BROADCAST engineering

AN INTERTEC PUBLICATION

May 1989/$3

30th Anniversary Special Issue

BE's predictions for 1999

FIELD PRODUCTION

A special job demanding specialized products.

For your audio needs: a growing line of compact, easy-to-use FP amps and mixers.

Shure FP products are built specifically for ENG, EFP, film, and video work. They're not general audio products that "might" work on remotes. And no one offers as wide a selection with this kind of built-in ruggedness and reliability.

FP32

FP42

For Stereo Remotes. The FP32 Stereo Mixer is comparable in size and features to our famous FP31. Its stereo capability, light weight, easy-to-use controls and convenient shoulder harness make it the first choice of field crews. Our FP42 Stereo Mixer simplifies mic cueing, so important in situations like sports remotes. Plus it enables you to easily mix down stereo in your post production booth. It offers all the features of the popular M267 plus stereo capability and a stereo headphone amp.

FP31

FP16

The Industry Standards. The FP31 is Shure's original field production mixer. Thousands bet their audio on it worldwide. The FP16, a one-by-six distribution amp with transformer balancing and link jacks, outperforms all competition. It's also ideal as a portable press bridge.

FP11

FP12

For Long Yardage Situations. The FP11 Mic-to-Line Amp provides freedom from noise in long line situations, with up to 84 dB of gain in 15 6-dB steps. It converts any mic to line level and includes an invaluable limiter circuit. The FP12 Headphone Bridging Amp is a must for shotgun and boom operators. It keeps them on target without need for a return line. It's ideal for multiple headphone feeds, troubleshooting, and as an intercom.

FP51

The new FP51 gated compressor/mixer rides gain automatically. Once you set the compression level, the FP51 adjusts automatically to changing signal levels in critical remote-to-studio feeds to maximize signal output. As a result, your broadcast is quieter, smoother, better balanced and more natural sounding.

For more information on the entire FP line, call or write Shure Brothers Inc., 222 Hartrey Avenue, Evanston, IL 60202-3696, (312) 866-2553.

SHURE®

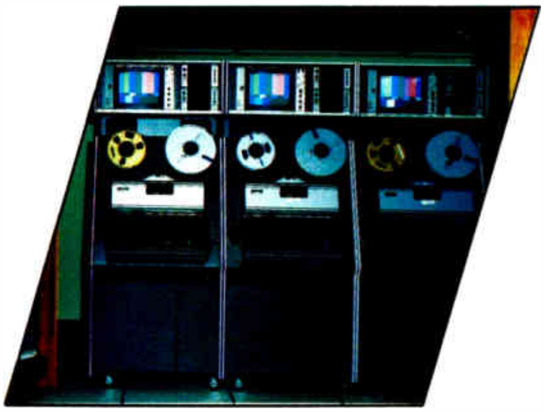
THE SOUND OF THE PROFESSIONALS...WORLDWIDE®

Circle (1) on Reply Card

Contents

May 1989 • Volume 31 • Number 5

Page 22



Page 36

Page 54

BROADCAST ENGINEERING

30TH ANNIVERSARY SPECIAL REPORT:

*The broadcast industry has changed dramatically since 1959 when the first issue of **Broadcast Engineering** rolled off the presses. The road that brought us to where we are now is paved with hard work and ingenuity. This report examines where the broadcast industry has been and where it will be heading during the next decade.*

ON THE COVER

This issue marks 30 years of publishing for **Broadcast Engineering** magazine. From 1959 to the present, monumental changes have occurred in the industry, and we are proud to have been a part of them. Our cover this month illustrates one of the driving forces behind these changes, the integrated circuit. The wafer shown holds thousands of individual ICs. (Photo courtesy of Precision Monolithics, Inc.)

DEPARTMENTS

Hitachi makes it easy.

NOW, THE RIGHT CHOICE IN ADVANCED CCD CAMERAS IS CLEARER THAN EVER. THE NEW SK-F3 AND SK-F700.

Hitachi presents two new 3-chip CCD broadcast cameras that give you higher resolution and better image quality than you have ever seen before in a broadcast camera.

The SK-F3 dockable and the SK-F700 studio cameras include the newest Frame Interline Transfer (FIT) CCD technology. Smear is virtually eliminated. Sensitivity is dramatically improved.

A 6-speed electronic shutter and contrast function are both built-in. And as for high resolution, the SK-F3 and SK-F700 hit a crystal clear 700 lines.

Your choice for a high performance camera system has never been easier. Learn more about the new SK-F3 and SK-F700. In the studio or in the field, they are clearly superior.

Contact Hitachi, 175 Crossways Park West, Woodbury, NY 11797, (516) 921-7200.

Hitachi Denshi America, Ltd.

NEW YORK • LOS ANGELES • CHICAGO • DALLAS • ATLANTA

Circle (4) on Reply Card

By Paula Janicke, staff editor

TTC sells first 240kW MSDC klystron

Television Technology Corporation (TTC) will supply a 240kW MSDC klystron transmitter to WNUV-TV, channel 54, Baltimore, for the station's planned upgrade to 5MW ERP. The new transmitter, the first of its type to be sold, will use about the same amount of power used by the station's current 120kW transmitter. Delivery and installation is scheduled for this summer.

4th International Conference on TV measurements

Montreux, Switzerland, will be the site of the 4th International Conference on TV measurements, June 20-22, 1991. The Institution of Electrical Engineers (IEE), organizers of the conference, will issue a call for papers in the areas of cable television, terrestrial TV broadcasting and direct broadcasting by satellite, including the following topics: standards, specification and codes of practice; chromaticity measurements for cameras, telecines and displays; and measurements for satellite broadcasting, MAC transmission, digital television, digital sound, data broadcasting and high-definition television.

For more information, contact Conference Services, IEE, Savoy Place, London WC2R OBL.

SMPTE issues a call for papers

The Society of Motion Picture and Television Engineers (SMPTE) has issued a call for papers to be presented at the 131st SMPTE Technical Conference and Equipment Exhibit in Los Angeles Oct. 21-25. Before a paper will be considered, the society must receive a 100-word abstract from the author by June 15. The abstract must be sent along with an author form, available from SMPTE headquarters, 595 W. Hartsdale Ave., White Plains, NY 10607. Completed manuscripts for accepted papers must be received by August 25. For more information, contact Marilyn Waldman, program coordinator, at 914-761-1100.

The theme of the conference, to be held at the Los Angeles Convention Center, will be "Tradition and Technology — Partners in Progress." The program will cover film and video technology and papers commemorating the 100th anniversary of the 35mm film format. Among other activities will be a welcoming reception, honors and awards luncheon, Fellows luncheon, banquet, engineering demonstrations and a spouse program.

Booth selection will begin May 12, when 150,000 square feet of exhibit space will be assigned on a point priority basis.

Continued on page 136

BROADCAST ENGINEERING

Editorial and advertising correspondence should be addressed to: P.O. Box 12901, Overland Park, KS 66212-9981 (a suburb of Kansas City, MO); (913) 888-4664. Telex: 42-4156 Intertec OLPK. Circulation correspondence should be sent to the above address, under P.O. Box 12937. RAPIDFAX: (913) 541-6697.

BROADCAST ENGINEERING is edited for corporate management, engineers/technicians and other station management personnel at commercial and educational radio and TV stations, teleproduction studios, recording studios, CATV and CCTV facilities and government agencies. Qualified persons include consulting engineers and dealer/distributors of broadcast equipment.

BROADCAST ENGINEERING (ISSN 0007-1794) is published monthly (except in the fall, when two issues are published) and mailed free to qualified persons within the United States and Canada in occupations described here by Intertec Publishing Corporation, 9221 Quivira Road, Overland Park, KS 66215. Second-class postage paid at Shawnee Mission, KS, and additional mailing offices. POSTMASTER: Send address changes to **Broadcast Engineering**, P.O. Box 12960, Overland Park, KS 66212.

SUBSCRIPTIONS: Non-qualified persons may subscribe at the following rates: United States and Canada; one year, $25.00. Qualified and non-qualified persons in all other countries; one year, $30.00 (surface mail); $108.00 (air mail). Back issue rates, $5.00, except for the Buyers' Guide/Spec Book, which is $20.00. Rates include postage. Adjustments necessitated by subscription termination at single copy rate. Allow 6-8 weeks for new subscriptions or for change of address.

Advertising offices listed on page 161.

It takes plenty of guts to back our products this solidly.

At QEI, we back our products — and our customers. Our power tubes, for example, carry the best warranty in the industry: 15,000 hours or 2 years. And only QEI includes a FREE comprehensive spare parts kit with every FMQ transmitter, exciter and remote control. Experience shows that you may never use more than 2 or 3 of these "guts". But since we can't be certain *which* 2 or 3, our kits include ICs, transistors, lamps, diodes, fuses — everything you're *un*likely to need.

24 HOUR SERVICE HOTLINE

Giving you the most complete spare parts kits in the industry is just the first step in a customer support program that lasts as long as your QEI transmitter. If you need expert advice on installing a spare whatever, call us any time at 609-728-2020, day or night. And if you ever need factory parts support, we can deliver — fast. We're just 1/2 hour from Philadelphia International Airport, not out in the middle of nowhere.

MAXIMUM EARNING POWER

You can count on it with every QEI transmitter, because we design them to stay on the air. And as a fully integrated company dedicated to RF and transmission products, we're able to build in quality and reliability — and still maintain our value advantage.

No wonder stations in both large and small markets have been using QEI products as long as we've been making them — since 1971. During that time we've put over 1300 exciters, more than 450 transmitters and over 1000 modulation monitors in service.

GET THE FACTS

When it comes to standing behind our products — and our stations — we're way ahead of the competition. That may make other manufacturers nervous, but it makes QEI customers very satisfied.

Call us at 800-334-9154, toll-free, for all the facts on the transmitters that deliver a solid return on your investment: the QEI "New Reliables."

QEI

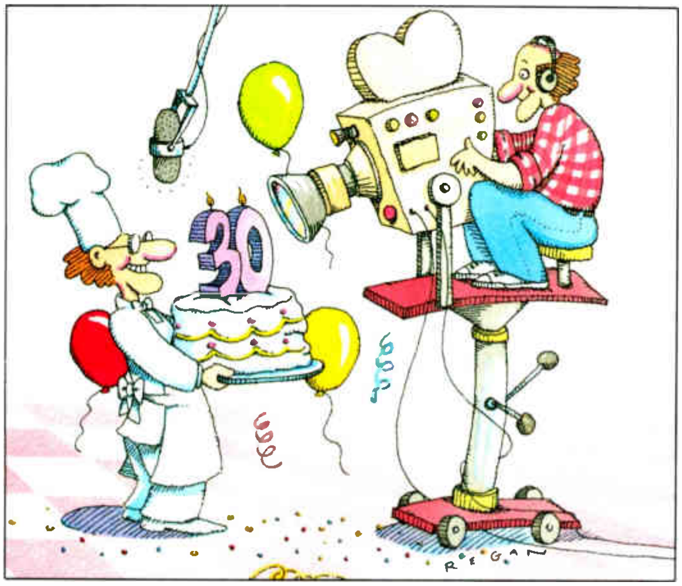
Quality • Engineering • Innovation

QEI Corporation • One Airport Drive P.O. Box D
Williamstown, New Jersey 08094
Toll-free 800-334-9154 • Fax 609-629-1751

Creating tomorrow from today

The world's first digital electronic computer was built with 18,000 vacuum tubes. It occupied an entire room, required 140kW of ac power, weighed 50 tons and cost about $1 million. Today, an entire computer can be built within a single piece of silicon about the size of a child's fingernail. And you can buy one at the local parts house for less than $10.

The progress of technology within our lifetimes has produced dramatic changes in our lives and in our industry. The current generation of microprocessor-controlled broadcast equipment is impressive, but it's only the beginning. This month, in observance of 30 years of publishing, **Broadcast Engineering** examines the progression of technology that brought us to this point, as well as the likely future for our business.



When the presses turned out the May 1959 issue of **BE**, the broadcast industry already was firmly established. From its infancy, this magazine pledged to monitor and report the technical side of broadcasting. Through the ensuing 30 years, **BE** has continued its vigil of radio and TV technological achievements. As the industry has grown, so has the magazine, both toward a common goal: improved communication.

A trade journal is more than simply words and pictures on a printed page. It is readers. Readers who find they can rely on the publication to provide them with useful, accurate and timely information on topics important to their daily work. This has been the goal of **BE** since its inception.

The theme dates back to our first issue. In an introduction to the broadcast engineering community in May 1959, then editor and publisher D. E. Mehl stated the goals of the new magazine:

"In this day of rapid technical developments, it is difficult to keep informed of the many technical phases of the industry. The goal of **Broadcast Engineering** is to bring to its readers as much technical information on current developments as possible so that all may benefit from these ideas, and to make that information available to everyone who desires it."

The goal is just as important today.

It is to the readers of **Broadcast Engineering** that we dedicate this special Anniversary Issue. We could not have achieved our goals without you. We look forward to facing the challenges of the future with you.

Jerry Whitaker,
editorial director

Be prepared.

For the first real improvement in AM sound in more than a decade.

The future offers real promise for AM radio. NRSC AM radios are almost here, factory-installed in new cars. Soon, home stereos and portable sets will also be NRSC-equipped.

NRSC (National Radio Systems Committee) has created a voluntary national transmission standard that makes wideband high-fidelity AM radios practical. As broadcasters adopt the NRSC standard, receiver manufacturers can extend and flatten their frequency response without risk of increasing the audibility of interference.

Is your station prepared?

The 9100B NRSC-standard OPTIMOD-AM® is the first choice of AM stations concerned about improving their sound to compete with FM. OPTIMOD-AM sounds great on both the new NRSC receivers *and* on the millions of narrow-band receivers already in the field that will be in use for years to come.

When replacing older-style processors with OPTIMOD-AM, stations experience a significant increase in coverage area. And when replacing any processor, stations experience a dramatic improvement in sound quality, on both *voice* and *music*, with no sacrifice of loudness.

Superior sound is an important part of an overall strategy to increase ratings and profits. With OPTIMOD-AM, your announcers' voices will have presence and impact, while still sounding very clean. Music will have real bass, with punch and warmth, not boom. The highs will seem to open up. And loudness and tonal balance will be consistent from source to source.

OPTIMOD-AM can be configured to operate optimally in mono, C-QUAM® stereo, or Kahn stereo. Mono units can be field-upgraded later to stereo by simply plugging in additional cards.

Be prepared. Call your Orban Broadcast Products Dealer for more information on OPTIMOD-AM 9100B, or call us direct.

orban

Orban Associates
645 Bryant Street, San Francisco, CA 94107 USA
Telex 17-1480 FAX (415) 957-1070
Telephone (415) 957-1067 or (800) 227-4498

Circle (6) on Reply Card

AM licensees urged to cut interference

By Harry C. Martin

The FCC has proposed a number of amendments to its rules and policies that encourage AM licensees to institute changes that would reduce interference and improve the AM service.

First, the commission proposes to allow AM licensees to reduce the areas encompassed by their protected contours so as to lessen interference to other AM stations. Interference could be lowered through several means, including power reduction or tower-height reduction, antenna reconfiguration or change in tower location.

Furthermore, under certain circumstances, the AM station could relinquish all its service areas to reduce interference, by surrendering its license. Currently, when a station surrenders its license, the parameters of its facilities are not deleted immediately from FCC records, but are grandfathered and maintained for one year while the commission accepts applications for a replacement station. The commission proposes to discontinue this grandfathering process and has ordered that, while the rulemaking proceeding is pending, it will not accept any applications seeking to use such grandfathered rights.

New applications filed after a deletion may not propose facilities that will either cause prohibited overlap of daytime contours to remaining stations or create impermissible levels of nighttime interference.

A second proposal is to accept contingent applications — now not generally accepted in the broadcast service — from AM licensees seeking to implement interference-reduction arrangements. And, if two or more licensees submit contingent applications to effectuate interference reduction, any participating applicant seeking a power increase or other major modification would not be subject to competing applications from third parties with respect to any opportunities created by the contingent arrangements. The commission noted that this change should encourage licensees to try to lower interference because they could be assured of the benefits of their reduction efforts.

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

The commission also proposes to establish a "service floor" to use in analyzing AM modification proposals. This would be the level of service that must be maintained subsequent to any changes in facilities. For example, because the commission traditionally has given priority to first and second full-time aural services, an appropriate floor might be established in the form of a requirement that licensees not create any new "white" or "gray" service areas.

The commission is seeking comments on all aspects of the proposed rules, including the appropriate parameters of a service floor and whether other services such as commercial FM should be taken into account when determining whether the services available to listeners meet the service floor.

Cable syndex rules affirmed

The commission has affirmed and clarified its May 1988 decision to reinstitute a simplified form of the syndicated exclusivity ("syndex") rules and to extend the scope of the network non-duplication rules. The deadline for cable systems to comply with the new rules has been extended to Dec. 31.

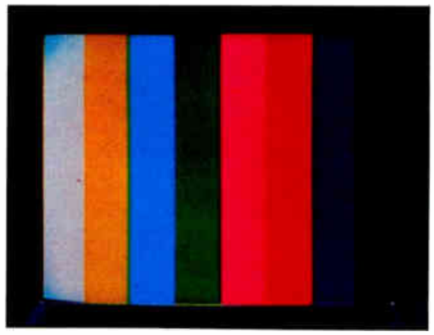
Under the new syndex rules, broadcasters can negotiate with program suppliers for enforceable exclusive exhibition rights regarding syndicated programming within a certain geographic area. Then, with a few exceptions, the station with those exclusivity rights may require a cable system to cease carriage of duplicating programming on other signals. The new network non-duplication rules provide that network non-duplication protection will not be limited to any particular period of time, but leave it to the networks and their affiliates to determine a mutually agreeable arrangement.

The commission also clarified certain aspects of the rules, including:

- *Bartering.* The syndex rules apply to bartered syndicated programming as well as to cash transactions.
- *Cherry picking.* The commission said that it is unlikely that cable systems will "cherry pick" to create a composite channel of the most desirable programming. It noted that while the new syndex rules allow cable systems to run a substituted program to its completion without incurring additional copyright obligations, the cable operator then must return to the regularly carried channel even if a program is in progress on that regular channel.
- *Notification.* To be entitled to syndex protection, a station must furnish a cable system with a request for protection within 60 days after signing the contract granting it syndex rights. If that notification is not given within 60 days, all rights under the contract are lost (although they could be recaptured by recontracting for them). If proper notification is given, the broadcaster is not entitled to protection until at least the first day that begins 60 days after the cable system received the notice of the syndicated rights. The commission also retained the requirement for network non-duplication that affiliates notify relevant cable systems for their affiliations within 60 days of signing the contract.
- *Pre-existing contracts.* To invoke syndex protection under a pre-existing contract, that contract must contain a clear and specific reference to the licensee's exclusivity rights upon the contingency that the government reimpose syndex protection.
- *Exemption.* The National Cable Television Association asked the commission that the exemption from the syndex rules for cable systems with fewer than 1,000 subscribers act to also exempt larger cable systems that operate within the same community as the small exempt system. The commission denied that request.
- *Hyphenated markets.* The commission clarified the geographic extent of syndicated and network non-duplication protection in hyphenated markets. It said that if a station is entitled to exclusivity in a hyphenated market, it is entitled to enforce such exclusivity against all cable systems within the 35-mile zone of each designated community in that hyphenated market.

Editor's note: For additional FCC information, GO BPFORUM on CompuServe.

BACK GROUND
EFF 1
BACK GROUND
EFF 1
BACK GROUND



The seven layers of OSI

By Tyler North

Although local area networks (LANs) were not developed specifically for broadcasting, they are suited ideally to broadcasting requirements. Broadcasters use LANs in automation systems, where a central device talks to or controls several others, and in newsroom computer systems, where a number of terminals share a common database or device, such as a line printer. Computer graphics systems use LANs to digitally transmit images between computers at the graphics systems' high internal resolutions, instead of in analog form at video line rates.

OSI layers

A computer network consists of a set of one or more computers, terminals, devices and communication links, interconnected to provide a service to all users on the network. As network formats evolved, the need for uniform design became apparent. For this reason, the International Organization for Standardization (ISO) adopted a 7-layer model known as *open system interconnection* (OSI).

The operative word is "open." Any system that conforms to this standard will interconnect to other systems. ISO OSI is intended to ensure that computers of the future are compatible, which is done by keeping the layers completely independent. Changes in one layer do not require changes within the other layers, but just in the interconnections with the adjacent layers.

