UHF area of that environment), a channel change and possibly an accompanying site change may be just what the ratings doctor ordered.

On the FM side of things, we have previously written about the possibility and desirability of channel upgrades. Upgrading an FM station is generally easier than upgrading a TV

station because of the greater number of channels available and the greater flexibility of FM allocation criteria. Moreover, a couple of proposals presently under consideration are likely to create even more flexibility in those criteria, possibly before the end of the year.

The normal way of looking for upgrade opportunities is to work with a consulting engineer who has access to the various FM databases. Most consultants can run a check of the higher-power channels which might

The long and the short of all this is that you should always be sensitive to what is going on at the FCC in planning your technical budget and in assessing possible technical strategies.

be used for your community relatively easily. Usually, they can also give you a pretty clear idea of where the transmitter for any such higher-power operation would have to be located and what other licensees might have to change channels in order to get you the upgrading.

Once you have identified some theoretical upgrades, the next step—as in TV channel swaps—is to determine on a preliminary basis what it would cost and what it would be worth. If the cost in new leases and in buying your way out of any existing leases, plus possible tower construction and new equipment such as an STL, transmitter or antenna, for instance, is too high, you will have to abandon your plans for an upgrade.

And when calculating costs for an upgrade, don't forget to include the cost of reimbursing any other licensee

which might have to change its channel to accommodate your upgrade. Although these costs are likely to be reasonably low, they should not be ignored. If the upgrade is worth the initial estimated cost, you can proceed by having your engineering consultant prepare a formal proposal for submission to the FCC. If your proposal requires moving other stations around on the band—the maximum necessary moves should be two or fewer—you should also contact the affected stations and advise them of your plans and your willingness to reimburse the cost of the changes in their own operations.

Even if all your initial planning goes smoothly, you should count on processing delays of at least 18 months to two years at the Commission. The staff people who handle FM allocation proposals have been swamped with both new channel drop-ins and upgrade proposals.

Once the allocation proposal has been granted, the upgrading station must then file a minor-change application for a construction permit specifying the higher-class facilities. Such minor-change applications are normally processed on an expedited basis, but it is still best to estimate at least two months.

For those of you who have already explored the possibilities of an upgrade and come up empty-handed, relief may be in sight. The Commission is considering two separate proposals, either of which could facilitate upgrading, and both of which may be adopted in one form or another by the end of the year.

The first involves the proposal to permit an across-the-board power increase to all Class A FM stations. The second proposal on the table at the FCC involves the use of directional antennas by short-spaced stations.

The long and the short of all this is that you should always be sensitive to what is going on at the FCC in planning your technical budget and in assessing possible technical strategies. ■

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Circle 141 on Reader Service Card Page 91

EQUIPMENT

JVC's New Frame Sync ... Skotel Time Code Generator ... Ram Broadcast's SX Console ... and More NAB New Products



JVC Bows Multi-Format Frame Synchronizer

In a bid to encourage multi-format integration of video equipment, JVC has launched a multi-format frame synchronizer and full-frame time base corrector. The KM-F250U accepts inputs from composite video signals, separate Y/C signals (with a chroma carrier frequency of 688 kHz from 3/4" U-VCRs or 3.58 MHz from S-VHS units) and component video signals (Y, R-Y, B-Y). Simultaneous outputs are available in each format, although two types of Y/C separate signals cannot be output simultaneously. The unit performs full-frame time base correction and employs CCIR 601-standard 4:2:2 signal processing with 13.5MHz sampling frequency and 8-bit quantization. Suggested list price is \$6250.
Reader Service #200

Skotel Bows Time Code Generator

Features of the Skotel TCG-80N-FT include film tachometer interface, 3/2 pull-down recognition and character inserter. The unit functions as a normal time code generator when the tachometer interface is inhibited.

Designed for video production of material originated on film, the 80N-FT identifies source to single frame and permits striping tape from film in LTC and VITC simultaneously (option required for VITC). Code is then output for display on local picture monitors. Reference input is composite video. The system can be housed in 1RU including VITC output option. Suggested list base price is \$3755.00.
Reader Service #201

Ram Broadcast Shows Series SX Consoles

Ram Broadcast's Series SX modular console expands from 12-inputs/20 modules to 26-inputs/34-modules in three mainframe sizes. An analog mixing desk with digital electronic specifications, the SX series offers a cue and utility bus which can be used for Mix Minus in either dual mono or stereo. The consoles also feature stereo program and audition busses, full function digital logic control and interface and mother-boardless design. Penny & Giles faders are standard; redundant power supplies and built-in intercoms are optional.
Reader Service #202

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Circle 142 on Reader Service Card Page 91



EQUIPMENT

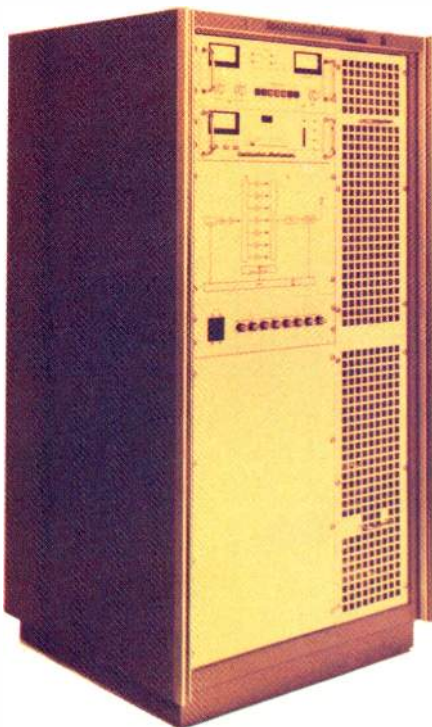
Perfectionist Console from Logitek

The Perfectionist audio console from Logitek is a "workhorse" model board available in either eight- or 12-mixer versions. Other features include four active balanced line level stereo inputs per mixing channel; four active monaural microphone preamps per console; 88 dB S/N for line inputs; 75 dB for mic inputs. The console comes configured in either 12-mixer, 48-input or eight-mixer, 32-input models with either Penny & Giles slide or rotary attenuators.