By the numbers

The 7-layer OSI interface consists of seven layers divided among three levels. (See Figure 1.) Layers 1 through 3 comprise the "network service level." The physical layer attaches to the medium, which in most broadcast LANs is a coaxial cable. The datalink layer provides reliability through checksums. This may be done with special protocol chips. The network layer corresponds to a device driver, monitors the network for congestion and checks routing.

Layer 4, the transport layer, is the software path between the network and the user. Stated another way, it is the path between the higher and lower levels. In networked PCs, this layer is found in the disk operating system.

Layers 5 through 7 form the higher-level "customer portion" level. The session layer manages the data used inside a program. The presentation layer performs text or data compression necessary to make data suitable for the network or understandable to users, and often is done through library routines. The application layer contains the programs that allow the user to work with the data.

Talking up and down

The user may envision host-to-host, horizontal communication with another user. In reality, however, data travels vertically, down to layer 1 and up again to the same layer as the transmitter. Horizontal communication takes place only at the "physical" layer, which is the layer of the connection to the wire, coax, fiber or other medium.

Gateway

In some cases, networks may be so busy that certain users have excessive waits before they can gain access. This would be the case with network-carried video signals, where the data rates are high. In these situations it may make more sense to operate several networks at once, connecting the items that most frequently need to communicate on a single medium. To facilitate occasional communication between these smaller networks, a "gateway" or "bridge" is used. Because no higher-level interface is needed, the bridge consists solely of a network service layer.

Network architectures

One of the most commonly used LAN systems is Ethernet, named for *ether*, the passive medium of which early radio pioneers thought space consisted. Ethernet was proposed by Xerox and developed by Xerox, Digital Equipment Corporation and Intel as IEEE standard 802. Ethernet complies with the ISO OSI 7-layer model.

One alternate network design is known as a "token ring," in which terminals are interconnected in a continuous loop or ring. In operation, an electronic word or "token" is passed around the ring from station to station. As the token arrives at a station, that station can replace the token with a transmission. When the transmission is completed, the token is again circulated around the ring.

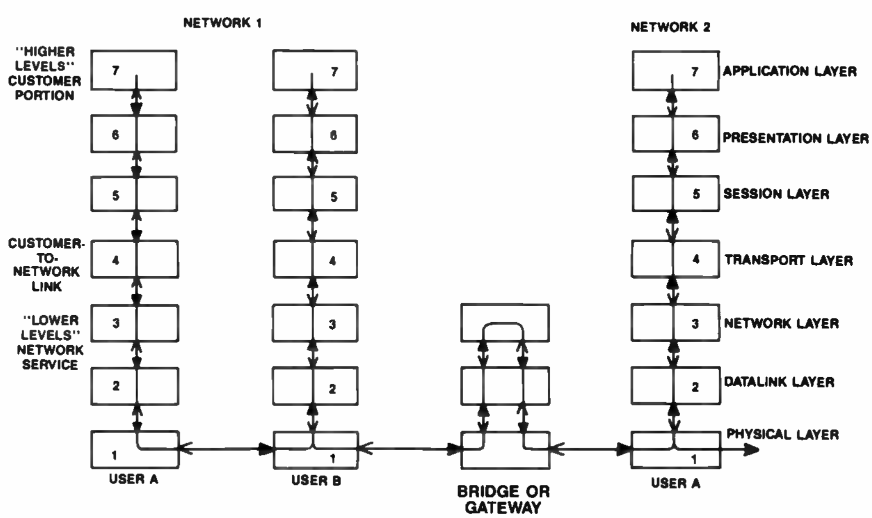
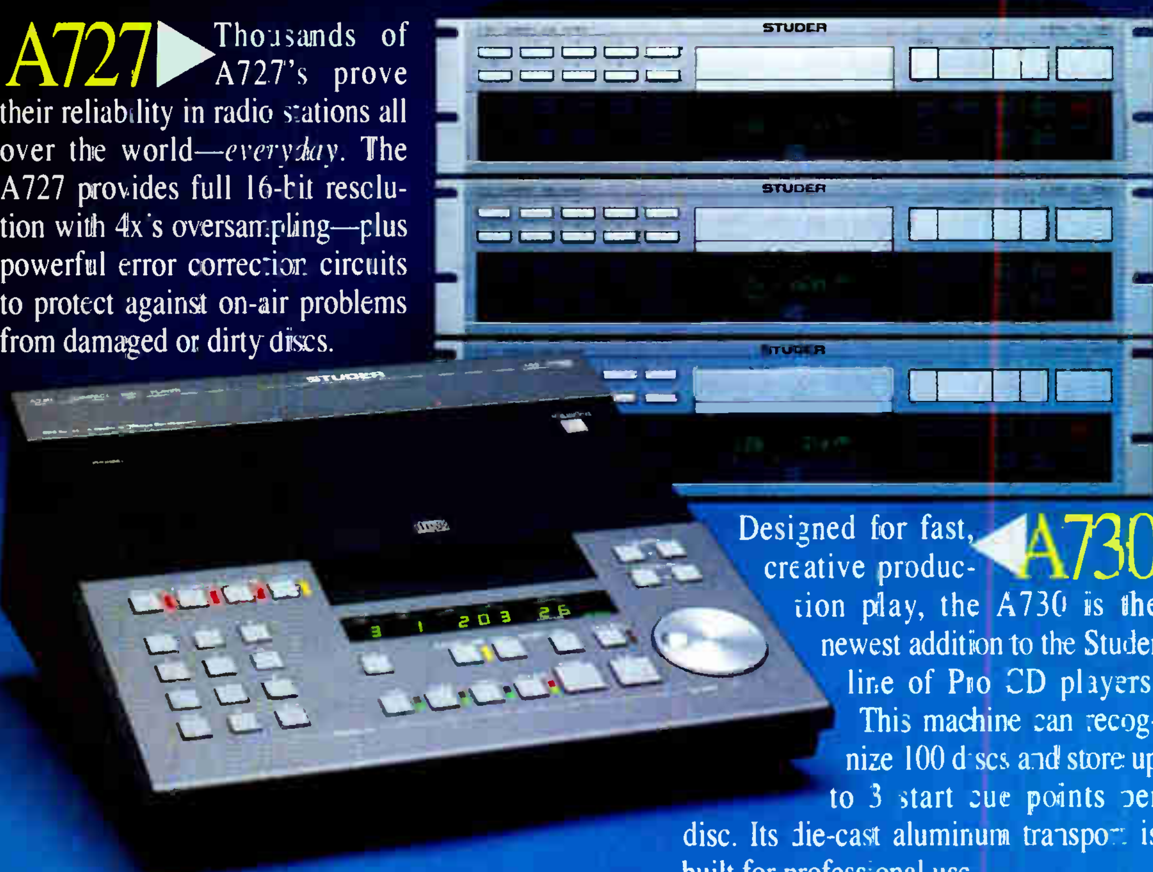


Figure 1. Levels and layers of ISO OSI computer network used in broadcasting. The bridge interconnects two networks.

North is a station automation consultant for Dynatech, Madison, WI.

Not for amateur radio.

You're no amateur at this game, so why play around with amateur CD players in the studio? You've tried consumer models in the past, just to see if they'll work long enough to make sense. We can understand that. But in the long run, they *don't* make sense. And you know it. Even modified or beefed up versions have given you headaches. . . wrong levels, hifi connectors, too many buttons or the wrong ones. Not to mention skips, mutes and breakdowns. Why take chances playing around with an amateur deck in a pro application? Leave that home player at home where it belongs. Check out the Studer A727 and A730—pro players for radio pros.



A727▶ Thousands of A727's prove their reliability in radio stations all over the world—*everyday*. The A727 provides full 16-bit resolution with 4x's oversampling—plus powerful error correction circuits to protect against on-air problems from damaged or dirty discs.

◀A730 Designed for fast, creative production play, the A730 is the newest addition to the Studer line of Pro CD players. This machine can recognize 100 discs and store up to 3 start cue points per disc. Its die-cast aluminum transport is built for professional use.

FEATURE	A727	A730	"Brand X" Player
Fader Start	▼	▼	
Parallel Remote w/Tallies	▼	▼	
Start & End Review	▼	▼	
End of Track Alarm	▼	▼	
RS422 Serial Control	▼	▼	
System Clock in/out	▼	▼	
Digital Output	▼	▼	
Die-cast CD Drive	▼	▼	
Cue Memories		3	

FEATURE	A727	A730	"Brand X" Player
Disc Recognition		100 discs	
Varispeed Built-in		▼	
End of Modulation Sense		▼	
Monitor Speaker		▼	
Separate PGM & Monitor Outputs		▼	
Remote Monitor Speaker Mute		▼	
Audio Channel Reset		▼	
Rack Mounts Standard	▼		
Flush Mounting		▼	

Go ahead. Make the comparison.

Before those amateur machines break again, call your Studer Revox Full Line Dealer, or contact us directly.

STUDER REVOX

[illegible]

Los Angeles [illegible], New York [illegible], Chicago [illegible], Dallas/Ft. Worth [illegible]

In Canada: Toronto [illegible]

Circle [illegible]

If high-tech fails, use humble basics

By John Battison, P.E.

Last month, I described my involvement in legalizing a former pirate radio station in Ireland and my Irish client's application for seven FM stations. I said a decision was expected within two weeks of hearing. My information was wrong.

It actually took three weeks to the day for me to receive a transatlantic phone call from my client in Dublin saying, "We've won!" Our proposal to use seven FM stations to cover southern Cork County, rather than the three proposed by the Irish Radio-Television Commission, was accepted with conditions yet to be fully presented. One condition that was made public was that we must let the competition in Cork City go on the air six weeks before my client. Three weeks from hearing to license — how's that for speed?

The stations are expected to be on the air in about four months. The transmitters and studio equipment will come from both U.S. and European companies.

Some thoughts on coax

In this age of technology, engineers become accustomed to using high technology for even simple servicing. This is wonderful, when you have the equipment available. It certainly speeds up service work and maintenance. However, what do you do when you don't have super-sophisticated test gear? Making every possible use of new technology is fine, but let's keep in mind some of the old fundamentals that got radio started. I used to tell students not to use calculators to solve problems, but to run them manually. I asked them, "What would happen if your battery ran out in the middle of a field?"

The smart-aleck answer was, of course, "Use a solar-powered calculator." But what if it's nighttime? Suppose your slide rule is broken? This kind of argument could go on for hours. The point I want to make is to not become so dependent on high technology that you forget the fundamentals and what to do when high technology fails you or is unavailable.

Detect the problem

A common problem is coax that doesn't do its job of delivering power from point A to point B. Point B is usually the antenna, sometimes located several hundred feet in the air. The coax is suspected of either a short or an open. Now try to locate the fault. The first task is to determine whether the problem is located between the tower base and the transmitter or up the tower.

Ohmmeter measurements are usually not precise enough to give the desired information. All they can tell you is whether or not a complete circuit exists. If the antenna is connected at the far end, there should be a low-resistance reading at the transmitter end. If the resistance is not representative of the antenna, you probably have either a short or an open, and you still don't know for sure where the trouble is located.

A time domain reflectometer (TDR) is a wonderful device because it can locate a circuit interruption within a few inches, but not everyone has access to one. Although it is possible to borrow one from a local power company, many smaller stations without such neighbors would have no way of finding out where the trouble was located.

At times like this, remember the humble grid dip oscillator (GDO). Hams used this device to tune transmitters, construct circuits and adjust antennas and transmission lines in the days of open wire lines with crossover insulators inserted every few feet to keep the line balanced. This little device is still around, but you'll have difficulty finding one.

The GDO (or grid dip meter, as it often was called) consisted of a small battery-powered oscillator with an external plug-in coil in the grid circuit. The frequency range, determined by the inductance of this coil, was medium to high. Some units even covered the VHF band. Placing this coil close to a circuit under test would result in a drop in grid current when the circuit was the same frequency as the grid dip meter.

Remember your theory

To check a suspect line, the GDO is loosely coupled by means of a turn or two of coil on the input of the coax. Transmission-line theory says that a coax will repeat the same impedance every ½-wave along its length. So you'd expect to see a dip at every frequency for which it is a whole number of ½-wavelengths to the short.

If you find dips at 3MHz, 4.5MHz, 6MHz and 7.5MHz, you also should find one at 1.5MHz. This indicates that the short is about ½-wavelength at 1.5MHz from the point.

To determine how far along the line it is, merely calculate. For general purposes, you can approximate transmission-line propagation velocity at about 0.93. The calculation is:

$$\frac{0.93 \times 0.5 \times 3 \times 10^8}{1.5 \times 10^6}$$

$$= 0.93 \times 10^2 = 93\text{m or } (93 \times 3.28\text{ft}) = 305\text{ft}$$

Remember, this is not a precise measurement, but it should give you a good idea of whether the problem is up the tower or on the ground.

If preliminary measurement with a VOM shows the problem to be an open line, you can locate the break area by looking for dips at an odd number of ¼-wavelengths apart.

Using the same frequency as before, but assuming an open line, you would expect to see dips at such places as 0.75MHz, 3 × 0.75MHz or 2.25MHz, 5 × 0.75MHz. Note that each dip still will be 1.5MHz apart. However, because you are seeking a short, divide 1.5MHz by 2 to find the frequency at which it is ¼-wavelength to the break.

Obviously, this is not the simplest way of finding shorts or opens, but it works, and it was used for years. Many of the older ideas are still valid, and from time to time, I may revive some. I'll refrain, however, from recommending the use of wet electrolytic rectifiers in old jelly jars when a solid-state rectifier stack fails.

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

KLYSTRODE TECHNOLOGY SAVES ENERGY.

THANKS EIMAC

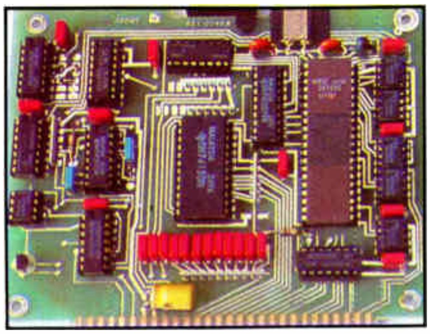
Eimac®

varian

eimac san carlos division

301 Industrial Way / San Carlos, CA 94070 / 415•592-1221

Circle (9) on Reply Card



Today's modems are fast and versatile

By Gerry Kaufhold II

Broadcast engineers will find modems throughout their facilities — in the station's remote-control equipment, at remote transmitter sites, in the sales office computers and possibly in their own PCs. The growing popularity of facsimile (fax) machines also has contributed to the proliferation of modems in TV and radio stations.

Low-cost modems can move data at rates from 110b/s to 1,200b/s. Recently, some modems have appeared that can operate at up to 9,600b/s.

Modems operating at 1,200b/s push data down a voice-grade telephone line using frequencies of 2,100Hz and 1,300Hz, and receive information at about 100b/s. The primary hindrance to higher speed for modems is the audio bandwidth of voice-grade lines. The lower frequency limit is about 300Hz, and the upper frequency is about 3,300Hz. Other problems are noise in the signal, low peak-to-peak (weak) signal level, various reflected signals mixing with true signals, and delays caused by satellites. The V.32 modem analog front-end (MAFE) overcomes these problems by using digital signal processing.

Smart signals

The quality of a telephone connection can't be predicted during call placement. Once the connection is made, however, the quality of the circuit probably will hold constant throughout the conversation. To determine the line characteristics for a given phone connection, a call-originating V.32 modem injects a signal and starts a delay timing counter. Samples of reflected audio returning down the line are digitized and compared with a digitally delayed version of the original transmitted signal to find a match. When the reflections and the delayed transmission agree, the delay counter value is transferred into a digital echo-canceling circuit that will provide echo-cancellation for the remainder of the modem connection.

The V.32 modem at the answering end then performs its own signal-injection and echo-cancellation algorithm. Echoes due to satellite links can be canceled up to ½-second. In addition to echo cancellation, some modems perform automatic frequency and level equalization.

Modulation

For 9,600b/s operation, the output of a V.32 modem is a straight digital pulse at 3,600Hz. A complicated algorithm adds lead and lag to this basic pulse. Viewed on an oscilloscope, the pulse would appear to be several overlaid pulse streams with lots of "jitter" at all the rising and falling edges. The data is decoded as a combination of this jitter and predefined bit timing.

Some application of information theory is required to reconstruct a data word. Theoretically, the effective data rate can be as high as 19,200b/s. Because the modulation technique is non-return-to-zero (NRZ), adjacent bits of the same value (either 0 or 1) do not cause a change of state of the modulation pulse. The effective transmission frequency, therefore, usually is below 2,500Hz.

The pulse is wave-shaped to prevent overloading of the telephone line. Wave-shaping circuit values are chosen to achieve a compromise between high pulse rates and telephone line bandwidth limitations.

Call protocol

After initializing its echo-canceler, the call-originating 9,600b/s modem sends out a predefined data word reconstructed by the receiver to ascertain the timing of the bits that will be sent.

Unlike Bell 212A modems, there is insufficient bandwidth to send low-speed verification signals. Instead, the transmitting modem verifies the transmission by comparing the reflected echo against a delayed version of the signal it just sent. As long as the incoming reflected signal matches the delayed version of the outgoing transmitted signal, the modem assumes that the telephone line has not failed.

At the end of the transmission, a "hand-off" signal is embedded and sent in the datastream. The receiving modem then quickly readjusts its echo-canceling algorithm and begins transmitting. If, for some reason, the signal quality deteriorates significantly, the modems automatically will "fall back" to 2,400b/s or 1,200 b/s operation.

There is still the problem of random noise during transmission. To overcome this, digital error-checking and correcting bits are added to the transmitted signal. The receiving modem pulls these bits out of the received datastream and can reconstruct data even from noisy transmissions.

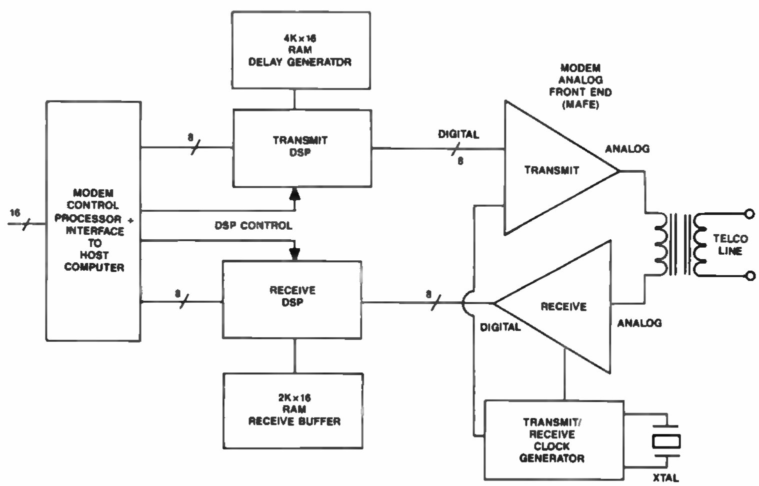
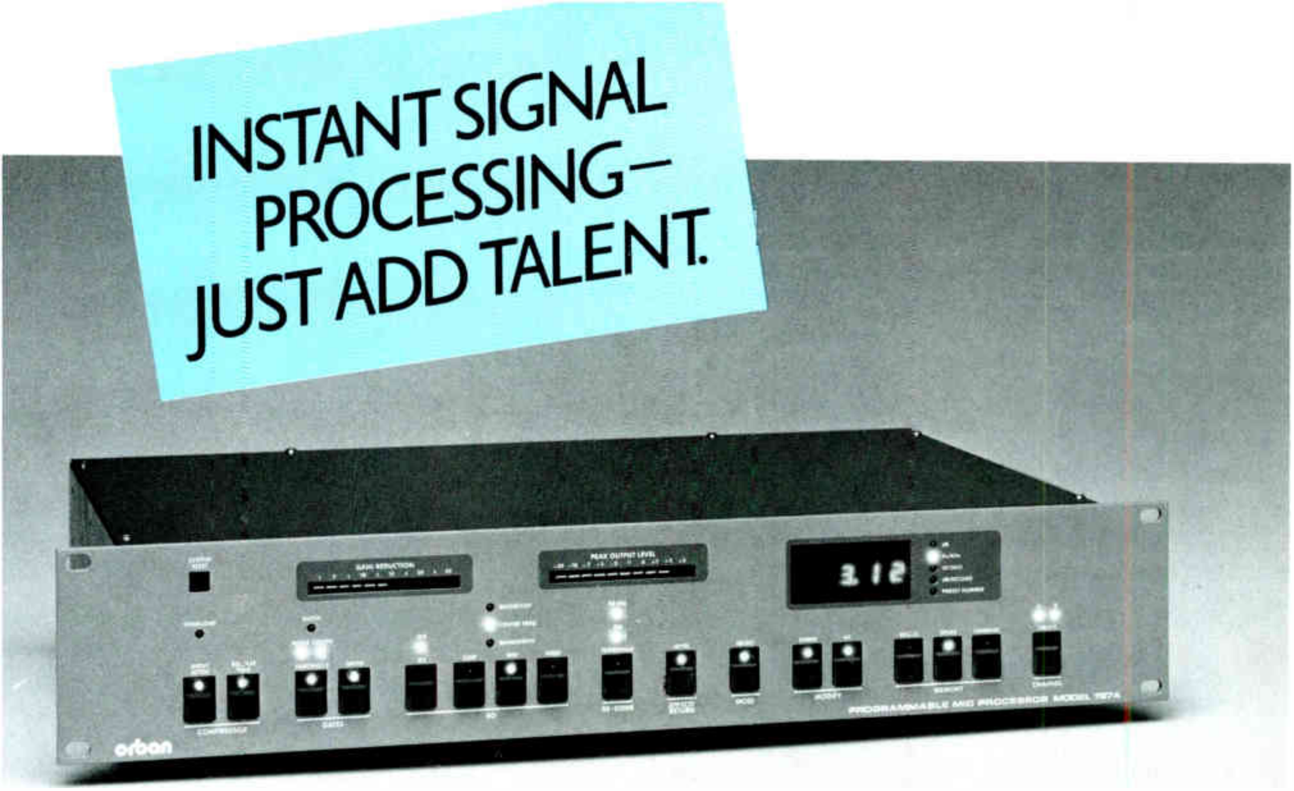


Figure 1. Block diagram of a modem analog front end, which can achieve 9,600b/s by using digital signal processing.

Kaufhold is a market development engineer for SGS-Thomson Microelectronics, Phoenix.



Orban's new digitally-controlled 787A Programmable Mic Processor integrates an unprecedented combination of vital signal processing functions into one powerful, compact package. It delivers fully programmable **mic- or line-level** processing with access to 99 memory registers through MIDI or RS-232 interfaces, or a console-mounted remote control. All you do is add the talent.

The 787A offers a space-saving, elegant solution to many annoying problems (voice or instrumental deficiencies, poor room acoustics, noise, sibilance, wandering levels) in multi-track and MIDI recording studios, commerical production, video post, audio-for-video, and film scoring facilities. The 787A increases production efficiency through consistently repeatable processing. Less time need be spent tweaking separate processors, so more attention can be devoted to capturing top creative performances as they happen.

The 787A is complete audio processing arsenal in a box—a flexible parametric EQ, a smooth compressor, noise and compressor gates, and a handy de-esser. The 787A can be operated in mono or dual-channel/stereo (with the addition of a second-channel slave). An optional Jensen transformer mic preamp with 48V phantom power adds further flexibility.

Orban's 787A Programmable Mic Processor will help you remember tomorrow the way your talent sounded yesterday.

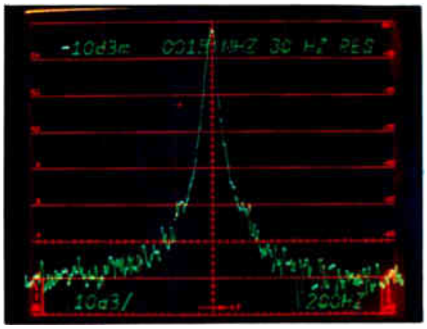
orban Blue Chips

Orban Associates
645 Bryant Street, San Francisco, CA 94107 USA
(415) 957-1067 Telex: 17-1480 FAX: (415) 957-1070

Circle (11) on Reply Card

Troubleshooting

Part 3



Maintaining your computer

By Brad Dick, radio technical editor

Last month we began looking at the types of problems that can develop with hard drives. As more broadcast equipment becomes dependent on these systems, it's important for engineers to recognize the signs of impending problems and know how to prevent catastrophic failure. Let's look at some typical warning signs and software that can help prevent hard disk failure.

Formatted disks

As with floppy disks, hard disks must be formatted before they are of any use. Two types of formatting must be performed on a hard disk: *low-level* (sometimes called *hard* or *physical*) formatting and *high-level* or *logical* formatting. The low-level format sets the following information on the drive:

- number of tracks or cylinders per platter.
- number of platters.
- sector size in bytes.
- number of sectors.
- interleave factor.
- sector preamble information.

The DOS format command performs high-level formatting when the following is completed:

- boot sector is organized.
- file allocation table (FAT) is created.
- root directory is created.

Both types of formatting must be completed before the hard disk can be used. Once the disk is formatted properly, it may operate for several years before reformatting is needed. A power loss during a write command or a trashed FAT may require that the disk be reformatted. As the number of files increases and old files are erased, file fragmentation also can become a problem. As fragmentation increases, so does the time required to access the data. These problems can be resolved by using the DOS format command.

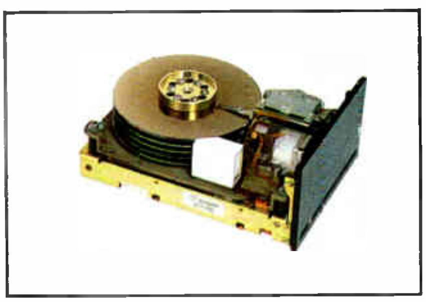
Mechanical problems

Other types of problems develop as the disk system ages. The mechanical tolerances of the servo-head assembly are extremely tight. Over time, these mechanical components wear, and the precise alignment that once was possible begins to drift. Unfortunately, the drifting involves only the data. The servo information written to the disk during the low-level formatting process does not change. The servo information and the data, therefore, move out of alignment with each other. The resulting displacement between the servo information and files or data can create several types of errors.

The failure may first be noted through error messages displayed by DOS: *boot failure, sector not found, bad sector error.* An earlier warning sign may be a drive that takes a long time to recover data or reads a sector repeatedly. When these problems develop, it's time to take corrective action.

You can do several things to prevent these occurrences. First, watch the drive's performance closely. Long or repeated read cycles should warn you of potential trouble. Back up your data often. If you've ever had a crash resulting in the loss of 20Mbytes to 40Mbytes of data, you appreciate the importance of good backup procedures. If you can't afford a tape backup system, purchase one of the software backup programs, and use it faithfully. When a drive begins showing signs of age or unreliable operation, check it out immediately. Don't trust your station's operation to a malfunctioning hard disk.

Many times a disk will fail because the low-level formatting expires. As discussed previously, the low-level formatting information is not refreshed during the read/write cycles. Constant use and time can affect the strength of the magnetic particles and, as a result, the servo information. Re-recording this information in the correct position can salvage a drive that shows signs of developing problems. Although physical formatting usually is done only by the manufacturer, a user can perform the same process.



Today's broadcast systems often rely on high-density hard disks, such as this one. A little preventive maintenance may mean the difference between smooth sailing and disaster.

Reformatting programs

The software required to perform this task is not well-known. IBM buries its physical format program on the Advanced Diagnostics disk. Unless you've purchased the diagnostics package, you don't even have the program. Another source of reformatting programs is a third-party software company. The advantage of third-party programs is that they often contain sophisticated file-recovery utilities.

These programs perform a *non-destructive* low-level format on the hard disk. The program first reads the information from the disk and stores it in RAM. The data is then re-recorded back onto the disk. Both servo and file data are rewritten back to the disk.

The process has several advantages. One is that the data is realigned with the header IDs used by the servo. Another is that the process refreshes the servo data as it's recorded back onto the disk. The programs often allow the disk interleave factor to be optimized to the computer. This can increase greatly the transfer rate of data between the disk and computer.

Every computer will fail; the only question is when. If you are using computers for broadcast applications, a little preventive maintenance can go a long way toward warding off disaster. If you are not backing up your data, you deserve the consequences, so get a backup program and use it. Although software exists to help recover from catastrophes such as those described, it's far better to try to avoid problems in the first place.

Editor's note: Next month we begin a multipart series on servicing CD players. Several brands of players will be discussed, and specific instructions will be covered to help you service your own CD players.

Acknowledgment: Appreciation is expressed to Gene Senecal, technical support technician at Gibson Research, Laguna Hills, CA, for his help with this article.

Part 2

Management for engineers

On being a leader

By Brad Dick, radio technical editor

In last month's column, Jim was facing his first day on the job as chief engineer. He had explained to his young son that his new problems would be with people, not with equipment. By the time that first day was over, however, Jim would have welcomed equipment problems.

When he returned to his office after the Monday morning staff meeting, he found Frank, the union steward, waiting for him. It seemed that the new hire, Waneta, had taken it upon herself to perform a few adjustments on one of the new D-2 machines. According to Frank, it was now "all screwed up."

Frank was upset for two reasons. First, he felt that maintenance should be performed only by the maintenance staff. "After all," he pointed out, "the contract requires that maintenance be performed by a *qualified* (to Frank that meant union) engineer." Second, as a new hire, Waneta was supposed to "do what she's told," as Frank put it. It seemed that she was often taking on additional duties and trying to learn about other areas. Frank described her quest for knowledge as "butting in." As he listened to the complaints, Jim began to feel a desire to return to maintenance.

A different set of tools

Being able to troubleshoot the most advanced electronic equipment does not prepare you to deal with situations like these. If you think personnel issues will be easy to solve, you've been sniffing solder fumes too long.

Even if you work alone, perhaps as chief engineer at an AM or FM station, you still must interact with others on the staff. Have you ever run across a program director with an ego as big as all outdoors? Have you ever worked for a manager who talked about broadcast quality before you were hired, and about the lack of money after you were on board? You can never run away from people who have the power to make your life miserable.

Level three: social interaction

In last month's column, we discussed the hierarchy of human needs, which can be illustrated by a pyramid consisting of five levels. Beginning with the most basic need, they are as follows: physical needs (level one), safety/security (level two), acceptance/social needs (level three), esteem/ego (level four) and self-fulfillment (level five). The most productive and happy employees have their level-three and -four needs met on the job. Let's examine some ways that Jim might help build job satisfaction (level-three) and personal satisfaction (level-four) in his staff members.

How a manager helps employees meet level-three needs depends upon leadership style, task structure and company policy. Some companies encourage social interaction among workers, and others do not. It is relatively easy for a leader to support such activity if permitted by the company.

Allowing staff members to take breaks together is one way to encourage socialization. Remember that your staffers want to socialize with other station employees, so be sure they are not isolated from the rest of the station. Although it may be convenient to have them take their breaks in an engineering office or workroom, they should be permitted and encouraged to interact with the staffs of other departments.

You don't have to host Christmas, New Year's or Groundhog Day parties, but consider having an occasional staff buffet luncheon. This allows everyone to bring something to share with others. How about organizing a softball or bowling team? The people who choose to participate will develop bonds that transcend the studio walls.

Increased visibility

It's actually quite easy to develop a team spirit (and meet level-three and -four needs) within an engineering department. Engineers often are seen as somewhat weird — as loners or "nerds." These characterizations make it easy to form a team simply by recognizing that engineers are different.

Develop a department logo that makes your staff stand out from the station. If no one on the staff can draw, ask the art department or an artistic friend to help. Have custom cloth or iron-on patches made of the logo so the engineers can place them on their jackets or other clothing. At my former station, the engineers were provided jackets with the station's logo on the back and a custom engineering department logo on the front.

The engineers saw the jackets as recognition of their talents and of their importance to the station. When they wore them, they stood out from the other station employees. A seemingly minor item such as this can go a long way toward meeting level-three needs while building pride and improving staff performance.

Level four: self-esteem

To develop self-esteem, employees must feel good about their performance. Individual recognition of a person's effort is critical to effective job performance. Without praise, all other efforts will be fruitless. As a supervisor, you must recognize good performance, both privately and publicly. When employees go that extra mile or put in extra effort, whether or not they are paid for it, reward them with verbal recognition. If the deed warrants, ask your supervisor to mention it in the company newsletter.

If your station builds many custom projects, put your engineering logo on the front panels. Have a silk-screen or decal produced for use on each custom-built device. Develop another custom decal that says, "Built by ______________". This logo should be placed on every piece of equipment built by your staff. In the space, print the name of the engineer who built the device. How much more care will your staff members take if they know that their names are going on the equipment?

Sales managers frequently offer incentives to the sales department to encourage high performance. You may not be able to offer the engineering staff free trips to Acapulco or Las Vegas, but there are plenty of other desirable rewards.

These are only a few ideas that you can incorporate into your management plan. If you don't have anyone working for you, then do the same thing for yourself. Fulfilling level-three and -four needs improves performance, reduces turnover and fosters an increased pride in workmanship — none of which can be accomplished by any company policy.

NEW FROM ARRAKIS SYSTEMS

10,000 SERIES

For features, performance, price and reliability,

NOBODY BUILDS CONSOLES LIKE ARRAKIS.

Call (303) 224-2248

Circle (13) on Reply Card

arrakis SYSTEMS, INC.

ARRAKIS SYSTEMS INC. 2619 MIDPOINT DRIVE FORT COLLINS, CO 80525

History has been marked by occasional dramatic jumps in technology. Most of the progress, however, has been made in incremental amounts — one development leads to a second, and so on. With the technology base available today, the future of broadcasting will be exciting, indeed.

Major industry milestones

1959 • **Broadcast Engineering** magazine founded.
- National Stereophonic Radio Committee formed to decide on an FM stereo system.
- Audio cartridge recording system introduced at NAB by Collins Radio.
- Broadcast Electronics introduces Spotmaster cart machine.
- Ampex VTR at Moscow trade fair records the Nixon/Khrushchev "Kitchen Debate."

The 1960s:

1960 • Stereo FM tests conducted over KDKA-FM, Pittsburgh.
- Ampex introduces Intersync system for VTR.
- Toshiba proposes a videotape recorder using a helical scanning process.

Milestones in the evolution of technology

By Jerry Whitaker, editorial director

Advances in technology and increased competition have created new opportunities and new challenges for radio and TV broadcasters.

Our industry's appetite for innovation has grown enormously during the relatively brief history of broadcasting. Stations have absorbed technical advances as quickly as they roll off the production lines. Broadcasters today have to adapt quickly to changing technologies — especially those that affect their on-air image — or be left in the dust.

During the 30-year history of **Broadcast Engineering**, we have seen television go from a medium only the wealthy could afford to one that covers almost 100% of the country's homes and is watched more than seven hours every day. We have seen FM radio emerge as the dominant form of aural broadcasting while AM has slipped into the background. We have seen exceptional programming and miserable programming. There was enough good, however, for broadcasting to grow and prosper. Now, more than ever, the nation depends on television and radio for most of its information and entertainment.

New technology also has given consumers more video and audio sources from which to choose, siphoning viewers from the traditional stronghold of three networks and their affiliates. But the strength of our unique system of broadcasting in the United States is *localism*. Radio and TV stations with a strong commitment to news, public affairs and local entertainment programming will not only survive, but continue to dominate. The ability, too, to operate efficiently is a must in today's competitive market.

Still, over-the-air television today faces significant threats from alternative entertainment and information sources. Looming on the horizon is the greatest threat of all: high-definition television delivered via fiber optics. In many ways, radio faces a more certain future. Until somebody finds a way to drag cables to all automobiles, boats, airplanes and bikes, radio still will be in there informing and entertaining audiences.

The development of satellite technology has made possible the creation of many new radio and TV networks, including CNN, MTV, TNT, Westwood and NPR, to name a few. Satellites also have reshaped the concept of a network from a complex wire-connected system to a simple point-to-point group of affiliates that pick off feeds from various channels or satellites as needed.

The satellite age also has greatly expanded the influence of cable television. Although cable television has been around since 1950, its impact on traditional broadcasting has been felt only within the last decade. Cable penetration has increased from just 11% in 1973 to more than 53% today. Much of this growth can be traced to the new programming services offered by *superstations* and specialty networks formed on the basis of satellite interconnection. (Table 1 shows the latest broadcast facility statistics.)

The march of technology

The steady advance of technology makes it easy to lose sight of the great progress made from one decade to the next in broadcast equipment design. Only by stepping back and comparing where we are with where we have been can we measure the true distance covered. The advance of technology generally can be divided into decades, as illustrated in the accompanying time line. During **Broadcast Engineering**'s 30 years, we have been witness to the following milestones:

Continued on page 26

- Echo I and II passive reflector satellites launched.

1961
- FM stereo transmission system approved by FCC.
- Electron beam recording demonstrated.
- Ampex SloMo Disc developed.
- First live televised presidential news conference (John F. Kennedy).
- First Western viewing of live television from USSR on the BBC (Moscow welcome for Yuri Gagarin).

1962
- FCC issues FM licensing reallocation rules.
- Philips introduces audiocassette tape player.
- Telstar communications satellite provides first international relay of TV pictures.
- Legislation passed in U.S. creating Comsat.
- RCA announces first fully transistorized video recorder.

1963
- RCA develops metal oxide semiconductor (MOS) process.
- FCC releases new FM table of assignments.
- TV transmitter remote control authorized by FCC.
- ITFS service established by the FCC.
- Electronic line-store (625-405 and 405-625) standards converter developed by the BBC.
- TV used on a U.S. manned space flight, the Mercury 9.

1964
- RCA develops complementary MOS (CMOS) technology.
- Society of Broadcast Engineers holds first official meeting at NAB in Chicago.
- Intelsat organization formed.
- Character generator system introduced.
- RCA videotape cartridge developed.
- First TV program automation system installed.
- TV camera placed onboard Ranger 7 moon explorer.
- TEAC provides slow-motion color video playback system for NHK coverage of 1964 Olympics.
- Industry committee formed to establish videotape standards, with SMPTE as secretariat.

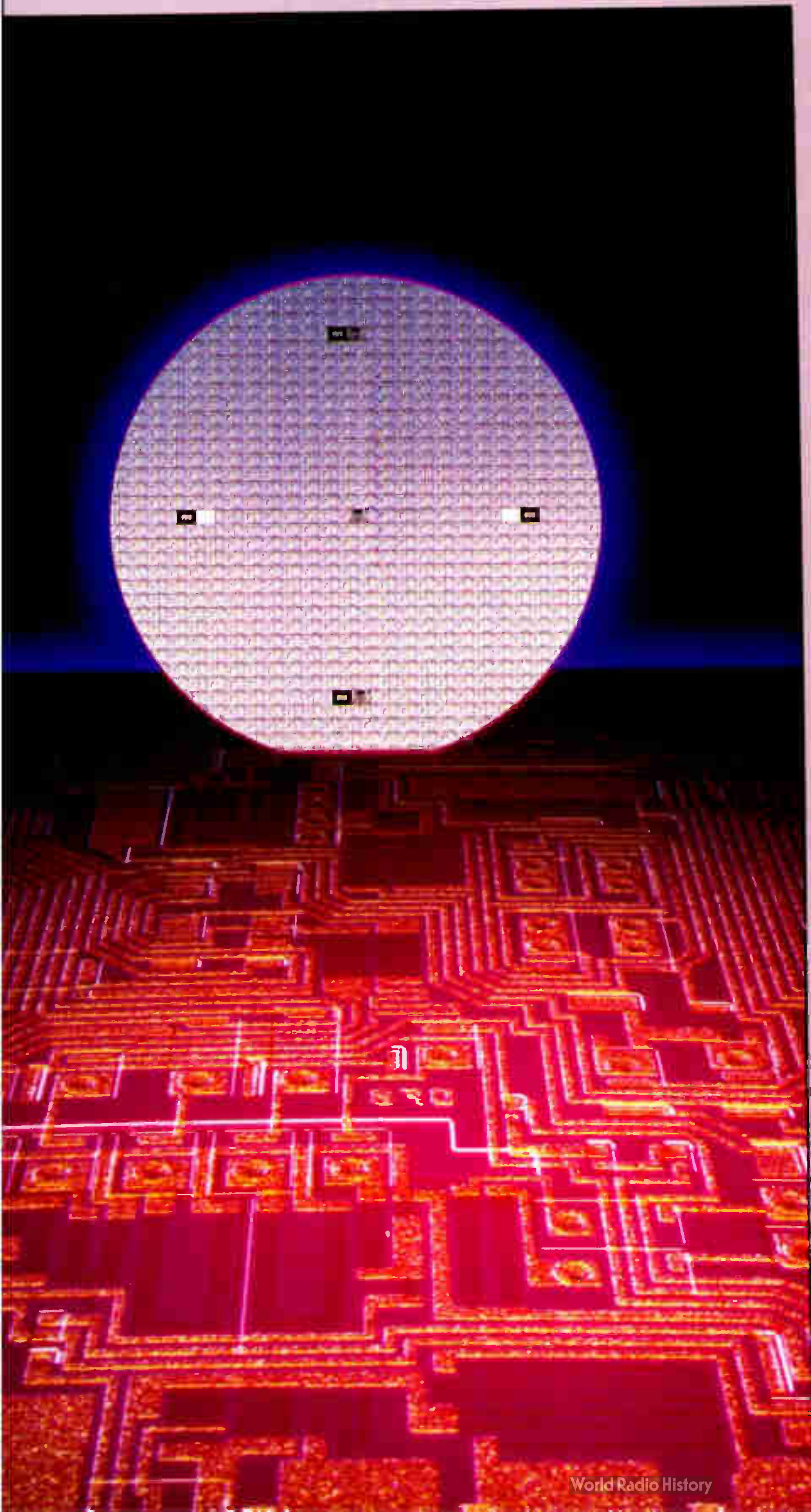
1965
- "Early Bird," first international communications satellite, launched (Intelsat I).