Reader Service #203

Continental Electronics has Solid-State Transmitter

Continental Electronics, a division of Varian Associates, introduced its first totally solid-state FM transmitter. The 814C 3.8 kW features single-phase power supply. The splitter/combiner technique is used, based on a 700 W broadband



amplifier module to achieve a rated power output of 3.8 kW.
Reader Service #204

Sachtler's System

System 14 is a full pedestal/dolly/spreader/tripods/cover package for video camera applications. The pedestal features a pneumatic center column that can be locked into position. Dolly wheels are precision-mounted and easily steerable. The tripod, designed for sturdy ENG performance, features a standard Sachtler 14 11 fluid head model with both S14 long and medium tripod legs.

Reader Service #205

AEG's New System Encoder

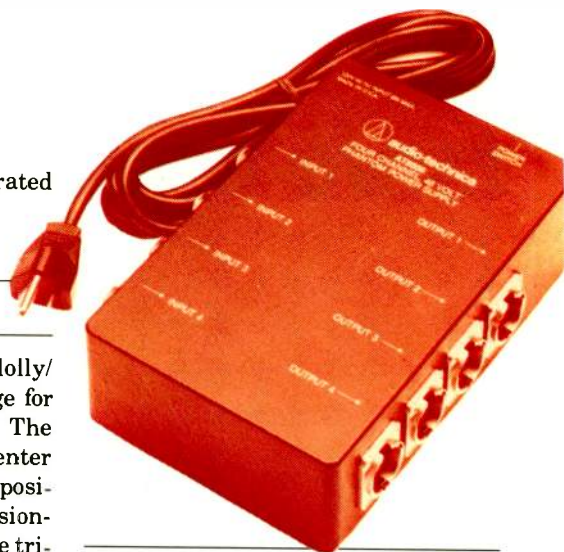
The Radio Data System Encoder from AEG permits the addition of supplementary information to the multiplex signal for transmission by VHF/FM broadcasting transmitter. The supplementary signal complies with EBU specs. The unit features 16-bit processing, low power consumption and self-test programs.

Reader Service #206

Blue Skies from Alden's Weather Display

Starring at the NAB for Alden Electronics was the firm's C2000RC Composite Weather Radar Display. The unit automatically gathers and displays precipitation echoes from up to 16 radars and overlays the intensities on a regional background. Further, Alden's wholly-owned subsidiary Zephyr Weather Information Service continues to provide full-service weather data information to broadcast television. Delivery includes NWS, NAFAX, DIFAX GOES imagery, ESD satellite imagery and Zephyr Domestic Plus.

Reader Service #207



Four Mics Share New Phantom Power Supply

Up to four microphones may be powered simultaneously by the new AT8506 phantom power unit from Audio-Technica. The four-channel, line-operated unit produces 48 V dc for mics requiring phantom power.

The AT8506 is a highly regulated power supply that is operated from 100 to 120 V ac, 50-60 Hz. It maintains a constant voltage source, with no channel interaction, even with heavily loaded or shorted inputs. Each channel can provide up to 14 mA. The unit weighs less than two and a half pounds and features an internally protected regulator IC to prevent overheating. It is completely compatible with Audio-Technica's MODU-COMM two-way communications system.

Reader Service #208

Midwest Has Digital Processing Equipment TBC

The DPS-270 time base corrector has been announced by Midwest. The unit lists for \$2990 and is designed to operate with both U-Matic and S-VHS tape machines. Flexibility is provided through Y/C in and out or composite in and out. The signal to noise ratio is 58 dB with luminance signal bandwidth of 5.5 MHz and less than 2 degrees differential phase and two percent differential gain.

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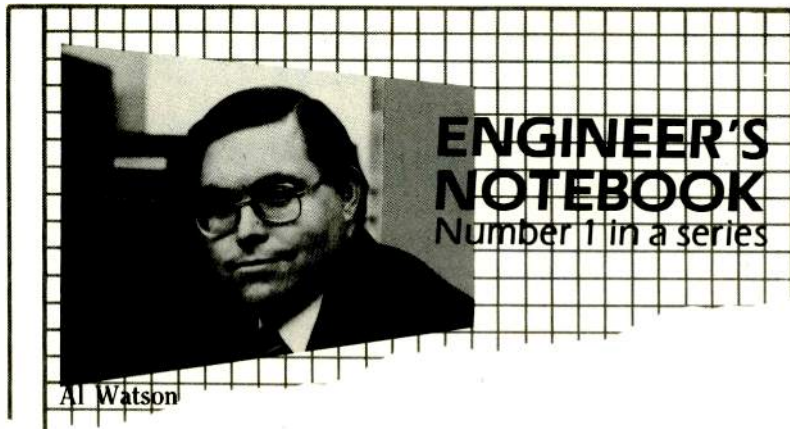
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Circle 143 on Reader Service Card Page 91





N/DYM™ Technology Comes to Broadcast Microphones

By Alan Watson, Director of Engineering
Electro-Voice, Inc.