1966
- First bipolar IC amplifier introduced.

1967
- PAL/SECAM standards announced.
- First high-band color disc recorder for playback of short program segments in normal, slow or stop action is used on ABC-TV coverage of the *World Series of Skiing*.
- First time-code editing system for video, called On-Time, is developed by CBS, Hollywood.
- Solid-state imaging technology demonstrated.
- Intelsat II satellite launched.

1968
- CBS uses a portable minicam for political convention coverage.
- Trinitron tube developed.
- 1-inch Plumbicon developed.
- First radio/TV business automation systems installed.

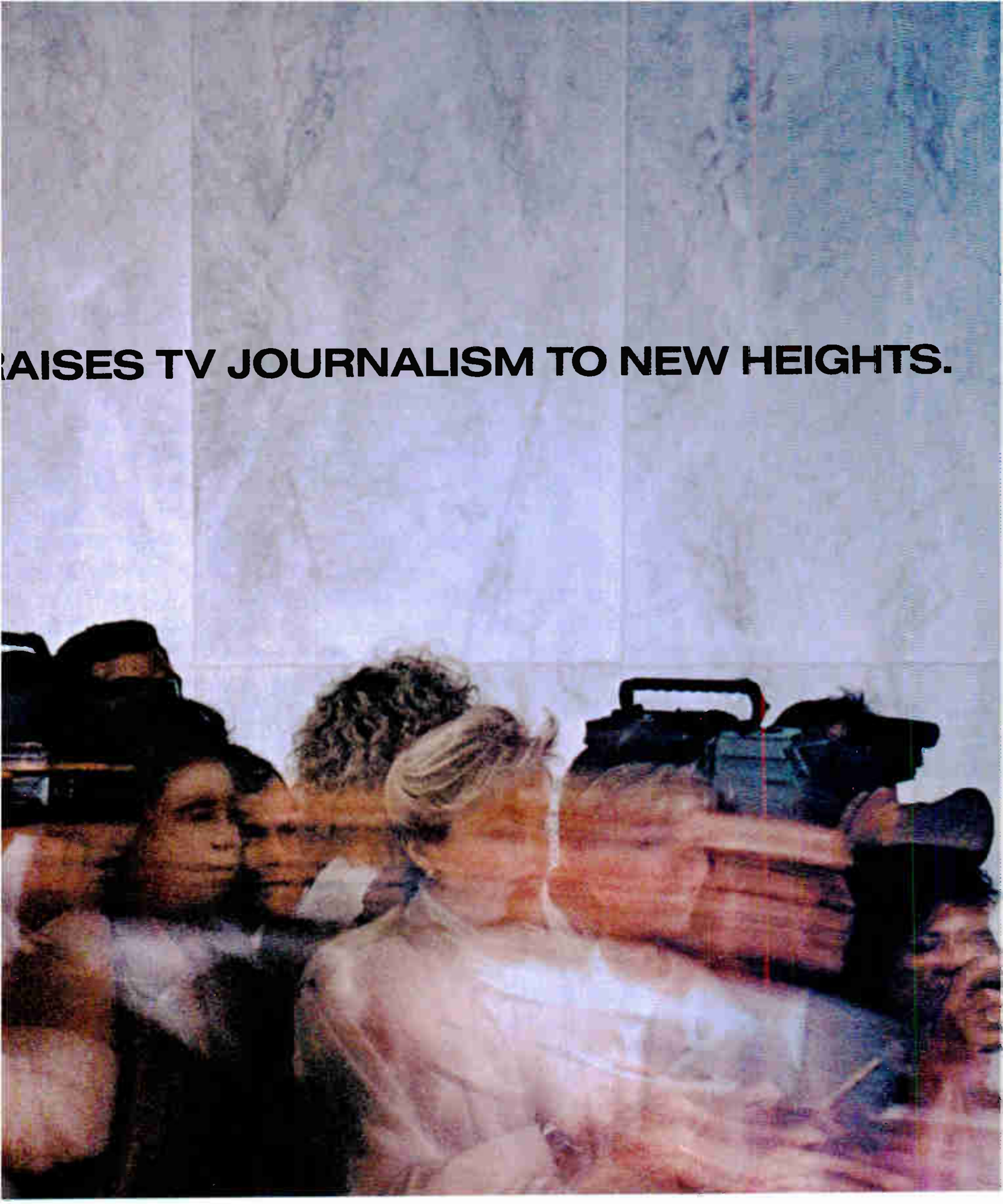
1969
- Instant random-access audio cartridge machine introduced at NAB by IGM Communications.
- SMPTE time code established to end the chaos of incompatible time codes for various editing machines.
- Neil Armstrong walks on the moon (July 20); worldwide audience watches the event live.



Introducing the smallest, lightest broadcast Betacam® camcorder in the world.

The BVW-200 weighs only 15 pounds, including lens, cassette, viewfinder, and lightweight battery. So you can hold any shot better and longer. Plus, it records for an entire hour on a single NP-1A battery.

But state-of-the-art features are what make the BVW-200 extraordinary by any standard. Betacam SP® format. Advanced CCD technology for higher sensitivity, resolution of 550 lines, and a superior S/N ratio. There's even viewfinder playback.



And all of this fits into a 15-inch length. And a low profile for unobstructed peripheral view. The BVW-200. More compact and maneuverable than any other camcorder before it.

Suddenly, the impossible shot is yours. To find out how the BVW-200 can help your work reach new heights, see your Sony Broadcast Sales Engineer. Or call: (800) 635-SONY.

SONY®

BROADCAST PRODUCTS

Sony Communications Products Company, 1600 Queen Anne Road, Teaneck, NJ 07666.

TELEVISION STATIONS: TOTAL = 1,388	**VHF** 545	**UHF** 508	**EDUCATIONAL** 335
LOW-POWER TELEVISION: TOTAL = 455	**VHF** 126	**UHF** 329	
RADIO STATIONS: TOTAL = 10,439	**AM** 4,929	**FM** 4,141	**EDUCATIONAL** 1,369
CABLE TV:	**SUBSCRIBERS** 48,637,000	**PENETRATION** 53.8%	**PAY PENETRATION** 32%

NOTES:
1. Totals represent stations currently on the air.
2. Stations holding construction permits are not counted.
3. Radio and TV translators are not counted.
4. Penetration of cable systems is based on the number of homes passed (73.9 million) compared with the TV household universe (90.4 million).

Table 1. The latest statistics on radio, television and cable TV facilities in the United States.

Continued from page 23

- *The decade of the '60s.*

From the standpoint of broadcast equipment, this was the decade of color television, videotape, stereo FM and remote transmitter control. The color TV conversion process often was slow, as local stations replaced or modified pickup, playback and transmission equipment one piece at a time. By the early 1960s, the switch to color programming was gaining steady momentum, led primarily by NBC. By the fall of 1965, almost all of NBC's prime-time schedule was produced on color film. CBS was a year behind in reaching that point, and ABC followed in the 1967 season.

Program relay by satellite went from the laboratory to the field during the '60s.

Tape recording technology continued to progress, with the widespread use of color videotape machines and unique production devices such as the Ampex SloMo disc recorder. The videotape cartridge system was shown in the middle of the decade by RCA, offering stations a simple, and usually reliable, method of spot playback.

TV broadcasters stretched the limits of portability with the large cameras and recorders of the day. A TV camera was placed aboard the Ranger 7 moon explorer in 1964, and in 1968 CBS made history by using a portable minicam for political convention coverage. News gathering hasn't been the same since.

Program relay by satellite went from the laboratory to the field during the '60s. The young technology provided viewers fascinating images from faraway lands *live*. The public loved it.

A new and useful device called the *character generator* made its debut in 1964, finally giving broadcasters an alternative to studio cards "supered" over video.

Various schemes were involved in attempts to automate radio and TV stations. Although the hardware worked, it left much to be desired and rarely lived up to its promises of flawless execution and reduced personnel count. The idea was right, but the technology was too primitive to meet the expectations of station managers.

The conversion of FM radio stations to stereo operation was a lengthy process that spanned most of the decade. Although operation under the new mode of broadcasting was authorized to begin on June 1, 1961, it was not until 1969 that most stations had converted to FM stereo. The delay in implementing the new technology was primarily because of the lack of profitability of FM broadcasting at that time.

Many radio and TV stations converted to remote-control operation of their transmitters. Advances in transmitter design and remote-control technology helped this process along greatly. Improved station coverage area and studio facility relocation were two of the reasons for increased interest in remote-control operation during the '60s.

- *The decade of the '70s.*

With color television, stereo FM and transmitter remote control in full swing, broadcasters looked for more efficient

Continued on page 30

Courtesy of Harris

Courtesy of Lexicon

Studio source and control equipment has changed dramatically within the past 30 years. Audio control boards and video switchers have become more compact, versatile and user-friendly. Shown is a 1959 model Gates Radio Gatesway audio board (left), compared with a new technology digital mixing and recording console.


ABCDEFGHIJKLMNOPQRS
2

WE'VE SEEN THE FUTURE AND IT FITS.

Just when broadcasters and professional users are shifting from one-inch and 3/4-inch video tape systems to 1/2-inch analog component video, along comes the specter of 19mm D2. First they made it smaller; now they want to make it bigger again.

When Panasonic set out to design Composite Digital recording systems, we had a big responsibility —to keep it small. Our customers have a right to expect their investment in 1/2-inch to be preserved. We know that a change in technology means more than a change in equipment; walls, racks, layouts, suites, vans and tape storage are all long-term investments that shouldn't have to be re-done every time there's a new chip on the block.

Panasonic's new Composite Digital system not only delivers superior multi-generation capability, long-term signal stability and unprecedented operating ease. It is designed to fit right where it should—into your existing facilities.

Panasonic's design philosophy is always to create products for the future with today clearly in mind. Our editing recorders and systems work with all of today's existing standards for video, audio and control. When you're ready to convert your editing suite to Composite Digital video, Panasonic will fit in.

Panasonic cameras, from our new, all solid-state AK-450 to the new all-digital DPC-1, are designed to slip transparently into the operators' experienced hands.

Today's mobile teleproduction requirements include everything from commercial production to fast-breaking news. That's why our system design is built around interchangeable components and true portability—and will remain so from today to digital to HDTV.

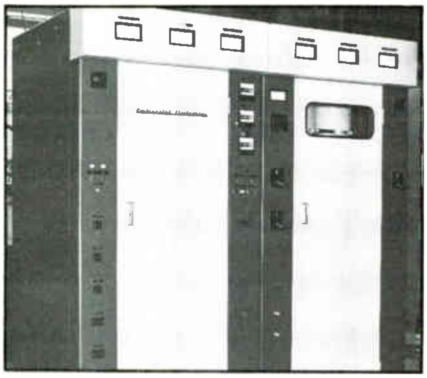
Here's the bottom line. Television in the 1990's demands technical advances and innovations—digital video and HDTV. But *your* demands are for systems that permit smarter, leaner operations. And that is why Panasonic's broadcast equipment, both for today and tomorrow, is designed to fit into your plant, your vision and your budget.

Panasonic Broadcast Systems Company One Panasonic Way, Secaucus NJ 07094 (201) 348-7671

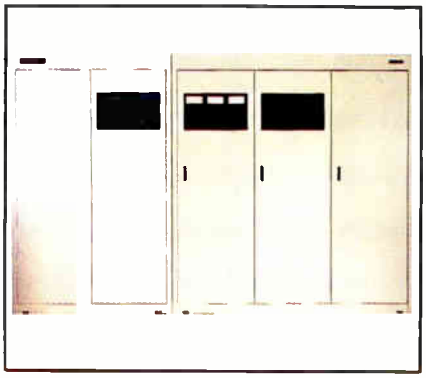
Panasonic
Broadcast Systems

Circle (18) on Reply Card


HERE.
HERE.
HERE.
HERE.
HERE.
EXPENSES
NET INCOME
AND ESPECIALLY
HERE.



Courtesy of Continental



Courtesy of Harris

Dramatic improvements have been made over the years in AM transmitter efficiency. New-technology transmitters run cooler and quieter and often can switch around a problem stage on their own. Shown is a 1960s-vintage Continental 10kW AM transmitter, which used six vacuum tubes, (left), compared with a new 50kW all-solid-state digital modulation AM transmitter that uses a microprocessor for control and diagnostics.

dividends for the entire broadcast industry. UHF stations finally began to see light at the end of the efficiency tunnel. The tremendous efficiency penalties faced by UHF operations now are being removed by improved devices, including the Klystrode and the multistage depressed collector (MSDC) klystron.

AM broadcasters also shared in the efficiency gains, with all-solid-state, high-efficiency transmitters up to and including 50kW. Increased efficiency translates to significant savings for stations, making facility updating an attractive option. FM radio and VHF-TV transmitters also improved during the decade, although not as dramatically as AM or UHF. The biggest change for FM and VHF has been the use of solid-state drivers for high-power (20kW and above) units, and sophisticated fault diagnosis equipment built into the rigs.

All in all, this decade has been a period of dramatic growth and change. It has been, in fact, about as much fun as we could stand.

Acknowledgment: Historical information was provided by:
- John Battison, BE consultant on antennas and radiation.
- Edison Schow, broadcasting department, City College of San Francisco.
- Blair Benson, BE TV technology consultant.
- Peter Hammar, consultant, LaHonda, CA.
- Don Rushin, 3M Company.
- Larry Cervon, Broadcast Electronics.

End Format Chaos

HR600+ High-Resolution Multiformat Transcoding TBC

The HR600+ is an extremely high-resolution TBC which has a list price of just $5,950.00 U.S.

With over 600 lines of resolution and 7.5 MHz bandwidth, the HR600+ is the best in the industry.

The HR600+ time base corrects and transcodes between:

- True Component —
  - J-matic and U-matic SP (Y/688, 7 pin)
  - Betacam, Betacam SP and MII (Y/R-Y/B-Y, 12 pin)
  - S-VHS and ED Beta (Y/C, 4 pin)
- Composite —
  - ½" and ¾" VCRs (BNC)

Digital effects option —
posterization, sepia, mosaic

NOW AVAILABLE WITH FREEZE FRAME AND STROBE
Model #810 limited effects
$8,750. US
Model #811 full effects
$9,750. US

Proven — Service, Price, Performance

All Prime Image products made in the USA

Prime Image

Prime Image, inc. • 19943 Via Escuela • Saratoga, California 95070 • (408) 867-6519

Circle (17) on Reply Card

The 1970s:

1970 • PBS network established.
• Color-under recording used in first 3/4-inch VTR from Matsushita, Victor Company of Japan and Sony.
• ACR-25 random access videocassette recorder introduced by Ampex.

1971 • *U* format introduced by Sony/TEAC and JVC.
• CMX formed after a joint experiment between CBS and Memorex.
• NHK (Japan) begins experiments with high-line-number TV systems, and discusses the feasibility of a 1,125-line system.
• RCA joins EECO to develop and market the TCE-1000, an electronic editing system based on time code.
• Cinema Products CP-16 news film camera introduced.

1972 • Teletext experiments begin in United Kingdom.
Time base corrector introduced by Consolidated Video Systems.
• BBC develops "Sound-in-Sync" digital encoding system for audio-video combining.
• CMX 300, the first computerized editing system, is introduced for on-line editing and auto assemble of pre-edited shows.

Five decades of magnetic tape

By Don Rushin

From hi-fi to high definition, magnetic tape has been a key element in broadcasting.

"The tape came up to speed, then, opening theme — Crosby: Blue of the Night; applause; introductory patter — Crosby and Carpenter; song — Crosby: My Heart is a Hobo; applause.

"Murdo McKenzie signaled me to 'cut.' I pressed the stop button. There were surely no more than two seconds of silence, which seem more like minutes to me, and then a shower of compliments. One small machine, one of a pair, side by side on a makeshift table — the only two of their kind in the United States arranged to record and reproduce magnetic tape with such remarkable fidelity — had, in a listening demonstration lasting almost exactly five minutes, upset the entire future of sound recording in this country."

— Jack Mullin on his demonstration of the Magnetophone tape recorder to Bing Crosby in August 1947 at the NBC/ABC Hollywood studios.

Rushin is marketing director for the 3M professional audio-video and specialty products division.

The place: London. The date: Sunday, Feb. 25, 1940. Twilight comes early to London at that time of year, and on this particular Sunday, it mixed with fog and smoke from thousands of fireplaces to wrap around those unlucky enough to be out of doors. Indoors, in front of hundreds of thousands of hearths, Londoners relaxed with their Sunday newspapers and the wireless. World War II had been a fact of life for nearly six months, but the first bombs had yet to fall. It was the era of the *phony war*, when Hitler still believed it was possible to form an alliance with right-wing forces in Britain and end the war.

Suddenly, listeners who hadn't tuned their sets quite properly heard the familiar strains of "God Save the King." An upper-class English voice announced the inauguration of the *New* British Broadcasting System. What followed was an evening of popular and concert music, interspersed with "news" programs designed to convince listeners that Germany and England shared the same interests and ideals in the upcoming struggle.

The New British Broadcasting System (NBBS) probably would have come into being anyway, but what really made it work was audio recording on magnetic tape. Tape had existed in Germany on an experimental basis since 1920, and commercially since its introduction at the Berlin Radio Exhibition in 1935. What made the NBBS broadcast remarkable was a new recording breakthrough by two Reichs-rundfunk Gesellschaeft (German radio) engineers. Drs. Otto von Braurmuhl and Walter Weber found that if a very high-frequency signal were mixed with the audio during recording, the reproduced signals were so good that it became difficult to tell them from the live performance.

NBBS, which used captured commercial transmitters in Luxembourg, Belgium and Scandinavia, relied on tape for virtually all its programming. It was, therefore, possible to air the same concert at the same hour from all the stations. British listeners wondered how it was being done.

The Third Reich, however, was not the only country in which experiments with magnetic tape were being conducted. In September 1944, the Minnesota Mining & Manufacturing Company, St. Paul, MN (known today as 3M), already producing coated "Scotch" pressure-sensitive tapes,

How Good is Our 3rd Generation? Take a Look at Our 5th!

PERFORMANCE DATA (AG-7500A)

	1st Generation	3rd Generation w/o TBC	3rd Generation w/TBC-200	5th Generation w/TBC-200
Horizontal Resolution (Color Mode)	400	370	360	350
S/N Ratio (dB)				
Luminance (Color Mode)	57.2	51.7	52.0	49.0
Chrominance (AM)	51.8	47.5	51.4	44.5
Chrominance (PM)	44.3	40.1	43.8	35.2

Data represents measurements by independent engineering evaluation. VCRs taken at random from inventory.

- Signal Source: Shibasoku TG-7/1
  - Luminance: 50 IRE flat field w/burst
  - Chroma: 50 IRE w/100 IRE p-p
  - Resolution: Monoscope Shibasoku 58A/1
- Noise Meter: Rohde & Schwarz UPSF2/UPSF2E2
  - Y-S/N: 200 kHz HPF, subcarrier trap on 4.2 MHz. LPF, weighted
  - C-S/N: 100 Hz HPF 500 kHz LPF, unweighted

From the first to the third, even to the 5th generation Panasonic® SVHS Pro Series specifications speak for themselves. And they say "outstanding." Here are some of the reasons:

The AG-7500A editing VCR with its new laminated amorphous heads produces superb quality generation after generation.

The AG-A750 editing controller has everything you need for highly accurate single event editing.

And the AG-7400 portable 2-hour VCR is a natural performer in the field.

Our TBC-200 time base corrector has a 16-line correction window, chroma plus/enhancement, chroma noise reduction and no-roll circuitry. To make multi-generation recordings even better.

The UTP-1 signal transcoder is more than ready to transcode virtually any component signal into any other component signal. Saving you an extra generation.

The IFP-44 editing interface controls Pro Series decks on both the source and edit side. To easily integrate into selected 3/4" systems.

Our CCD Cameras are equally spectacular. And with the Panasonic SVHS Pro Series you not only get outstanding performance, you also get the added economy of 2-hour operation in the field and in the studio.

The Panasonic SVHS Pro Series. In a word it's outstanding.

For more information and your local dealer, call your nearest regional office.
Eastern Zone: (201) 348-7620
Central Zone: (312) 981-4826
Southern Zone:
Dallas Region: (817) 685-1122
Atlanta Region: (404) 925-6837
Western Zone:
Seattle Region: (206) 285-8883
Los Angeles Region: (714) 373-7275

SVHS

Panasonic
Professional/Industrial Video

Circle (29) on Reply Card

received a special request from the Brush Development Company of Cleveland. The Brush company was "interested in obtaining tapes coated with an emulsion containing a uniform dispersion of ferromagnetic powder," as the inquiry stated. Brush, under a special Navy department research contract was, along with 3M, about to launch the era of magnetic tape.

The first try

Brush agreed to supply the powder if 3M would apply it to a sample stripe of backing so it could be tested. The task was handed over to Dr. Wilfred Wetzel, who was unaware of the work that had been done in Germany. One of the first problems he faced was that the oxide supplied by Brush turned out to be nothing more than iron, and that once applied to a paper backing it continued to rust, changing its chemical and magnetic properties.

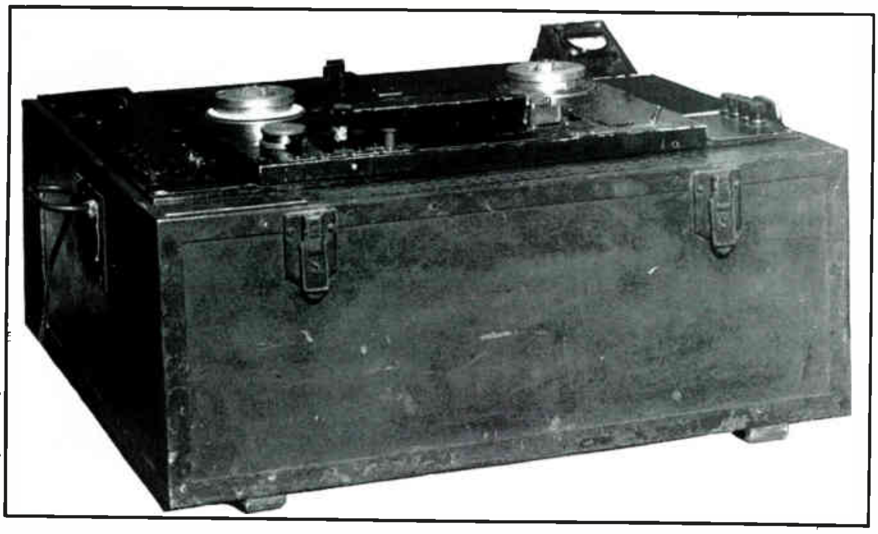
Another was that 3M had no recorder — not even a recording head — and Brush was being somewhat secretive about what the product would be used for. Whatever the purpose, Wetzel realized, the coating would have to be smooth to prevent it wearing out whatever it would come into contact with. So 3M scientists, under Wetzel's direction, tried a number of techniques for gluing the particles onto ¼-inch strips of paper eight to 10 inches long. As fast as they did so, the samples were mailed to Brush.

In 1944, no one in the United States had yet made a magnetic tape recorder. Wire recorders, using the principles of magnetic recording (patented in 1898 by Poulson), were being used for some business dictation. Even greater interest, however, was shown by the U.S. Navy department, which was using them to record what it could intercept of German U-boat radio messages. Much higher-quality recording was needed, and that was the goal of the Navy department research contract with the Brush Company.

By late 1944, the World War II Allies were aware of the magnetic recorder developed by German engineers, a recorder that used an iron-powder-coated paper tape that achieved much better sound quality than was possible with phonograph discs. A young Signal Corps technician, Jack Mullin, became part of a scavenging team assigned to follow the retreating German army and to pick up items of electronic interest. He found parts of recorders used in the field, two working tape recorders and a library of tapes in the studios of Radio Frankfurt in Bad Bauheim.

There also was a growing awareness that other companies were experimenting with tape, and many more were beginning to show an interest in building recorders.

Almost simultaneously, 3M physicists and chemists were developing for Brush and the Navy a coated tape with a smooth surface and uniform dispersion of ferromagnetic powder that would withstand being drawn over a magnetic head to record electromagnetic signals. The goal was to produce a tape for high-fidelity magnetic recording. By 1945, the first workable magnetic tape product had been developed.



Courtesy of Ampex

A well-worn transport assembly of a German Magnetophone tape recorder. This machine was one of those brought back to the United States by Jack Mullin.

After the war

At the end of the war, in August 1945, Brush informed 3M that its Navy department contract work was finished, and that further development on magnetic tape was to be conducted directly with Brush. The previous year's research had proved costly for 3M and, as yet, hadn't produced a cent in revenue; prospects for return were remote. But 3M elected to finance its own research based on the potential for extensive post-war application.

At first, 3M management considered being a contract supplier of finished products to Brush, and perhaps to others. But the prospects of being merely a producer, with huge development costs and limited return, did not interest 3M. There also was a growing awareness that other companies were experimenting with tape, and many more were beginning to show an interest in building recorders. Instead, 3M decided to add magnetic tape to its product line.

As months added up and scores of experimental magnetic tape formulations were tried, funding questions became serious; 3M considered putting the whole project in abeyance because no further orders were forthcoming from Brush. Fortunately for 3M, there were farsighted people at the company who, by force of argument and enthusiastic evidence, kept the project alive and advancing.

3M physicist Wetzel foresaw a broad potential market for magnetic tape. He also concluded that because sound could be recorded magnetically, the step to magnetic TV pictures would be highly practical. He saw both requiring tape, which held the potential for much higher signal density than wire or steel ribbon.

In January 1946, 3M learned that Brush was developing a tape recorder to show in New York. The tape project at 3M accelerated, with binder and backing improvements progressing rapidly. By May 1946, large usable quantities of tape were being produced — tape that would prove extremely helpful to Jack Mullin, the former Signal Corps technician who had scavenged German tape recorders during the last months of World War II.

Enter Bing Crosby

On May 16, 1946, Mullin was scheduled as the speaker at the regular meeting of the San Francisco chapter of the Institute of Radio Engineers, held at the studios of radio station KFRC. A demonstration of the German tape recording equipment had been promised, and the room was packed. Mullin played recordings he had made of an orchestra, vocalists and a pipe organ on some of the tapes he brought back with him. The reaction was little short of a sensation.

One of those who heard about the

Continued on page 42

To make you a better editor we had to get personal.

Personal computers are easy-to-use, fast, and extremely reliable. That's why we chose this powerful technology for the engine of our new low-cost editor, the ACE™25.

As you cut your first shows, you'll realize that the ACE-25 is not only fast, powerful, and fun to use, but that it also delivers a host of *professional* features: an easy-on-the-eyes menu display with EQ bar-graphs and VU meters, a 1000 line EDL with list management, and a multi-function rotary knob that controls everything—from transports, to key clip, to audio levels.

This new technology also allows us to give you the flexibility you've always needed. You can choose between an internal composite, or a *component* video switcher, plus an internal audio switcher—each built on a single board and designed to fit neatly into the ACE-25 system's main chassis. Even better, these unique switchers are controlled fully by the keyboard's rotary knob! All this simplifies system operation and lets you devote your energies to the creative job at hand.

And now the best news! No matter what your business, whether it be TV news editing or off-line post production, the ACE-25 delivers more features than any comparably priced editor.

You see, we took the PC's greatest strengths and used them to *your* advantage to give you power and affordability—*and* an editor that's easy to get to know.

So call Ampex at 800-25AMPEX to find out more about the newest, friendliest editor in the world.

It's about time you had some fun in the edit bay.

AMPEX

n business, as in life, you get what you pay for. rue, there are values to be had, but when selecting a tudio camera one word speaks louder than any ther: technology.

Consider Ikegami's HK-323 field/studio camera. Per- ormance and technology-wise, no other studio camera omes close. Which is why some of our competitors are ttempting to convince you that their inferior, and often ld technology, is worth buying at a reduced price. act is when it comes to quality versus price, the IK-323 is the best value in the industry!

t's small, lightweight design, combined with the most ophisticated engineering available, eliminates what was nce the need for separate studio and field cameras, and oes one better by offering a hand held version, the IK-323P, which operates from the same base station.

The HK-323P hand-held companion camera.

Other unique and state-of-the-art features include: a Master Control Panel (MCP) that can control up to 40 cameras with triax, multicore, or fiber-optic cable (a triax repeater option triples cable length from one to three miles), fully automatic setup including green regis- tration (all automatic or manual adjustments are stored

THE HK-323 FIELD/STUDIO CAMERA:

CONSIDER ANY OTHER STUDIO CAMERA, YOU'LL PAY THE PRICE!

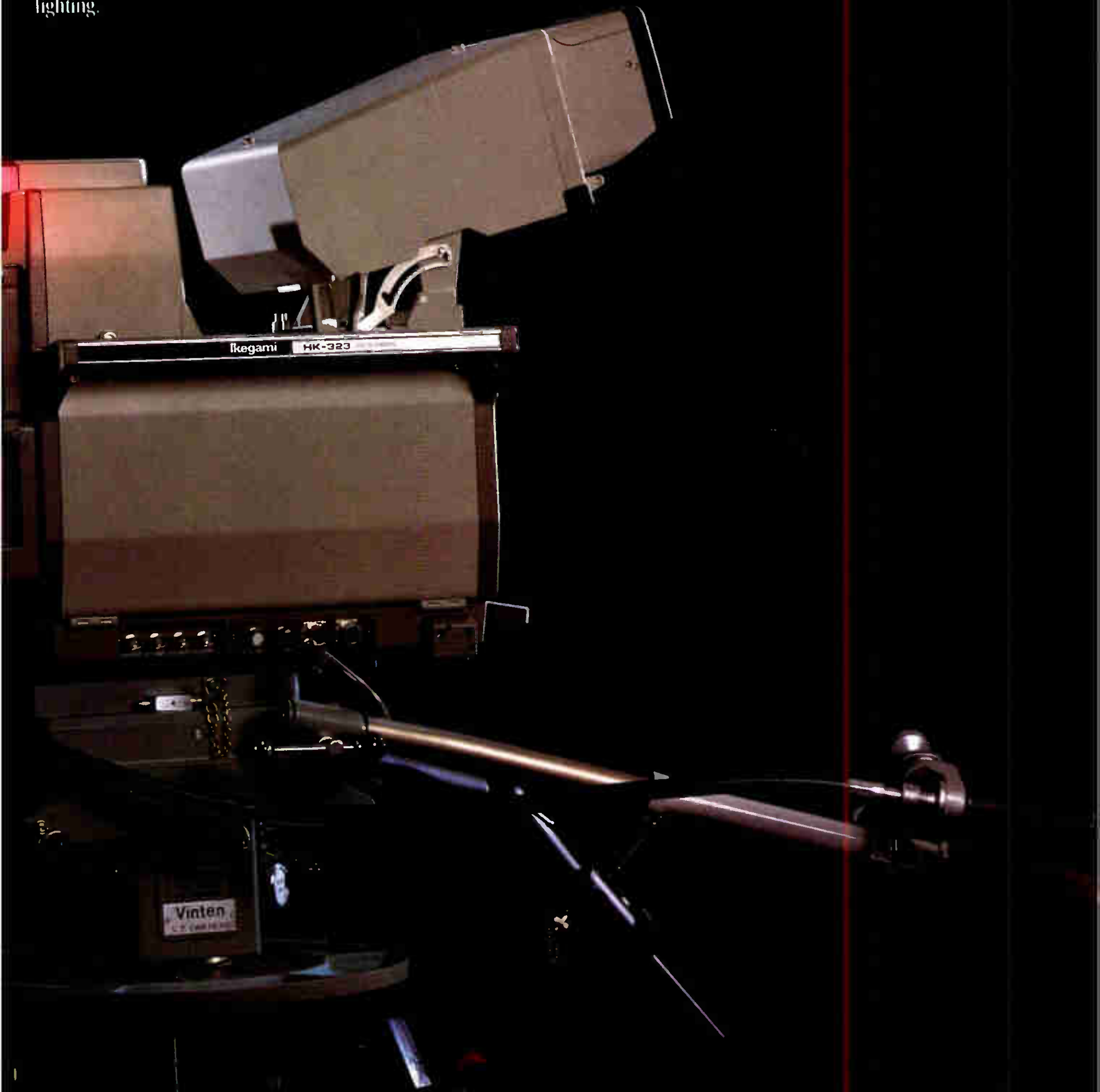
Ikegami

in memory, powered by a lithium battery, whose 5-year life is backed up by a permanent, redundant E^2-PROM). 1″ or 2/3″ Diode Gun Plumbicons® (upon request), high performance prism optics, a broad contrast range knee circuit that handles 1600% normal level, built-in color correction, comet tail suppression, scene file memory with up to four presets, and the sharpest picture quality regardless of scene color content or special color lighting.

Ikegami's commitment to quality goes right down to our all fiberglass board construction, component selection, and body construction.

Some day our competitors would like to manufacture a camera this good. Until then, don't be taken in by what seems like a great deal. You'll pay the price.

For more information, contact your Ikegami Office.

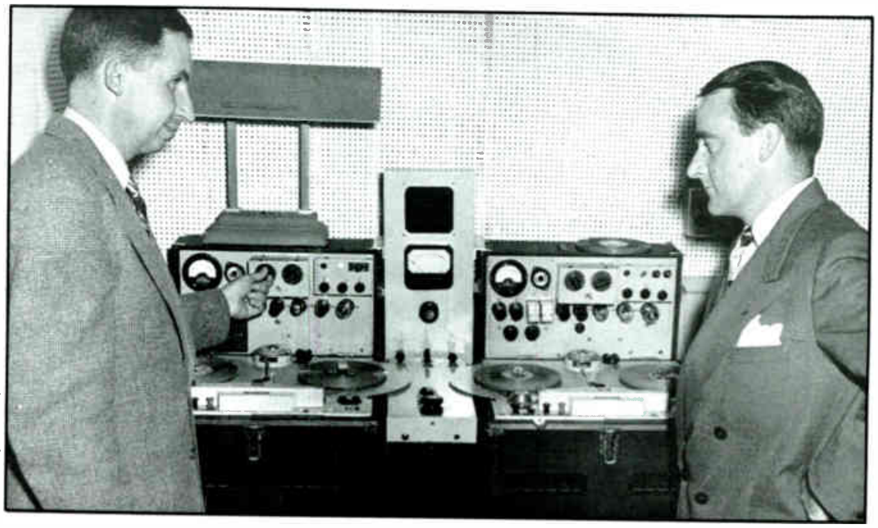


Ikegami Electronics (USA), Inc. 37 Brook Avenue, Maywood, NJ 07607
East Coast: (201) 368-9171 West Coast: (213) 534-0050 Southeast: (305) 735-2203
Southwest: (214) 869-2363 Midwest: (312) 834-9774 Hawaii: (808) 946-5955

Continued from page 38

demonstration was Frank Healy of Bing Crosby Enterprises. Healy thought that Mullin and his machines might provide the solution to a ticklish problem for the singer. In the 1940s, all programming, at least on the "prestige" networks (NBC, CBS and the fledgling ABC), was live. Broadcasters and sponsors alike thought that transcribed shows — those recorded in advance on 16-inch, 33⅓ rpm discs — sounded inferior and that audiences would resent their "canned" quality. But Crosby, one of the highest-rated performers in the NBC stable, had insisted on freeing himself from the weekly grind of appearing live at the microphone. He sat out the entire 1945-46 season, and came back only when third-ranked ABC promised to let him prerecord the "Kraft Music Hall" — as long as the ratings remained high.

Mullin played recordings he had made of an orchestra, vocalists and a pipe organ on some of the tapes he brought back with him. The reaction was little short of a sensation.


Courtesy of Ampex

In this 1947 photo, Jack Mullin (left) shows his modified Magnetophone tape recorders to Murdo McKenzie, Bing Crosby's technical producer. Mullin's ability to edit on his high-fidelity German recorders without noticeable generation loss created a sensation in American broadcasting. Mullin's machines later inspired the Ampex model 200.

To Healy and Crosby's technical director, Murdo McKenzie, that meant recording bits of the show on a series of discs, then re-recording from one to another to produce a finished program. It was expensive and time-consuming. Worst of all, it sounded bad — particularly when one section had to be re-recorded two or three times.

Accordingly, one day in August 1947, Mullin was called in to record the first Crosby show of the upcoming season on his German equipment, while Healy and McKenzie recorded it on disc. Mullin remembered the historic encounter:

"The most unforgettable moment in my life was the one when I stood before my Magnetophone tape recorder and pressed the playback button for the first time in the presence of Bing Crosby, John Scott Trotter, and Bing's producers, Bill Morrow and Murdo McKenzie. Everything was at stake. By invitation, I had been present with my colleague, Bill Palmer, to record the first radio show of the 1947-48 season in the NBC/ABC studio complex in Hollywood. And now we were to hear the result of our efforts and be judged by perhaps the most critical ears in the world of radio and recording.

"Prior to our invitation to come to Hollywood from San Francisco to record, and possibly, just possibly, to edit our tape into a complete show, the producers had looked into every alternate means of recording sound that showed any promise of success. Mostly, these boiled down to variations of disc recording methods and photographic sound-on-film systems. I am sure ABC held out little hope for success in testing our apparatus.

"The result of the (very successful) demonstration was that the Crosby people wanted me to stay right there and go through an editing process, to make a broadcast out of it. I did," Mullin told a reporter, "and they saw how easy it was with tape. The next thing I knew, I had a job recording the 'Bing Crosby Show' for the rest of the season."

The problem was that Mullin had only his two rebuilt German recorders and 50 reels of German recording tape for the task. Luckily for him, 3M was working on a commercial product with a backing of acetate film rather than paper.

Mullin also faced another problem — the 3M tape was "too good" for the German machines, which couldn't handle the tape's higher coercivity. Wetzel and his associates went back to the lab to come up with a tape that would work on the old machines, and on the 12 audio recorders Ampex Corporation was rushing to complete for the American Broadcasting Company. Crosby had been instrumental in persuading the network to buy the machines, copied from Mullin's German originals.

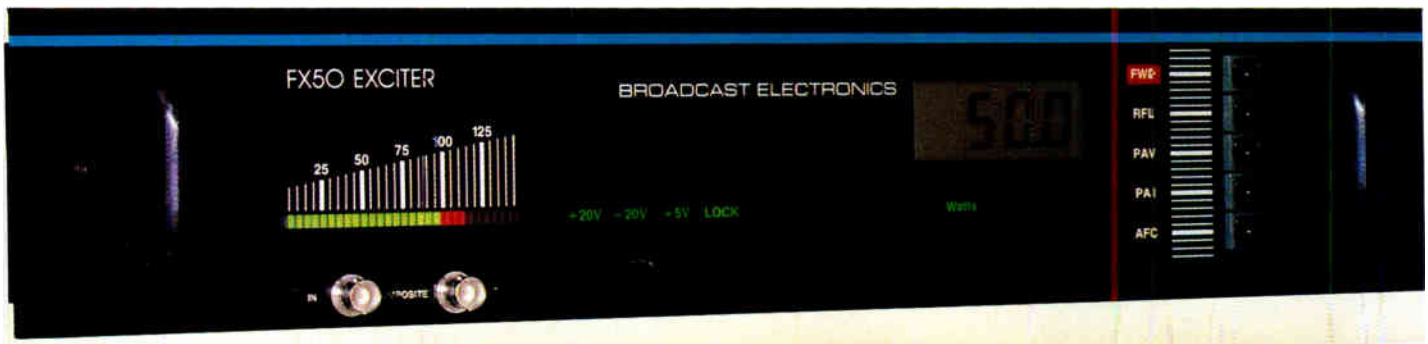
It's worth noting that when the "Kraft Music Hall" aired on the night of Oct. 1, 1947, it was broadcast from a 16-inch disc rather than from the tape Mullin had recorded in August. McKenzie and his crew, after having assembled the show from Mullin's master tape, put it on a disc for on-air playback. After one or two shows, they decided to gamble on broadcasting directly from the tape; but just in case the tape should break there was a musician standing by in a nearby studio ready to go on the air with a piano recital.

"The most unforgettable moment in my life was the one when I stood before my Magnetophone tape recorder and pressed the playback button for the first time in the presence of Bing Crosby . . . . Everything was at stake."