Those familiar with the benefits enjoyed by musicians through the new neodymium-magnet microphones have no doubt predicted that the new technology would soon be available in broadcast microphones. And now, with the advent of the Electro-Voice RE45N/D hand-held shotgun microphone, the prediction has come true.

The advantages N/DYM™ technology brings to broadcasting are significant. Above all, it gives us a microphone with the high output previously available only from condenser mics—but without the problems of dead batteries, noises caused by poor ground connections in phantom-powering, humidity damage, static electricity, and poor rf rejection.

The Alnico magnets used in most dynamic mics yield a sensitivity of 6 dB less than would be possible if the steel parts of the magnetic structure could be completely saturated with the field. Increasing the Alnico magnet size does not work since the added size interferes with the acoustic design of the mic. Neodymium magnets, however, are so powerful that the magnet can be far smaller and still provide the "lost" 6 dB of sensitivity.

N/DYM Technology extends far beyond a mere substitution of magnetic material. To maximize the new opportunities, Electro-Voice engineers found that the ideal neodymium magnet shape is one with a thin, wafer-like configuration.

This permitted using a voice coil and attached dome of far larger diameter while reducing the surround—yielding important added advantages for broadcast engineers: a smoother, more evenly contoured pickup pattern with extended high- and low-frequency response and better rejection of unwanted noise from the sides.

For more information, please write to us for the specification sheet and brochure on the RE45N/D—the broadcast industry's first N/DYM dynamic shotgun microphone.

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Circle 144 on Reader Service Card Page 91

EQUIPMENT

The unit employs true component processing and provides a 16-line correction window. Special circuitry allows a viewable picture in shuttle and jog modes and the unit is remote controllable. The unit is designed and manufactured by Digital Processing Systems.

Reader Service #209

Sennheiser's Latest Mic

The MKH 30 P 48 is a pressure gradient microphone with bilateral directivity. The symmetrical transducer is designed to reduce the dependency of the directional characteristics on the received frequency. Other features include defeatable preattenuation at 10 dB to prevent overmodulation and a switchable bass attenuation feature to compensate for close miking. Frequency response ranges from 40 to 20,000 Hz, impedance is 150 ohms, and the maximum output is 2.5 V

Reader Service #210

Alexander Powers Up New Batteries

The BP1-11 from Alexander Batteries features 11 cells, allowing longer equipment use by avoiding an 11-volt cutoff point. To obtain full battery capacity, the unit should be discharged one volt per cell. The BP1-11 is rated at 13.75 volts with a 1.5 Ah capacity. A new series of chargers for the NP1, NP1A, BP1, and BP1-11 units was also introduced.

Reader Service #211

SMA Designs Component Monitoring Device

Electronics effects house SMA Video has developed the SMA-100 component video adaptor which plugs into existing composite scopes and takes the place of a separate RGB monitor. Designed for Betacam production and post,



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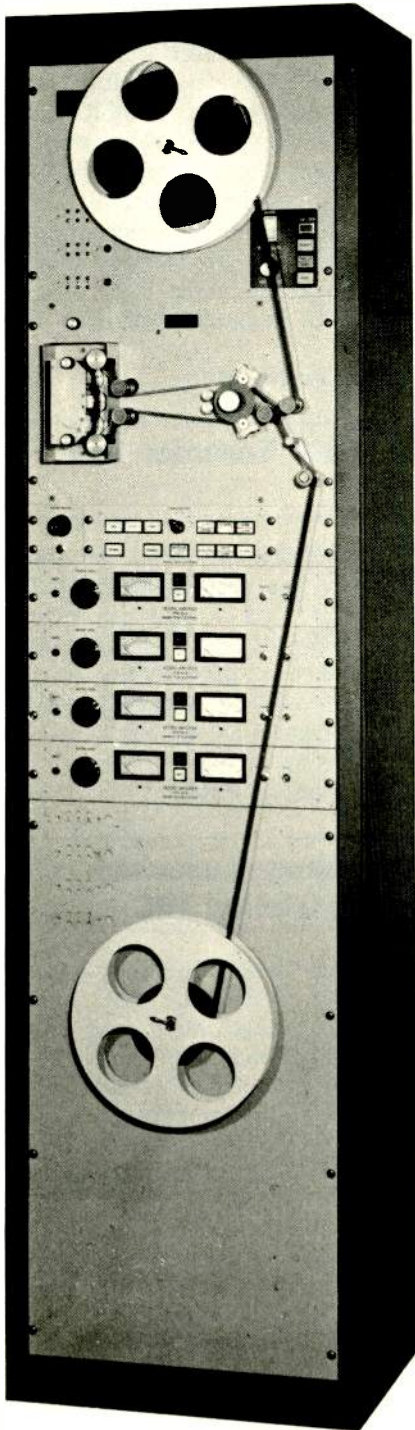
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You could probably get by with a standard "all-around" headset, but do you really want to? Similarly, you could probably find something that would "make-do" from a headset source offering only a couple of models from which to choose. But, for a complete selection, one that offers a solution to your every broadcast need, turn to Telex.