That practice persisted not only at network studios but also in the studios of larger stations around the country for a year or two, until broadcast engineers discovered that tape simply didn't break. Once ABC began to switch to tape, it made two copies of each program and started them simultaneously on playback decks. If one were to fail, the engineer had only to switch to the backup, missing hardly a syllable.

New FX 50 Exciter

Audio Performance That Rivals CD's



THD and IMD 0.003%, 93 dB S/N, 50 Watts

Broadcast Electronics introduces the ultimate FM Exciter - the new FX 50 - with performance even superior to the world standard FX 30.

CD Sound
The new FX 50 Exciter has the lowest distortion of any exciter available with THD and IMD of 0.003%.*

Move Up To CD Standards
Every new "B" Series FM Transmitter incorporates the FX 50 for true CD transparency. And, the FX 50 is the ideal retrofit for your present exciter.

CD Dynamic Range
With a signal to noise ratio (S/N) of 93 dB* the FX 50 can handle all of the nuances and power of compact discs.

Set It And Forget It — 50 Watts
Sophisticated automatic control systems assure stable reliable 50 watt MOSFET power output even under mismatch conditions.

*Typical

For information on the FX 50 Exciter and on Broadcast Electronics' new "B" Series FM Transmitters which incorporate the new FX 50 Exciter, call Bill Harland or Russ Erickson at 217-224-9600.

BROADCAST ELECTRONICS INC.

4100 N. 24th ST., P.O. BOX 3606, QUINCY, IL 62305, (217) 224-9600, TELEX: 250142, FAX: (217) 224-9607

Circle (21) on Reply Card

Courtesy of Ampex

Ampex chief engineer Harold Lindsay checks out the first American professional audiotape recorder, the model 200. This machine was first used by ABC in 1948.

tape in 1947 launched the recording tape industry in the United States. Initially, it took a lot of tape to reproduce a limited amount of sound. Broadcast tape recorders in 1947 operated at speeds of 30ips. By 1949, decent quality could be obtained at 7½ips, a fourfold improvement. That speed is still the industry standard.

A historical footnote: Although ABC had been the first network to embrace recording tape, it was one of the last to put full confidence in it as an archival medium. When Lee Harvey Oswald fired at President John F. Kennedy in Dallas on Nov. 22, 1963, ABC engineers realized that history was being made. They dusted off the transcription turntables and captured all the events of that long weekend on a series of discs. Other networks recorded their coverage on tape. It was the last hurrah of the electrical transcription.

Fear of tape breakage was ever-present in those early days.

Fear of tape breakage was ever-present in those early days — not because it actually did break, but because of a history of breakage with some tape forerunners. Even Mullin, who knew the medium better than anyone else, was never sure how his splices would hold up to the high tensions of those early recorders.

In the 1930s, the British Broadcasting Corporation had acquired several *Blattnerphones*, recorders that used ribbons of steel as the recording medium. Editing was done by cutting the ribbon with tinsmith's shears and soldering it back together. Occasionally, the soldered joints would come apart and engineers dove for cover as the steel strip thrashed about. One of the problems with the paper tape used on the early Brush Sound Mirror recorders was that it couldn't stand up to the fast braking of the machines.

Gradually, the musicians hired to stand by disappeared, and transcription turntables began to gather dust. Tape moved from the control room to the recording studio, where it was to have a profound effect on all forms of music and on the nation's listening habits. And just as 3M and Ampex had met the Crosby and ABC deadlines, they were able to meet the daylight-saving deadline of 1948 — just barely.

Tape catches on

ABC's love affair with magnetic tape soon spread to the other networks, which planned to use it to facilitate the switch from standard to daylight-saving time at the end of April 1948. The radio networks had been thrown into turmoil earlier that year when Congress voted to let the individual states decide when, and if, they would go on daylight-saving time. For a historic 22 weeks, ABC pretaped 17 hours of network radio programming daily to be replayed at periods appropriate to widely varied time zones.

When 3M began delivering tape, it was only in limited quantities. Everybody wondered whether the tape supplier would be able to meet the April deadline. Somehow it did, but just barely. To make his 50 reels of German tape last until reinforcements arrived, Mullin saved every scrap, every edit, and spliced them together for reuse. Splicing tape at the time meant "Scotch" sticky tape with a dusting of talcum powder. Mullin remembers checking each splice on a just-broadcast reel, then reassembling the tapes for reuse during the next week.

Much the same thing happened at the ABC studios in Chicago when the network got its first recorders. After the network signed off at midnight, a pair of 3M technicians went to work checking every splice in every tape so they could be reused the next day. Somehow, they managed to finish just in time for sign-on the following morning. During the 22 weeks this routine went on, the station lost only three minutes of airtime because of a tape or splice failure.

To make his 50 reels of German tape last until reinforcements arrived, Mullin saved every scrap, every edit, and spliced them together for reuse.

The introduction of Scotch 100 magnetic

Recording pictures

Although 1948 was audiotape's big year, it was also the year 3M engineer Bob Herr proposed the idea of recording pictures as

WE'VE MADE DEAD AIR A DEAD ISSUE.

There are worse things in radio than dead air. But not many.

And if your CD players aren't built to resist tracking errors, you could find yourself listening to some very embarrassing silence.

Not with the new CD-701 from Tascam. Its unique disc clamping system is a technological triumph that virtually eliminates disc vibration. So you never hear the awful hush that means a tracking error has occurred.

What you do hear is the finest sounding CD unit you can buy, with the same proprietary "ZD Circuitry" praised by two of Japan's top audio magazines* for eliminating low-level digital distortion.

Then there's the optional RC-701 Remote Control with Auto Cue so you can cue to the music instead of the track (for even less dead air). Or you can add the Ram Buffer for true, instantaneous startup.

And with four times oversampling and 16-bit D/A converters in an extra-rugged chassis, the CD-701 is superbly designed for the broadcast environment.

Can a CD player really deliver this kind of performance, track after track, disc after disc? Only if it's a Tascam.

Contact us or visit your Tascam dealer for more information about the CD-701. And take the sounds of silence off your playlist.

TASCAM

**Radio Technology* Component Grand Prix '88, CD Division, *Stereo Sound* Component of the Year (1988) & Best Buy (1988)

Circle (22) on Reply Card

well as sound by using a wide tape at a speed of 15ips past a rapidly rotating head assembly. Nothing much came of it just then. When 3M's Wetzel demonstrated the first black-and-white video recordings in 1950, it was with a fixed-head brute-force recorder that consumed 7,000 feet of tape in 15 minutes.

Videotape's big day was April 15, 1956, when the 31st annual convention of the National Association of Radio and Television Broadcasters (NAB) opened at the Conrad Hilton Hotel in Chicago. Ampex planned to show its video recorder, the Mark IV (a forerunner of the production model, the VR-1000). 3M had supplied instrumentation tape as the recording medium.

The day before the show was to open, one of the Ampex staffers decided to try out the new tape. To his horror, he discovered that it just wasn't up to the high-frequency demands of the Mark IV and placed a phone call to Dr. Wetzel in St. Paul, MN. Ampex had been cagey about what kind of machine the tape was to be used on, no doubt fearing that 3M might jump into the video recorder business on its own.

Because Wetzel had been doing his own research on videotape, he had a pretty good idea what Ampex was up to. Nonetheless, the Ampex engineer, out of desperation, was forced to outline in detail exactly what the new tape was supposed to do. Could 3M do it, and in time for the debut the following day? Wetzel thought so, and put a team of technicians on the job. They worked through the night, coming up with sample after sample.

Hardheaded engineers and front-office men were on their feet cheering as the first reels rolled on the Mark IV.

Finally, by 6 a.m., they'd produced a sample that worked, and they coated two 5-minute reels worth of it. But Wetzel had already left for the airport. Vic Mohrlant, a technical services engineer, grabbed the samples and dashed to the airport, hoping against hope that Wetzel's flight had been delayed. For once, it had not. It was out on the runway waiting to take off.

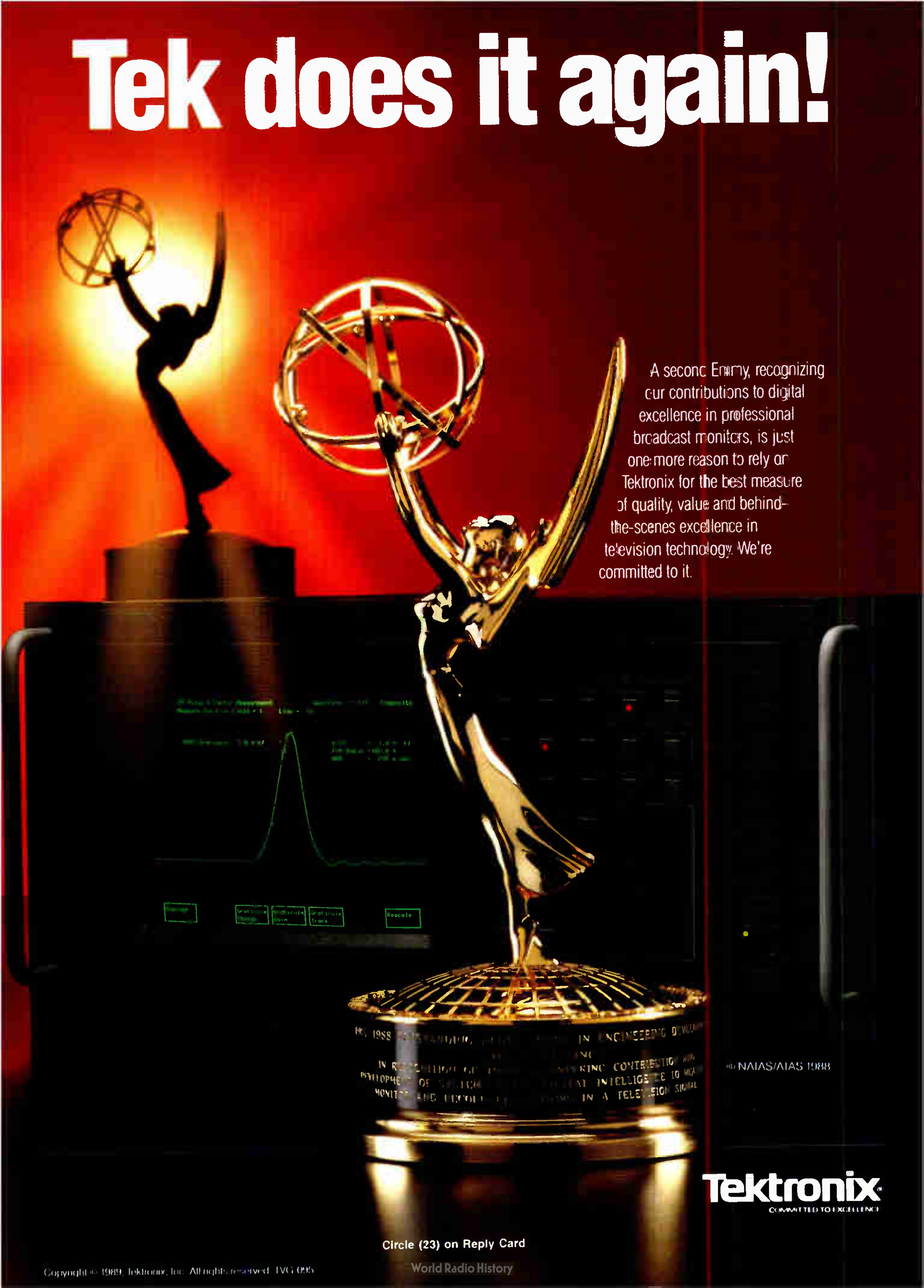
Mohrlant dashed out onto the tarmac, found a member of the ground crew who had a pole long enough to reach the cockpit, and persuaded the pilot to stop. Fastening the package onto the end of the pole, he shouted that it was an emergen-

Courtesy of 3M

Magnetic recording tape pioneers Jack Mullin (left) and Frank Healy (with glasses) discuss early tape programs edited for the "ABC Philco Hour" radio program with Bing Crosby (right). Crosby was an avid proponent of tape recording, and his ABC network show was the first nationally broadcast tape program in the United States. (The fourth man in the photograph cannot be identified.)

Courtesy of 3M

Bing Crosby, recording a radio program segment in the early 1950s on an Ampex 600 recorder using Scotch No. 111 tape.


Tek does it again!
A second Emmy, recognizing our contributions to digital excellence in professional broadcast monitors, is just one more reason to rely on Tektronix for the best measure of quality, value and behind-the-scenes excellence in television technology. We're committed to it.
© NAIAS/AIAS 1988
Tektronix
COMMITTED TO EXCELLENCE
Circle (23) on Reply Card
Copyright © 1989, Tektronix, Inc. All rights reserved. TVG-095

cy package for Dr. Wetzel aboard the flight. The pilot, no doubt concerned about a medical emergency, pulled the pouch off the pole and passed it back to his passenger.

The demonstration on April 15 caused the same kind of sensation that Mullin's IRE session had 10 years earlier. Hard-headed engineers and front-office men were on their feet cheering as the first reels rolled on the Mark IV. Many rushed to the stage to get a closer look. And orders for both tape and recorders piled up.

Videotape goes to work

The first commercial reel of Scotch 179 videotape went to CBS. The network used it to record "Douglas Edwards and the News" the night of Nov. 30, 1956, for delayed broadcast in the Central, Mountain and Pacific time zones.

History was about to repeat itself. All three networks had decided to change over to daylight-saving time on April 28, 1957. Again there was a mad rush to produce enough recorders and enough tape to make this possible. In fact, by April 28, the networks had no more than 50 usable reels among them, each with a price tag of $248.95.

This time, there was no concern among professionals about the possibility of tape breakage, but there were other worries. What would happen if a reel of the stuff containing an important program were placed in a magnetic field, or stored on top of a radiator or warm studio console? What effect would it have on unionized jobs?

What they weren't concerned about, however, were the effects of dust and dirt. One of 3M's biggest problems in meeting the April 28 deadline had been in coming up with perfect reels of tape. The smallest scratch, a speck of dust or dirt in the coating, or microscopic damage to the tape edges each was enough to reject a reel of videotape; in early runs, two-thirds of those produced had to be thrown away.

To keep dirt out and reduce the effects of humidity, the company packed its videotape in sealed transparent polybags. But stations and networks, used to handling film, asked for a return to the foil-lined black paper wrapping that had been used for film. Eventually, they learned the hard way that when it comes to videotape, cleanliness is more than just a fetish.

In early runs, two-thirds of (the tape) produced had to be thrown away.

The use of videotape spread rapidly for delayed broadcast and news applications. It was slow, however, to catch on in program production and the shooting of commercials, despite its advantages and economies. One reason was the editing process, which was significantly different than for film. Electronic editing still lay many years ahead.

"Kitchen Debate"

By the summer of 1959, videotape had become as accepted a part of television as audio recording was of radio and the music industry. That summer, the U.S. Information Agency had set up an exhibition in Moscow that included, among other things, a model American home — complete with well-appointed kitchen — and a color TV studio with its own video recorder. On July 24, Vice President Richard Nixon invited Soviet Premier Nikita Khrushchev to visit it with him. Khrushchev found the TV studio fascinating and readily agreed to step before the color camera to make a few remarks, then see himself played back on

AUTOMATION
SYSTEMS

***Vouldn't it be great if some-
ody supplied fully-integrated,
n-air automation systems,
esigned specifically to your
equirements, using standard
ardware, and backed by a
ull ten-year warranty?***

***OMEBODY DOES.
TAH SCIENTIFIC.***

Utah Scientific can supply your station with an automation system which is specifically tailored to your requirements and designed with easy future expansion in mind.

Our family of automation products ranges all the way from a simple PC-based event programmer for our Routing Switcher/Machine Control systems to the new TAS Total Automation System for handling the most comprehensive and demanding real-time applications.

This wide range of system choices makes Utah Scientific the perfect source for your automation system.

Call us today for more information. Find out how Utah Scientific's automation products can work for you now and in the future.

Somebody does!

US UTAH SCIENTIFIC
DYNATECH Broadcast Group

1685 West 2200 South, Salt Lake City, Utah 84119
(801) 973-6840 Toll Free: 1-800-453-8782

Circle (25) on Reply Card

tape. Nixon joined him, and before long, the subject had turned from lighthearted pleasantries to a full-blown debate on the relative merits of capitalism and communism.

Oblivious to the red eye winking at them from the front of the camera, the two progressed to vigorous thrust and parry. An Ampex official in attendance reminded them of the tape, which continued to run.

...before long the subject had turned from lighthearted pleasantries to a full-blown debate on the relative merits of capitalism and communism.

Khrushchev, shown how to operate the controls of the recorder, rewound the tape and played it back. Nixon persuaded him to let it be seen in the United States, but Khrushchev insisted that it be translated in full and played unedited. To make sure that it got out of the Soviet Union, Ampex International president, Philip Gundy, rushed back to his hotel with the tape, wrapped it in a dirty shirt and booked the first flight home.

By the time it was broadcast the following day, American newspapers had reported the event as an exchange acrimonious enough to start World War III. What viewers actually saw, though, was the two leaders in earnest and sometimes animated discussion, but by no means ready to launch missiles. The tape has been hailed as a milestone in communication as well as a historical document in its own right.

One thing the history of magnetic tape teaches us is that the more things change, the more they remain the same.

Courtesy of Ampex

A scene from the famous "Kitchen Debate" between Vice President Nixon and Soviet Premier Khrushchev in Moscow (July 1959). The encounter was captured on videotape and replayed later in the homes of 72 million American TV viewers. The event brought prominence to the technology of "live" playback from a strip of magnetic tape.

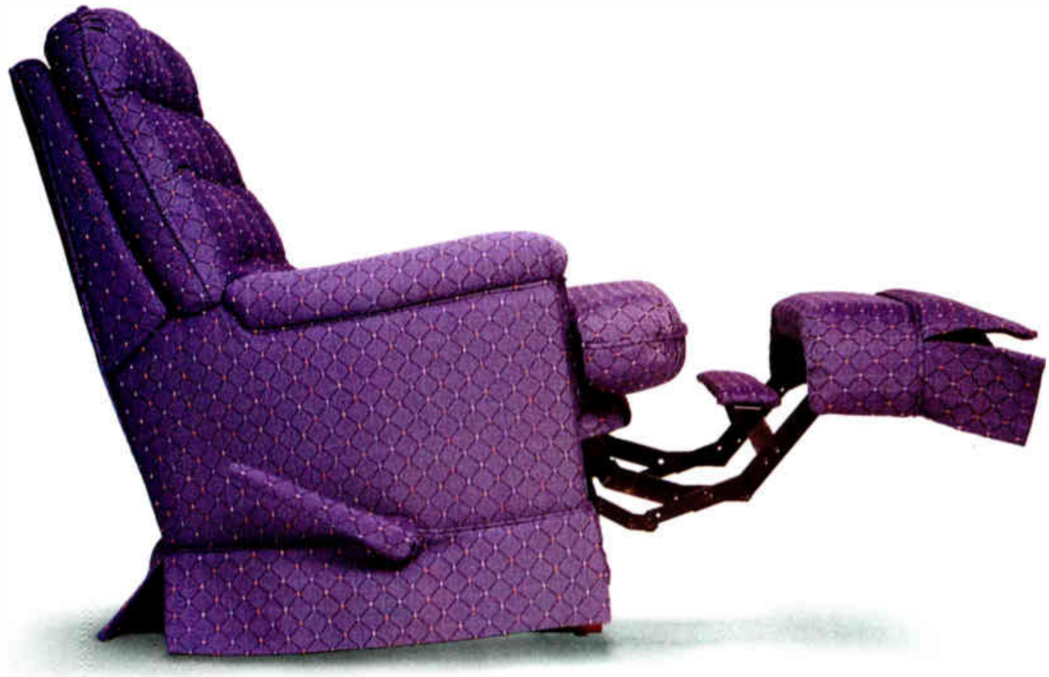
Courtesy of Centro

Video recording technology has become a leapfrog affair. Improvements in the tape led to machine improvements, which led to further refinement of the tape, and so on. This process has been under way since the introduction of the Mark IV VTR in 1956.

Bibliography:

Mullin, John. "Discovering Magnetic Tape." **Broadcast Engineering**, May 1979.

Ziff, Richard. "Magnetic Tape's Impact on Broadcasting." **Broadcast Engineering**, May 1979.



3-Way Lounger

One of these revolutic the world looks at TV v

BTS did not invent the three-way lounge chair. Barcalounger® did.

But you'd be surprised at how many of the most revolutionary ideas in the history of video did come from BTS. In fact, because we look at things differently, the whole world looks at things differently.