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Full Cushion	X		X	X	X	X		X	X	X	X
Light Weight	X	X			X	X	X	X	X	X	



Camera

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EQUIPMENT

Paintbox graphics and Harry animation, the unit provides simultaneous stair-step display of RGB and R-Y, B-Y signals alongside an NTSC waveform monitor. One rack unit high, the SMA-100 is compatible with all current NTSC waveform monitors including the Tektronix 528 and 1720. It will be available in the fourth quarter of 1988. Suggested list price is \$1,500.

Reader Service #212

Pro R-DAT Recorder from Sharp

Sharp Electronics Corp. has released the professional R-DAT digital audio tape recorder/player, model SX-D100. Specs for the unit include 5 to 22,000 Hz frequency response, +/- 0.5 dB; a 92 dB S/N ratio; 90 dB separation; and a 0.005 percent distortion rating.

Reader Service #213

Prime Image Launches High Resolution TBC

The new high-resolution multi-format transcoding TBC from Prime Image offers over 600 lines of resolution and 7.5 MHz bandwidth. The HR600+ time base corrects and transcodes between components—including U-matic and U-matic SP (Y/688, 7-pin); Betacam, Betacam SP and MII (Y/R-Y, B-Y, 12-pin) and S-VHS (Y/C, 4-pin)—and composite such as 1/2" and 3/4" VCRs (BNC). Available in October, suggested list price is \$5,950.

Reader Service #214

Image Video Creates DAE system

Image Video/Clark & Associates announce the AES-2000 single-screen multi-track digital audio editing system. The system comprises a desktop control panel, realtime high-resolution color graphics dis-

play, A to D/D to A conversion unit, processing unit with mass storage and computer keyboard and monitor. Sampling options range from 32K to 48K samples/sec; sampling accuracy is 16 bit and dynamic range is greater than 90 dB. Edit functions include insert/delete, track bounce and slipping, rock and roll, looping, event time code synchronization, equalization, soft key and time code positioning within track, reverb and simul-sync recording.

Reader Service #215

Perrott Debuts Minicharge/Discharge Unit

Perrott's PE 441 combines four independent battery mini-chargers and four independent dischargers in one unit. Suitable for NP-1 and NP-1A batteries, the unit extends battery life, eliminates memory and weighs 5 3/4 pounds.

Reader Service #216

Orban Unveils New Parametric EQ

Orban's new Model 642B parametric equalizer/notch filter is the latest addition to the 622 series, boasting better circuitry and specs. Dual four-band or mono eight-band configurations are selectable by a front-panel cascade switch. Each band can be tuned over a 20:1 frequency range, and tuning ranges of

the individual bands overlap broadly. The filters feature a "constant-Q" design that provides +16 dB boost and -45 dB cut in each band, resulting in full notch filtering capability with no interaction between parameters when one is adjusted. Bandwidth is continuously variable from 0.29 to 5.0.

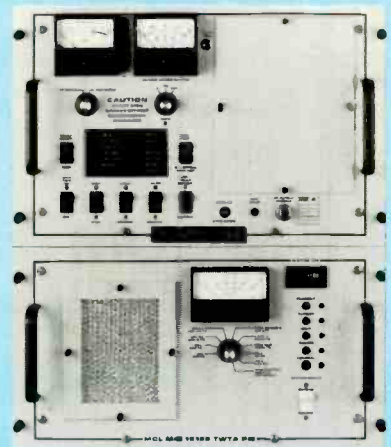
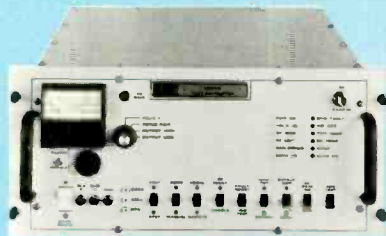
A vernier on the frequency control of each band facilitates precise tuning



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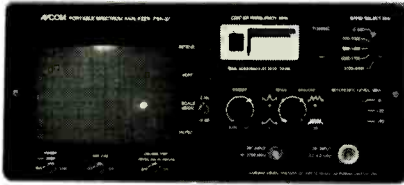
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Circle 148 on Reader Service Card Page 91

EQUIPMENT

of sharp notches. The 642B features continuously tunable 18 dB/octave high-pass filters and 12 dB/octave 349 "Automatic Sliding Besselworth" low-pass filters. Noise and distortion figures are comparable to 18-bit digital, according to the company.

Reader Service #217

Townsend Equipment to American Broadcast

Television automation equipment available until now from Townsend Broadcast Systems has been acquired by American Broadcast Systems, a new company formed by former Townsend automation division employees. American will now market the DC-80 and DC-800 series automatic video cart and automation systems. Features include computer control of commercial and spot playback, program automation, single or multi-channel formats, auto-record and net delay. Systems are available in any format in component or composite configurations, plus custom design.

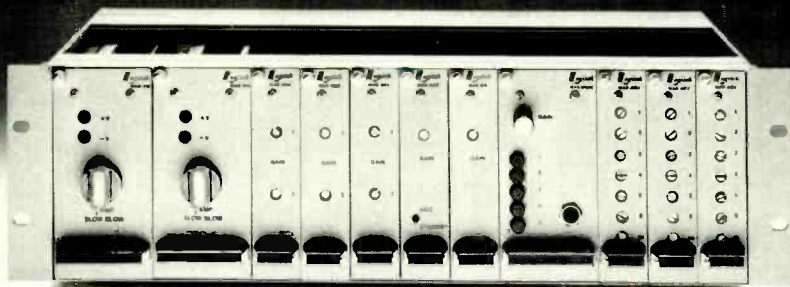
Reader Service #218

Barco Monitor Boasts High Stability

The new CM 22 professional color monitor from Barco Industries is a compact, nine-inch unit with high-resolution dot mask in-line gun CRT. Its Automatic Kinescope Biasing (AKB) technology assures absolute color temperature and black level stability, according to the company. The monitor features precise, stable signal convergence and is suited to both studio or location work. It operates off line current or 12 V batteries.

Convenient, preset front panel controls set hue, brightness, chroma and contrast. The monitor has two composite video inputs and one RGBS input. Its modular design allows rapid troubleshooting and board replacement.

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K3672BCD	55-60 kW	470-310 MHz	44% to 48%
K3572BCD	40-55 kW	470-310 MHz	43% to 46%
K3271BCD	15-30 kW	470-360 MHz	42% to 47%
K3270BCD	5-15 kW	470-360 MHz	42% to 47%

STANDARD SERIES

Low Band

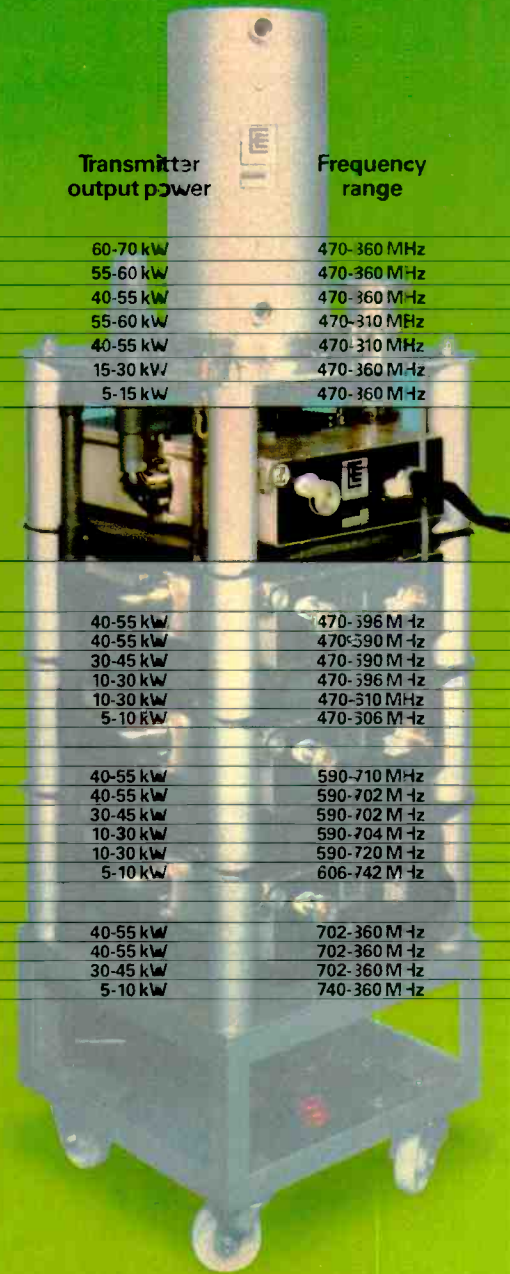
K3276HBCD	40-55 kW	470-396 MHz	38% to 43%
K3382BCD	40-55 kW	470-390 MHz	38% to 42%
K3217HBCD	30-45 kW	470-390 MHz	40% to 42%
K3230BCD	10-30 kW	470-396 MHz	40% to 42%
K376L	10-30 kW	470-310 MHz	34% to 40%
K370/W series	5-10 kW	470-306 MHz	29% to 35%

Mid Band

K3277HBCD	40-55 kW	590-710 MHz	38% to 43%
K3383BCD	40-55 kW	590-702 MHz	38% to 42%
K3218HBCD	30-45 kW	590-702 MHz	40% to 42%
K3231BCD	10-30 kW	590-704 MHz	40% to 42%
K377L	10-30 kW	590-720 MHz	38% to 45%
K371/W series	5-10 kW	606-742 MHz	32% to 35%

High Band

K3278HBCD	40-55 kW	702-360 MHz	38% to 43%
K3384BCD	40-55 kW	702-360 MHz	38% to 42%
K3219HBCD	30-45 kW	702-360 MHz	40% to 42%
K372/W series	5-10 kW	740-360 MHz	32% to 35%