We introduced the first CCD film scanner, for instance. The first Plumbicon camera tube. The first software-based character generator. The B format for videotape recording. The modular routing switcher. And of course, the first 3-D computer animation system, for which we won one of our three Emmies.

BTS has been a technological innovator in the video industry for six decades. Our cameras,

- Adapted Sony camera and 3/4-inch U-matic VTR used for roving reports at the national political conventions.
- MCA gives first public demonstration of laser videodisc.
- First prerecorded videocassette tapes offered to consumers.

1973
- *A* format 1-inch VTR shown by Ampex.
- First ENG cameras used in electronic field production.
- First multipoint distribution (MDS) microwave system launched.

1974
- First microprocessor used in broadcast equipment.
- 2/3-inch Plumbicon developed.
- Frame reducer/recorder introduced.
- Sony introduces Betamax home VCR.

1975
- *B* format 1-inch VTR shown by Bosch.
- Study group begins work on a digital video world standard.
- HBO begins program distribution via satellite.

1976
- Sony shows 1-inch VTR at NAB in Chicago.
- Ampex shows VPR-1 helical recorder with automatic scan

Perspective on the industry

By Jerry Whitaker, editorial director

If you liked this decade, you'll love the next one.

"Everything that can be invented has been invented."
— Charles Duell, head of the U.S. Patent Office, 1899

New technologies promise to radically change the radio/TV industry as we know it. Advancements in high-definition television and fiber optics represent a significant threat to conventional over-the-air broadcasting, but they also offer unprecedented opportunities to those who are willing to take some chances.

Consumers in the United States have demonstrated an insatiable appetite for new electronic gadgets. Radio and TV broadcasters have, in the past, been the benefactors of this growth market. Now, however, consumers are branching out from traditional over-the-air entertainment sources to other media. It's a whole new ball game for broadcasters.

Because **Broadcast Engineering** observes its 30th anniversary of publication this month, the editorial staff thought it appropriate to provide a perspective on radio and television today, as well as a glimpse of where we see the industry moving during the next decade.

The economics of broadcasting

A broadcast license used to be practically a permit to print money. All you had to do was take a big bucket out to the antenna and wait for money to drop from the sky. An exaggeration, yes, to be sure. Still, broadcasting today is not the same business it was 10 years ago, let alone 20.

The trafficking of radio and TV stations has been a serious concern ever since the FCC replaced the "7-7-7 rule" with the "12-12-12 rule" and eliminated the 3-year minimum ownership requirement. Indications are mixed as to whether Wall Street investors have lost their enthusiasm for broadcast properties. It is certainly apparent, though, that the frenzied buying and selling of stations has slowed significantly. This is a positive sign for the industry overall, because most of us would agree that broadcasting is best run by *broadcasters*.

If you have wondered why so many investors from outside the industry have gotten into the business, consider this: The *average* cash flow margin as a percentage of net revenue for a network affiliate TV station is on the order of 30%, and it's about 9% for the average independent station. For a network-owned station, the margins are as much as 50%; some are even more. An operation that returns 9% to the bottom line is not exactly a star performer, but 30% — let alone 50% — is sure to get any investor's attention.

Still, the major networks and their affiliates continue to feel the pinch of alternative entertainment sources. The encroachment of cable television into the living rooms of consumers has changed the face of broadcasting. Add to that the growing numbers of home VCRs and other entertainment media, such as the popular Nintendo computer games and compact discs, and you have a recipe for trouble.

It is estimated that cable may reach more than 60% penetration by the end of this decade. Program services such as HBO, The Movie Channel, Cable News Network, Lifetime, Discovery, TNT and others have provided consumers with a wide variety of program choices that they never had before. However, at least one study — "Television 1995," compiled by Blair Television — predicts that cable penetration will peak at about 60%. The report further predicts that increased cable TV choices will hurt current cable

tracking; also introduces a portable model, the VPR-10.
- World's first digital PAL TV transmission via satellite (Intelsat IV).
- Ampex shows first electronic still-store system, the ESS.
- VHS home recording format introduced.

1977
- PBS begins operation by satellite.
- TEAC introduces PCM digital audiodisc recorder.
- Type C format VTRs introduced.
- Last tower of historic Radio Central, Rocky Point, NY, is destroyed.

1978
- Teletext experiments begin at KSL-TV in Salt Lake City.
- NHK experiments with HDTV via satellite relay.
- NHK begins multiple-audio-channel television in Tokyo.
- Fiber-optic technology demonstrated.
- Digital VTR demonstrated.

1979
- Mutual Radio Network and National Public Radio begin operation by satellite (analog).
- B format and C format for VTRs accepted by SMPTE and ANSI.
- B format and C format portable VTRs with battery power shown.
- CCD telecine introduced by Bosch (FDL-60).

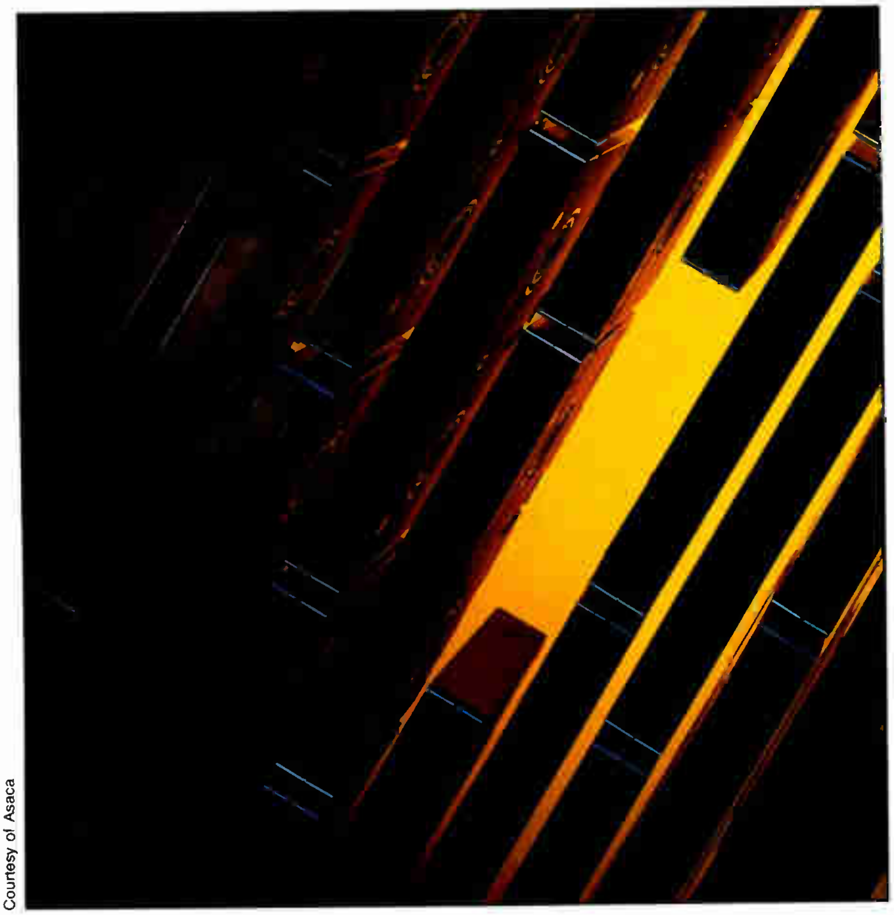
The 1980s:

1980
- First of second-generation type C machines introduced.

1981
- Beta Format introduced by Sony.
- M format introduced (Matsushita, Panasonic, RCA and Ikegami).
- First space shuttle launched.
- ½-inch Plumbicon (Philips) and Saticon (NHK) introduced.
- HDTV demonstrated in United States at SMPTE in Los Angeles.
- Digital video sampling frequency selected as 13.5MHz for worldwide use.
- ZDF, Siemens and Rohde & Schwarz introduce multiple-audio-channel television in Berlin.
- TEAC develops optical laser write/read disc system.
- Ampex introduces ADO digital video processor.
- First camera/recorder ENG systems shown at NAB.
- Ampex and Dynamics Control show all-digital studio cameras.

1982
- FCC issues the "marketplace" decision on AM stereo.
- Low-power TV service established by the FCC.
- First LPTV station begins operation in Bemidji, MN.
- Quantel Mirage introduced at NAB.
- NEC DVE effects system introduced at NAB.
- Bosch shows first ¼-inch camera/recorder, the KBF-1, in prototype form.
- CMX/Orrox shows a disk-based editing system.
- Two HDTV systems are shown at IBC in Brighton (Sony and Philips). Two other systems are proposed for Germany and England using a doubled 625-line PAL signal.

1983
- Network radio distribution by satellite (ABC, CBS, NBC and RKO) using digital format.
- Digital TV receiver shown by ITT-Intermetall in Germany.
- Multiple-audio-channel TV system selected by EIA for U.S.
- Ku-Band satellite transmission for broadcast tested by NAB and during space shuttle launch.
- FCC issues 80-90 decision on FM radio.
- Use of FM subcarriers deregulated by FCC.



Courtesy of Asaca

Automation will play an increasing role in both radio and television in the coming decade. After many attempts at automation, all the elements are now available to make the systems work as intended.

programmers rather than over-the-air broadcasters. The authors of the Blair study expect over-the-air television to continue to be the dominant form of video entertainment, at least through the middle of the next decade. Any way you view the situation, however, the advertising pie is being sliced into thinner portions for all concerned.

Then there's the plague of *push-button madness*. How many new TV sets have remote controls today? Most. It's hard to buy a color set that doesn't offer a remote-control option. And what are viewers doing during commercials? Flipping through channels. Terrestrial broadcasters no longer have a captive audience, and advertisers know it.

Radio is not immune to this problem either. The introduction of electronically tuned radios (ETRs) made it possible for listeners to switch easily between stations and bands, and land on a station that was tuned in perfectly. This has led to increased use of *scan* and *seek* features in automobiles, which can be triggered from the steering wheel on some models. This ability to quickly change stations because a commercial comes on, or a song that you don't particularly like is being played, undermines the foundation of radio broadcasting: a loyal listenership.

Because of these pressures, the broadcast industry today has a definite bottom-line orientation. The economic realities that we, as an industry, now face require closer attention to operating efficiencies than ever before. Today's business climate also demands careful and thorough evaluation of any new technology before equipment purchases are made. Furthermore, the engineering department of a station no longer can afford to operate as an entity. To prosper today, everybody needs to be pulling in the same direction.

Delivering video — high-definition video — via fiber optics makes a lot of sense. It is the ideal delivery vehicle.

Here comes Ma Bell

Although it is not a "clear and present danger" today, the phone company represents the biggest long-term threat to TV broadcasting. Delivering video — high-definition video — via fiber optics makes a lot of sense. It is the ideal delivery vehicle. Most, if not all, of the regional Bell operating companies (BOCs) have expressed an interest in wiring individual homes with fiber to provide a wealth of services to subscribers. These services would include voice, computer data and high-definition video. At this point, the BOCs are talking cooperation, not confrontation, with cable TV systems and broadcasters. Whether they will change their tune in the years to come is the $64,000 question.

The time frame for fiber to the home is another big, unanswered question. Estimates range from the early 1990s to the year 2000 for any significant penetration. Before any BOC replaces its copper lines with a fiber-optic pipe, consumers will have to demonstrate that they will pay extra for the additional services that fiber can deliver.

The BOCs are prohibited from providing video and other information services by the consent decree that broke up AT&T and created the BOCs in 1984. Phone companies may build broadband transmission systems and lease them to franchised cable operators, but they cannot operate the businesses themselves in areas where they also provide telephone service. A battle is being waged in Washington, DC, by the telephone companies to remove the ban. It is, not surprisingly, being fought by cable TV operators.

The telephone companies are a difficult opponent. They are well-financed, and they have well-placed friends in the Congress and administration. The chances of keeping the BOCs out of video delivery are, frankly, not very good. (See "The Future For Fiber," page 74.)

The future according to NTIA

The prognosis for radio and TV broadcasting is mixed. Some see doom on the horizon. Others see new opportunities. Speaking to the upbeat view is a study released late last year by the National Telecommunications and Information Administration (NTIA). The agency's 672-page report, "Telecom 2000," predicts a bright future for radio and television:

"Some gloomy predictions to the contrary notwithstanding, over-the-air broadcasting should remain a vital element in the national media mix, as few industries have demonstrated so consistent a talent and ability to deliver what the public and advertisers want. It is conceivable that television may prove less profitable, but there is no good reason to assume that in coming years we will experience a market-driven demise of over-the-air video service."

The study acknowledges, however, that cable will become "increasingly important" as market penetration continues. Furthermore, the NTIA expects that fiber-optic video services will provide to subscribers "a virtually unlimited library of video, audio and data services." This technology will, according to the report, give consumers "full control over their television sets. They will be able to watch precisely what they want to watch, when they want to watch it."

"Telecom 2000" also gives radio a clean bill of health: "For our increasingly mobile society, radio demonstrably continues to provide valued services and an information immediacy which the American public plainly needs and wants."

"Some gloomy predictions to the contrary notwithstanding, over-the-air broadcasting should remain a vital element in the national media mix . . . .

The study says the key to making these rosy predictions come true is continued deregulation by the federal government of radio and TV operations.

Changing hardware trends

The monopoly enjoyed by broadcasting is not only disappearing from the software side of the business, but from the hardware side as well. Ten years ago, the phrase "broadcast quality" meant the best the professional audio-video industry could produce. Equipment was designed specifically for broadcasters, to specifications demanded by broadcasters. This situation is changing rapidly, and the reason is volume production.

In raw numbers, the broadcast industry is small potatoes compared with other high-tech businesses. Research and development is extremely expensive and is now borne almost exclusively by manufacturers. The days of network-supported developmental labs are long gone. Fortunately for broadcasting, many R&D projects in the semiconductor and consumer electronics industries can be applied to radio and TV products as well. This spin-off effect provides our industry with the latest technology at reasonable prices. In today's business climate, it is the only way broadcasters can keep up. The stakes are too high for manufacturers to *go it alone* any more.

In raw numbers, the broadcast industry is small potatoes compared with other high-tech businesses.

Products today must be designed for more than a single market. Audio-video hardware intended for use at radio and TV stations also must be applicable to the post-production, recording studio and corporate/industrial markets. This broader customer base promises greater return on investment for equipment manufacturers, and lower prices to individual users. The down side is that the days of specialty and custom products for broadcasters are disappearing fast. The force of consumer electronics also is being felt, with the greatest impact on video cameras and recorders, and audio playback (CD and R-DAT) machines.

Most technical managers at broadcast facilities have a love-hate relationship with new technology. They are thrilled by the numerous features of a new product, but terrified at the prospect of seeing the system they purchased at the last trade show made obsolete by some new development.

Love it or hate it, technology marches on at an ever-increasing rate. A typical development cycle today — from specifications to a deliverable product — runs two to three years, depending on the complexity of the system. Manufacturers are working to reduce the development cycle to permit faster response to industry needs.

At the same time, however, the technical skills of the radio and TV engineers of

Love it or hate it, technology marches on at an ever-increasing rate.

tomorrow have many people worried. Wages for skilled engineers, especially in smaller markets, are no longer competitive with many other electronics-based industries. As a result, broadcasters are having trouble finding and keeping qualified technicians. And with technology stopping for no one, our industry cannot afford to slip into technical mediocrity.

The requirements for engineering positions in the future will continue to evolve into the category of "systems planners." We have seen this trend developing during the 1980s. It will accelerate in the 1990s as more emphasis is placed on planning and management, and less emphasis is placed on maintenance. Technical certification by the Society of Broadcast Engineers will become more important, as engineering managers search for yardsticks to take the measure of applicants.

The sophistication of equipment today makes it difficult for many products to be serviced in the field by any means other than board exchange. Furthermore, the economics do not permit it. The equipment to troubleshoot a complex computer-based PC board easily can run into the hundreds of thousands of dollars. No station can afford this gear. Plus, no engineer — no matter how conscientious — can be an expert on each piece of equipment used at a modern radio or TV facility. Repair by replacement will continue to increase as a troubleshooting process for all but the simplest of systems. A related effect of this approach will be the necessity for spare boards, or even spare systems, for certain types of equipment.

It is a foregone conclusion that the use of computers in broadcasting will increase, and *connectivity* will be the key to making it all happen. For many years, foresighted engineers have realized that the efficiency of their facilities could be improved greatly if devices could communicate with each other. But, as the computer industry discovered a long time ago, machine-to-machine interface is often easier said than done. Now, however, connectivity is becoming a reality.

Successful stations in the 1990s will be the ones that break down the traditional barriers of departments and empires, and build one unified system around interconnected computers and smart machines. The result will be a system that is greater than the sum of its parts. This type of effort requires a "systems engineer" who can see the big picture. We can no longer view a station as a group of independent elements. We must view it as one organization working toward a common goal. The equipment we use must be designed and integrated to make that concept a reality.

The *BE* "crystal ball"

Because this issue marks 30 years of publishing **Broadcast Engineering**, the editorial staff could not resist the temptation to offer for your consideration our list of predictions for the next 10 years. That would take us to 1999 — far enough into the future that, by the time **BE** observes its 40th anniversary, everybody will have forgotten any incorrect or mistimed predictions. (We will, however, remind you of the predictions if we were right.)

Successful stations in the 1990s will be the ones that break down the traditional barriers of departments and empires. . . .

Predicting the future is a dangerous practice, as observed by astronaut Neil Armstrong, who once said: "Science has not yet mastered prophecy. We project too much for the next year, and yet far too little for the next 10."

Nevertheless, here is how we see the next decade shaping up for radio and TV broadcasters.

Radio predictions

• *The air studio.* The on-air center will change dramatically as methods of putting music and commercials on the air finally enter the computer age. The new *smart consoles*, however, will be hidden behind a familiar face. The appearance of the audio board will not change substantially, except for the addition of a CRT and keyboard, because the current form-factor has been refined over the years to meet the needs and wishes of on-air personnel.

The addition of computers will make it possible to automate many of the repetitive tasks now performed by disc jockeys. The work surface will be user-configurable, to a point, so that announcers can set the board to their own liking. The board also will become the control point for all activities in the air studio. Recording and playback systems will be controlled by the console, as will special effects devices and the transmitter. Such integration will simplify operation and lead to a less cluttered room, thereby encouraging unencumbered creativity.

Disc jockeys will be able to quickly preview the beginning or end of any song just before airplay without worrying about recue time. Because all music will be stored in a digital mass storage device, access to any portion of a selection will be possible at the touch of a button.

The work surface will be user-configurable ...so that announcers can set the board to their own liking.

All signal routing and processing will be done in the digital domain. The console in the air studio will be a control head; no audio will pass through it, except for signals from microphones in the room (which will immediately be digitized). A central equipment rack will contain all the necessary analog-to-digital conversion, processing, switching, interface and supervisory hardware.

A station will be able to start out with a basic system and add other features as necessary by plugging new cards into the rack and loading the appropriate software. This central rack will serve not only the air studio, but all production studios as well. Connections between the equipment center and the control heads will be made with fiber-optic cables. Problems resulting from RFI finally will be gone.

• *Audio storage.* Audio recorders will not go away, but the use of tape will diminish over the next decade. Instead, optical recording methods (such as CDs) will be used and, eventually, semiconductor-based memory. Cassette recorders will continue to be the mainstay of field reporters for a while. However, R-DAT machines, after a shaky start in the professional audio-video industry, will emerge by the early '90s to become the dominant format for audio recording and playback in the field. Compact discs will continue to gain acceptance for music playback at radio stations. Black vinyl will disappear completely.

Mass audio storage built around magneto-optic disk technology will compete with R-DAT systems for the primary method of spot playback. Hybrid systems will emerge, with R-DATs and CDs serving as archive storage media that will feed the main storage disk as needed. The station automation system will direct the loading of program material to the disk based on a computer-generated schedule for the upcoming day part.

OUR LATEST MASTERPIECE IS THE AVS ADAC STANDARDS CONVERTER

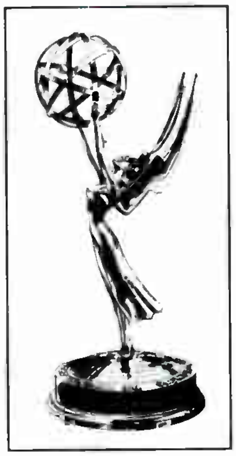
A true work of engineering art!

Since it was introduced to the U.S. marketplace a little more than a year ago, the AVS ADAC has revolutionized the art of broadcast standards conversions.

The ADAC's innovative motion interpolation system (still unique among standards converters), its adaptive digital comb filter decoder, and its ability to work with all broadcast standards and video formats (automatically selecting any of the world's standards), has placed this 10½" high marvel light years ahead of the competition.