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EQUIPMENT



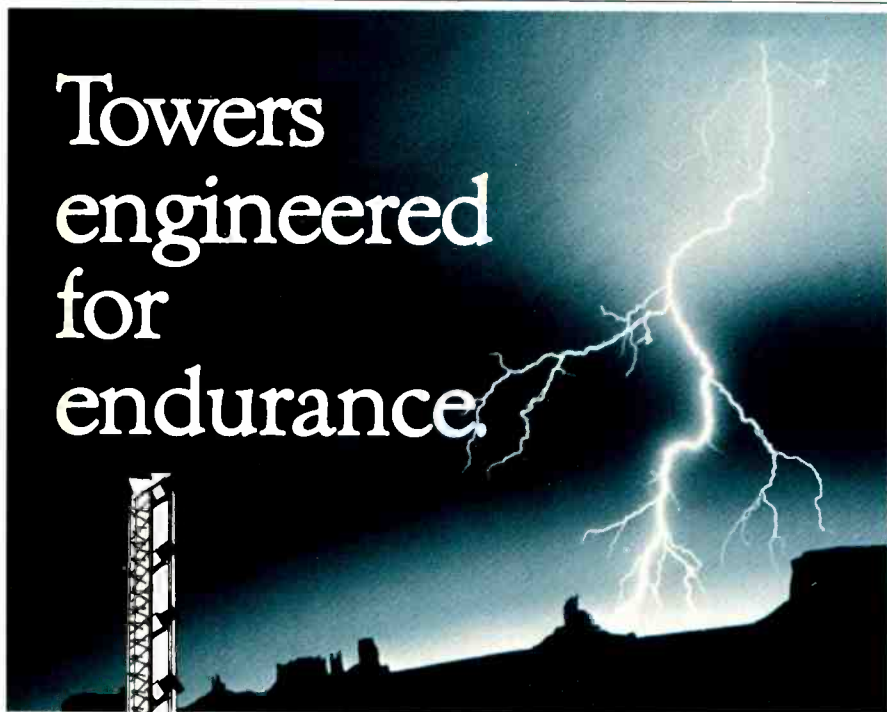
Telcom Launches Time Code Generator

Telcom Research's T5010 time code generator/reader provides four-field NTSC and eight-field

PAL color framing sequences, jam sync and continuous jam operation, high-resolution character generator

and keyboard entry and parallel input/output of time or user bits. The T5010 also reads standard SMPTE/EBU time code and keys information into video for on-screen readout. The LED display is .8" high and brightness is adjustable. Reader Service #220

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Audio Technologies Incorporated (ATI) has developed four micro-meters which visually monitor multiple audio lines simultaneously. The VU200/400/600/800 display one, two, three or four stereo signal pairs (eight channels) on two-color vacuum fluorescent bar-graph indicators with peak storage. Balanced adjustable gain inputs prevent line loading and distortion. The meters are 3 1/2-in. rack mountable. ATI also offers five small retrofit and upgrade connector-mounted amplifiers. ATI micro-matchers are fully shielded, derive operating power from equipment in which they are installed and can be configured for use with bipolar or unipolar supplies. Suggested retail price for ATI micro-meters run from \$339 to \$639. Micro-matchers are \$75 and \$95.

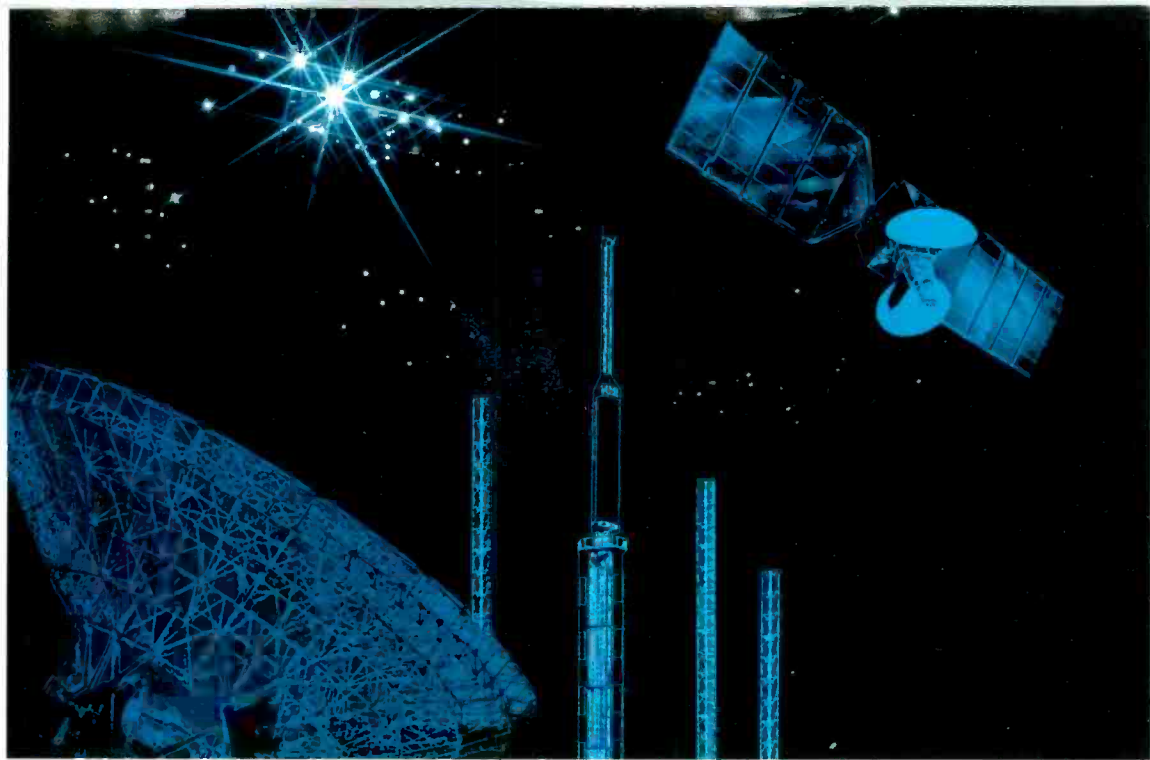
Reader Service #221

Norpak Shows Data Hardware

The center of attention at the Norpak booth was the TDS3 teletext delivery system. This system provides packet-structured data delivery and takes a modular form, allowing easy expandability. It is a fully integrated NABTS data delivery system for consumer teletext, financial information, educational courseware, time-sensitive business data and computer software.

Reader Service #222

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At Thomson-CSF we've been pioneers in developing the use of high-power tetrodes in transmitters for more than 70 years.

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EQUIPMENT



New S-VHS Character Generator from Knox

Knox Video has announced a component video version of the K40 Microfont Character Generator. Called the K40S, the unit features full-bandwidth signal processing for Y/C input/output. It is switchable between composite or Y/C operation and uses industry standard y/C DIN connectors for S-VHS compatibility. A separate composite

output is provided for a local monitor in Y/C mode. Suggested list price is \$2795.

Reader Service #223

Microtek Controls Antennas

The MAC-1 has been designed as a time programmable satellite antenna controller. The show exhibit featured receiver control, remote access and networking capabilities.

Reader Service #224

Kinematics Has Right Time for OEM

Kinematics/TrueTime has launched the OM-PCB Omega Timing Receiver for OEM timing applications. The unit is a single plug-in circuit board time-of-year receiver accurate to 0.001 seconds. Microprocessor-controlled, the OM-PCB can be configured for applications requiring UTC-traceable time (Coordinated Universal Time) or time synchronization between widely separated sites. Designed for computer synchronization or installation in remote data acquisition sites, the OM-PCB can be directly integrated into equipment and is not dependent on area or atmospheric condition. It measures less than 81 square inches.

Reader Service #225

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Toshiba's Mt-3 Satellite Scoop System effectively takes the work and worry out of live news coverage.

The Mt-3 was developed jointly by Toshiba and CBS Engineering and Development.

Satellite Scoop System
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Circle 154 on Reader Service Card Page 91



BUSINESS BRIEFS

News from the recent ITS (International Teleproduction Society) show in Los Angeles marked it as a successful first-round forum for the production and post-production industries. Actually a three-functioned seminar/product exhibit/award show, the convention was capped by the **Monitor Award** ceremony on June 27. Awards were presented to over 70 technical and creative professionals in various categories, with about 20 percent going to non-U.S. facilities. Ray Dolby (also the recipient of a *BME* Excellence in Engineering Award) culled the prestigious Pioneer Award for his contributions to video and audio production. A Special Achievement in Engineering Award went to New England Digital for its implementation of SMPTE time code in the Synclavier.

Manufacturer support of the Society is high in general according to show attendees, with **The Chyron Group** even offering to pay a year's dues in the ITS for anyone who buys a Chyron, DSC, or CMX product by the end of this year.

Agfa-Gevaert and Compugraphic Corp. have entered into a merger agreement whereby Compugraphic becomes a wholly-owned subsidiary of Agfa. According to Dr. Johan Bisschops, a member of the board of directors and executive committee of Agfa parent companies Bayer AG and Bayer USA, and, now, new chairman of both Agfa-Gevaert and Compugraphic, the merger will provide benefits to both companies through closer joint efforts in the graphics arts market...**Matrix Corp.**, a U.S. manufacturer of systems for medical diagnostic, computer graphic, and in-

dustrial measurement imaging also recently announced that it has become a subsidiary of Agfa...All of this activity fuels the rumors on Wall St. that Agfa-Gevaert may be planning to make a bid (along with several other companies, **Fuji Photo Film** included) for an ailing **Polaroid Corp.**

Videotek, Inc., has named Mark Everett its new manager of corporate

communications; Bill Smith is the companies new northeast regional sales manager...**Cook Laboratories**, the nation's oldest established audio recording company, has appointed Mason Jenkins as its director of sales...Joseph Larsen has been tapped to head up **Rational Broadcast's** sales division...And William Dorman is **Neutrik USA's** new product manager. ■



Burbank, CA-based production house AME, Inc., recently became the first facility on the West Coast to receive delivery of the new Sony DVR-10 D-2 digital videotape recorder. The five machines on the order will serve duty primarily on film-to-tape mastering and high-quality playback projects for the company's many motion picture and independent production clients.

Above (left to right), AME chairman and CEO Andrew McIntyre, Sony Communications Products Co. president Richard K. Wheeler, and AME president and COO Larry G. Kingen show off some of the new units.

Other production facilities that have received D-2 recorders include JSL, New York (a wholly owned subsidiary of AME); Post Effects, Chicago; and Crawford Productions, Atlanta.

CURRENTS

A GUEST EDITORIAL

Help Wanted: Attitude. Interaction. Experience.

By Margaret Bryant

I recently hired an entirely new engineering staff for a 50 kW AM radio station. Many people applied, and their education and degree of experience varied widely. What surprised me the most, however, was how few applicants were actually qualified to do the jobs.

When I hire, I look for many qualities, but the most important is experience. It's more and more difficult to find.

Small market experience—where one quickly learns to “make something from nothing” and become resourceful and creative, under orders all the while to spend no money—is by far the best. Contract engineers—who see just about every problem that's conceivable and are called in, often under pressure and with no budget, only when something actually *is* broken—also have terrific experience.

Unfortunately, changes at the FCC have rendered the full-time small market engineer almost an extinct species, while the contract engineer is an entrepreneurial spirit who is usually looking for opportunities different than those my station can provide.

I found, in fact, it was difficult to find experience of *any* type from many of the applicants. Time was, young people were captured by the “magic” of broadcasting and would grow up dreaming of working on a licensed transmitter, worrying all the while that their bootleg transmitter would be “busted.” Today, people seem to be captured by the challenge of getting into a restricted computer. As a result, I found many applicants had computer or digital circuit experience, but few had audio experience and fewer still RF experience.

Today holding a license is no real guide because it demonstrates little about electronic expertise. Many good people got into electronics after the FCC did away with the First Class license, while

many people with a license never retained more knowledge than necessary to run a console.

Certification, however, is something worth noting. Certification exams, such as that given by the Society for Broadcast Engineers, are based on real world experience, not electronics by rote. More than anything, I feel certification demonstrates an applicant is motivated.

College degrees are important to show non-electronic skills. I find most people who apply for a technician job are those who have broadcasting in their blood; most don't have a college degree but many have college experience or are attending night school.

How applicants interact with other people is also important. An applicant will have to work with other departments in the station and also with other members of the engineering staff. How the members of the engineering staff interact relates directly to how much work gets done, the quality of that work, and how much staff members enjoy working there.

These unmeasurable qualities in an applicant are very important. In the end, the evaluation of non-engineering skills is a combination of direct observation and gut feeling. I try to evaluate an applicant's non-engineering skills in an interview, and it's not an easy task. Calling an applicant's references usually confirms my impressions from the interview, but many times it is what the reference is *not* saying as opposed to what they do which tells me the most.

Happily, my recent search yielded three highly motivated people with complementary experience. Each is making individual contributions to the growth of the station, and I am proud to have them on the engineering staff. ■



Margaret Bryant is engineering manager at WMAQ, Chicago, IL. She supervised the station's recent format change to all-news.

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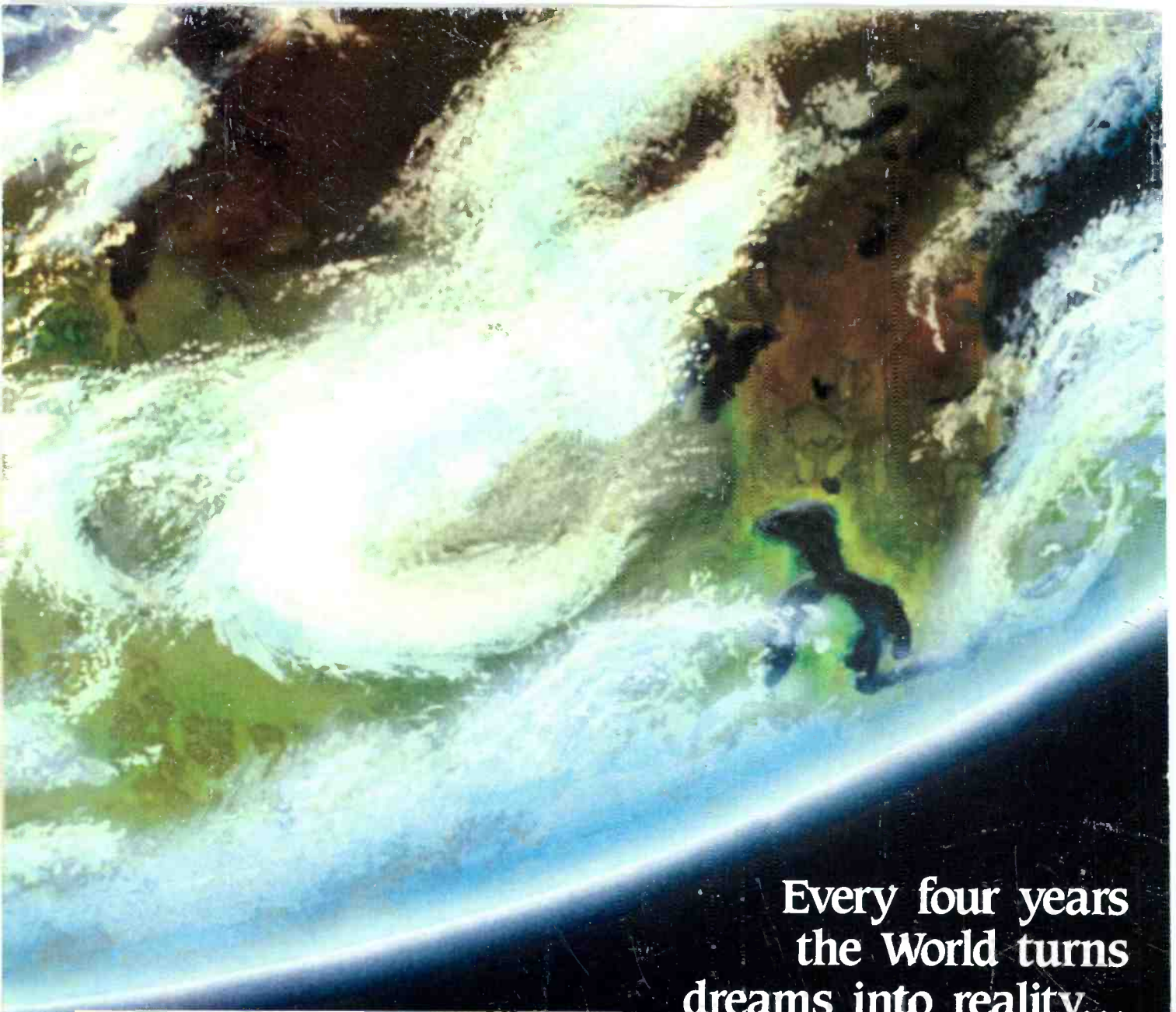
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