And, when you combine all these features with A.F. Associates' unmatched after-sale service, you know why the ADAC is the first choice among broadcasting and post-production facilities throughout the U.S.

AVS ADAC Exclusive Sales and Service in the U.S. by A.F. Associates Inc.



1988 EMMY WINNER!

To AVS Ltd.: "In recognition of their engineering contribution to the advancement of standards conversion technology."

National Academy of Television Arts and Sciences

A.F. ASSOCIATES INC.
ADVANCED SYSTEMS AND PRODUCTS FOR THE VIDEO INDUSTRY
LEASING AVAILABLE THROUGH COMPTON CAPITAL CORP.
IN THE WEST: (619) 277-0291; IN THE SOUTH: (404) 242-1661

100 STONEHURST COURT, NORTHVALE NJ 07647 (201) 767-1201

A Video Services Corporation Company.

Circle (134) on Reply Card

Within the next decade, the mass storage system will become the focal point of station operations. It will be managed automatically by the main station computer, based on input from the sales and programming departments. Networked terminals in each studio and on most employees' desks will provide a detailed picture of what's going on at any moment.

• *Remote broadcasts.* The four walls that make up an air studio will become less im-

There is no better way to impart a feeling of localism — of connection with a community — than doing remote broadcasts, lots of them.

portant in the next decade as radio takes to the streets more than ever before. Localism is the basis of radio. There is no better way to impart a feeling of localism — of connection with a community — than by doing remote broadcasts, lots of them.

Because the audio control board at the station can be controlled via a modem, the talent will take just one box to the remote site. That box will be an off-the-shelf portable computer loaded with the appropriate software and two internal custom expansion cards. One card will connect to a T-1 phone line (or radio/satellite link as appropriate) to provide full-bandwidth transmit audio, talkback/IFB, control of all commercial and music sources, and even transmitter telemetry. Another expansion card will provide the necessary audio I/O ports for microphones and headsets.

Cellular telephones will play a large part in remote broadcasts for coordination activities and for spot news reports. Improvements in cellular radio will make phones far more efficient and attractive to broadcasters. Cellular phones will be used to relay not only voice messages to the station, but also computer data.

• *The production studio.* The concept of the digital audio workstation will expand to include all elements of audio recording, sampling, processing and editing. Improvements in computer and storage technology will permit a significant amount of audio production to be completed at a simple workstation. Disk-based recorders will offer high-speed random-access editing at reasonable costs. Optical disk recorders and intelligent players will be commonplace in production suites, where they will replace multichannel recorders for mastering and dubs.

Audio mixing desks will become larger for some needs and smaller for others. There will be continued demand for large, complex desks that can be computer-controlled. High-end users want this technology and need it. However, a parallel trend will see mixing desks becoming smaller but more powerful through the use of digital control.

Special effects, reverberation, time compression/expansion and equalization will be accomplished with digital systems that interface with the audio mixing desk or workstation. Outboard devices will continue to be used in production studios, but they will be interfaced with a user-configurable control panel on the desk. The user will simply call up the menu for a particular device and make the necessary adjustments. Such an arrangement will provide access to and control of all outboard gear from the mixing desk.

The increased use of electronic music sources and audio workstations for recording and editing will lead to extensive use of MIDI for machine control. The protocol, with modifications along the way, will serve as the universal machine interface format at radio stations.

The increased use of electronic music sources and audio workstations...will lead to extensive use of MIDI for machine control.

• *The transmitter.* There are only so many ways you can generate RF, and we have seen most of them already. Engineers will move increasingly toward all-solid-state transmitters for AM and FM, but they aren't going to stampede to the new technology. Transmitter buyers are some of the most conservative people in the world. Rigs will continue to be designed for an expected lifetime of 20 years. The move to solid-state will be more rapid with AM because of the efficiency improvement that transistorized systems can provide on the medium-frequency band. FM will continue to use tubes at higher power levels.

The biggest development in antenna design will be reduced-skywave AM antennas, which will begin to replace the aging towers currently in place. Don't look for many changes in FM antennas or transmission lines. There's not much left to improve.

The biggest change at the transmitter plant actually will come in the way pro-

There are only so many ways you can generate RF, and we have seen most of them already.

gram signals get from the studio to the transmitter. Look for T-1 digital radio links and T-1 via fiber-optic lines.

The pressures of local zoning restrictions and real estate costs will drive more FM broadcasters, and even AM broadcasters, to consider community transmitter/antenna sites. Most community facilities will use individual transmitters driving a common antenna. Experiments also will be conducted that use a single broadband FM transmitter and antenna for multiple stations.

• *General trends: AM.* In the United States and elsewhere, AM radio is entering a critical phase in its existence. Even as the medium continues to lose audience shares to FM, work has begun in earnest on the rehabilitation of AM broadcasting. Nevertheless, the downward trend will continue for a few more years, bringing FM's audience share to about 85% vs. 15% for AM in the United States, where it will stabilize. The low audience shares will give further impetus to broadcasters to get serious or get out; some will elect one alternative, some the other. Many stations will change hands.

...the good AM stations will get better, and the bad ones will get worse.

Programming will be the key to success for AM. Innovative programmers will find a way to make AM go with niche programming. Some stations, however, will go dark because of poor signal penetration into certain markets. In short, the good AM stations will get better, and the bad ones will get worse. Stations that are willing and able to spend the necessary money to keep their facilities up-to-date and provide the resources and encouragement to intelligent programmers will succeed. Stations that will not, or cannot, face a bleak future.

THE NEW MODEL 1241

A HIGHER LEVEL OF KEYING

Graham-Patten Systems, the performance leader in high quality video keyers, now takes you to a higher level. The new Model 1241 presents farsighted solutions to on air, remote, and post production demands. This advanced video keying system has functions usually found only in switchers. The Model 1241 is a cost effective choice that will significantly improve your production capabilities.

The Model 1241 is your key to extended video power. It offers six independent self or external key inputs, the cleanest keying edges and borders available, and external control of key and black auto-transitions. Plus, the Model 1241 has these additional advanced features:

Edging Effects
- Borders up to 15 lines wide
- Soft borders, shadow and glow effects
- Border fill from external source
- Shadow positioning
- Outlining effects
- Variable density borders, from transparent to full color

Additional Features
- Individual clip control for each input
- Mask with invert feature
- Non-sync indicators
- Separate preview capabilities
- Remote control interface
- Operates in either **NTSC or PAL**

Call us for a brochure,
discover a higher level of video keying.
800-547-2489
In California 800-422-6662

GPS
GRAHAM-PATTEN SYSTEMS, INC.
DESIGNED WITH VISION

Circle (30) on Reply Card

The number of AM stations broadcasting stereo will increase slowly, but not to the point that it will revitalize the AM band. Improved radios will continue to be offered by receiver manufacturers, but AM broadcasters will learn that the first step in cleaning up the AM band is to clean up their own act. Expect to see renewed interest in rebuilding AM facilities. Improvements will be made where they will result in greater coverage or a better on-air sound.

Unfortunately, simulcasting AM with the live FM at combo stations will continue. Simulcasting full-time is a cop-out, a sign that station management has given up on AM. The only good thing to be said about simulcasting is that it keeps the AM property alive until somebody comes up with a programming scheme that will work.

AM broadcasters will look to cable companies as a method of finally delivering high-fidelity audio to listeners. Innovative stations will arrange for cable systems to carry their audio using a direct, wide-bandwidth link from the studio, rather than an off-air (compressed, narrowband) signal.

FM broadcasters as a whole are in a good position to face the challenges of the 1990s.

• *General trends: FM.* Market pressures will continue to push FM stations to deliver a higher-fidelity signal. As the market penetration of compact discs increases, consumers will become more aware of what good audio sounds like. They will expect similar performance from their favorite FM stations.

FM broadcasters as a whole are in a good position to face the challenges of the 1990s. The industry has just gone through a major renovation effort spurred on by the Docket 80-90 decision. Broadcasters in the top 50 markets have improved their studio and transmission plants significantly during this decade, and are now poised to concentrate on unique programming to capture their share of the advertising pie.

FM faces a paradox, however, with regard to programming. The last thing a successful station wants to do is change anything. The old adage, "If it ain't broke, don't fix it" has merit, but being one of five stations in a market programming the same format is not the way to guarantee a secure future.

The big technical question for the next decade is FMX. Will it push FM to new technical heights, or will it become the "quad" of the 1980s? The jury is still out. Proponents of the system need a few success stories, and soon, before broadcasters and receiver manufacturers will jump on the bandwagon. The much-publicized Bose report, which was critical of FMX, has added more heat than light to the situation. The discussion, which should be weighed on technical grounds, runs the risk of becoming a battle akin to the AM stereo debacle. We sincerely would like to see FMX become a reality. We are not ready at this juncture, however, to predict that it will.

The much-publicized Bose report, which was critical of FMX, has added more heat than light to the situation.

Television predictions

• *Digital control and processing.* Digital technology will reshape the TV station of the 1990s, but it will not take over the world. First, digital means different things to different people. Is an analog routing switcher that is controlled by a computer a digital system or an analog system? It is both. Completely digital hardware will be cost-effective in some areas and completely unrealistic in others.

Digital terminal equipment — including distribution amplifiers, routing switchers and production switchers — will be practical only when an obsolete plant is rebuilt. No engineering manager would propose to build an all-digital facility of any size based on current or demonstrated technology, but that will change in the coming decade. The bandwidth limitations imposed by terrestrial broadcasting ensure that analog distribution will be with us for many years to come.

Still, analog technology will fade from the scene toward the end of the 1990s. Nearly all pickup devices will be digital (CCD), and increasing numbers of display systems will become digital through the use of flat-screen solid-state technology. With both the pickup and reproduction devices operating in the digital domain, there will be attractive reasons for keeping the entire system digital.

The traditional multipurpose production control room will become smaller, as digital multilayering makes more compact, powerful switchers advantageous. Access to central recording, film and graphics areas via a huge routing switcher will continue to be the mainstay of major market TV stations and post-production facilities. Although digital islands will emerge for graphics and other special effects, large-scale conversion to digital hardware is not in the cards for most stations during the next 10 years.

Although digital islands will emerge for graphics and other special effects, large-scale conversion to digital hardware is not in the cards for most stations during the next 10 years.

• *Graphics.* Look for big changes in the field of computer-generated graphics. Systems will become more sophisticated, less expensive and easier to operate.

RISC (reduced instruction set chip) processors will continue to drive down the cost of computing power and, as a result, push the graphics industry forward by leaps and bounds. Memory chips with greater density (memory capacity) will allow higher-resolution displays with greater color depth. Specialized graphics ICs will affect all segments of the market by allowing complex animations to be produced in real time or even *faster* than real time, depending on the complexity of the images.

The technological gap between high-end and low-end graphics systems will continue to narrow. Look for more off-the-shelf hardware from the computer industry, loaded with a few specialized circuit boards and custom software. With the power that will be packed into stock computers, it is unlikely that many manufacturers will find it advantageous to continue to build their systems from the chassis up.

The technological gap between high-end and low-end graphics systems will continue to narrow.

The video workstation will become a significant force in the production and editing of all types of programs. Two system architectures will emerge. The first will be a single box that performs a wide variety of tasks, depending on the PC cards loaded into it. The second will be

MISSING

LINK

The evolution of remote broadcasting has long been plagued with a missing link, the link between site and studio. Trying to get high fidelity audio over a standard telephone line has been a little like nailing jello to a tree. But now the missing link is history.

Digital Frequency Extension, the New Generation.
Relying on the predictable quality of advanced signal processing technology, our EFT-3000 3-Line Digital Frequency Extender will give you the great remote sound you want. In fact, frequency response of 50Hz to 7.5kHz over three standard (dial-up) telephone lines.

A Giant Leap for Broadcasting.
In addition to giving you and your listeners the audio quality you deserve, the EFT-3000 can be set-up quickly by just one person. Once you've plugged-in and established the lines, all you do is punch a single button. In about ten seconds the EFT-3000 takes care of line equalization, group time delay and line level adjustments.

With auto-dialing, automatic answer and automatic encode/decode, set-up and operation are...you guessed it–automatic. And built-in microphone and headset amplifiers and front panel Touch-Tone® pad eliminate the need to drag extra gear to the remote site.

Survival of the Fittest.
To survive the rigors of field production and get high fidelity sound back to the studio, you need the EFT-3000. But, hearing is believing, so we have a demo tape you've got to hear. To get your copy and find out more about the EFT-3000 and our entire line of frequency extenders, just contact your local Gentner distributor or give us a call. Remember, we're the ones who made the missing link a shadow of the past.

Circle (31) on Reply Card

GENTNER
TELEPHONE PRODUCTS

1825 Research Way · Salt Lake City, UT 84119 · (801) 975-7200 · FAX (801) 977-0087 a single control surface that can drive a number of individual systems. From the user point of view, the result will be the same: One control panel will replace the multitude of panels now in the typical medium-sized production room.

The video workstation concept will extend the power to edit video to a wide variety of individuals. Nobody will be doing final cuts of commercials via a desktop workstation, but they will be preparing edit decision lists (EDLs) and rough cuts that will reduce significantly the amount of time required to finish the project in a $400-an-hour post-production suite.

As graphics hardware improves, software developers will increase their focus on ease of operation. Interactive interfaces will permit non-technical users to produce impressive finished products. Expect to see more systems based on personal computers, particularly MAC-II and its successors. The requirement for operators to be both artists and engineers will disappear. As the technology becomes transparent, the creativity of the artist will shine through.

• *Digital recording.* The future will be bright for the D-2 digital composite format. Although D-1 will continue to be used in high-end applications requiring the best video quality, D-2 will emerge as the replacement for 1-inch type C.

D-1 will make few, if any, inroads into on-air broadcasting. The machines are too expensive, and the component digital interface too complex for anything except a digital graphics island. D-1 is a premier format that will provide an important, but limited, function in the broadcast arena. D-2, on the other hand, will be readily accepted in the post-production and broadcast markets. It will become the dominant format for high-end, multigeneration post-production work. Improvements will come along, one by one, that will correct deficiencies discovered in the field, and add new features at the same time. Prices for D-2 machines also will come down as volume goes up.

(D-2) will become the dominant format for high-end, multigeneration post-production work.

The big news about digital recording will come in the form of a new format (as yet unannounced) that matches D-1 in quality but is portable. This development will revolutionize the production of network and syndicated programs because it will allow the VTR to be located at the camera pedestal. The need for expensive routing and switching facilities will be reduced greatly. (Most network and syndicated programs shot on video are done with multiple *iso* cameras, where each camera feeds a dedicated, centrally located VTR.) The program then will be edited on an off-line video workstation and an EDL given to a post-production facility, along with the original tapes, to produce a finished product. The project will be done in less time and for less money.

Portable digital ENG recorders will take over for news and field production applications. Expect to see camera-recorders that are all-digital in design. Concern about multiple generations for the production of news reports will disappear.

Digital HDTV recorders will be available for facilities producing full-bandwidth high-definition video. Prices will be high,

Continued on page 69

Introducing the Jazz Di

Jazz. That may strike the professional video producer as a strange name for an effects system. But Jazz music is open-ended. It can change mid-stream. It's not elitist or highbrow. Jazz is always creating and recreating within an ever-evolving structure.

That's how we came to name our new system. It can evolve, adapt, modify or improvise. All to suit your service or your customer's needs. It's advanced enough to offer every compatibility. Yet it boasts a startling simplicity in operation. And an even more surprising price tag. So as your company changes, Jazz can change right along with you.

OUR KEYFRAME EDITING ALLOWS YOU TO PRE-PROGRAM ALL YOUR EFFECTS. (AND STORE ALL YOUR SECRETS ON DISKS.)

How? Well Jazz is easily upgradeable through both hardware and software. And we're looking forward to bringing you 3D, machine control and even graphics capabilities. But for now, you get to play with all this Jazz:

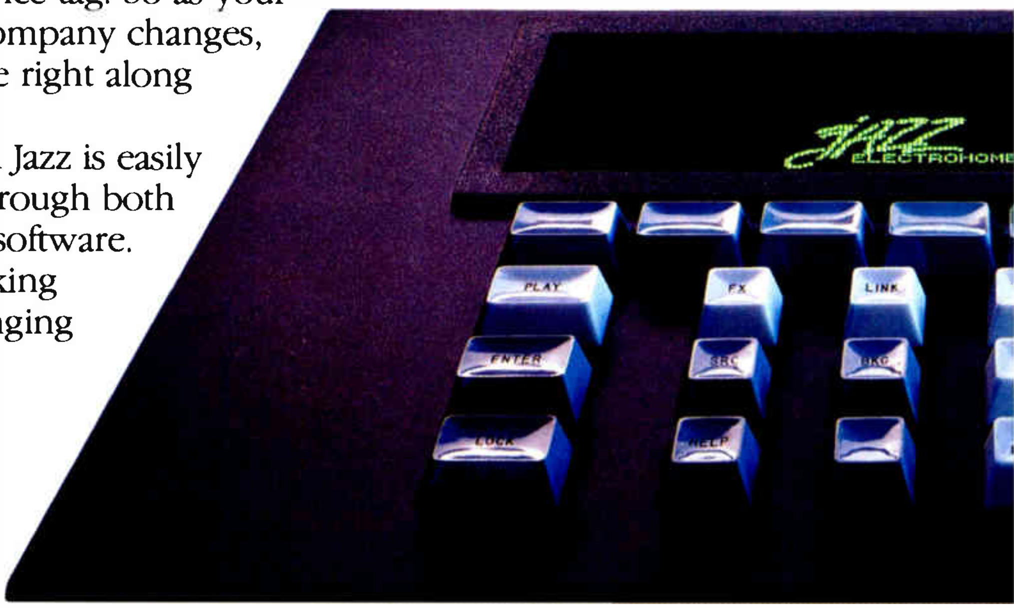
Flip and Tumble. With Jazz, you can change the axis. Or you can change the size. Which means you have an infinite number of possibilities.

Or you can Rotate if you like. That means clockwise or counter-clockwise. With variable speed in both directions.

Maybe you want to blow it out of proportion? Jazz offers you infinite Overexpansion just in case you want to reframe that perfect shot.

And our Posterization is as pretty as a picture. It operates

THE FORMAT WARS ARE FINALLY OVER. JAZZ IS EASY TO INTEGRATE AND A CINCH TO UPGRADE.



DON'T LET THE SIMPL
INTERFACE FOOL YOU.
JAZZ IS ONE OF THE MC

tal Video Effects System.

to an infinite level with a surprising smoothness.

You can crop an image. Pan a crop over an image. Pan an image within a crop. Or just pan a cropped image. Sounds confusing? It's not. And if you want to change it again, you can. It's easy and it's fast.

NO COMPLICATED NUMBERS OR QUOTIENTS HERE. JAZZ PLAYS RIGHT ALONG WITH YOU USING A SIMPLE SET OF WORDS.

That brings us to another key function. Jazz's Link Function allows you to manipulate a keyframe like never before. And virtually eliminates the kind of guesswork and legwork usually associated with creating key sequences.

And Jazz also creates Mirror Image. Horizontal and Vertical Inversion. Borders of any size or color. And a whole lot more effects than can be talked about in one ad.

Of course it all comes together with our Keyframe Editing capabilities. It's the ultimate in cut and paste. You just step through the keyframes and modify any or all of the variables that have been recorded. And we don't have to tell you how helpful that is when a job is tight for time or money.

How can we sum it up? It's fast, clean and direct. You don't have to be a techno-wizard to operate it. And you don't have to be a financial wizard to see that it's profitable. Jazz keeps your production services flexible. And it keeps your company growing.

So if you're looking for a new system, or a change of systems, look to the one that's always changing. Jazz from Electrohome.

JAZZ IS FAST ENOUGH TO STICK WITHIN A BUDGET. AND IT'S SO INTUITIVE, IT'S A JOY TO OPERATE!

POWERFUL TOOLS FOR TODAY'S PROFESSIONAL PRODUCER.

JAZZ ELECTROHOME

Continued from page 64
however, and few — if any — machines will find their way into over-the-air TV stations, which will be producing and transmitting advanced-definition TV (ATV).

The use of optical and magneto-optic disk storage for production, special effects and editing will accelerate, driven by increased storage capability and lower cost. Disk technology will not replace magnetic tape, but it will be used extensively for online editing because of its random-access capabilities.

Data-compression schemes will be developed that permit archiving digital video in a compressed disk file. Right now, the D-(pick a number) formats are basically digital implementations of analog notions. The late 1990s will bring the digital video equivalent of an *ARC-file* on a PC bulletin board. Such storage methods will capitalize both on the redundant data in a typical video signal and on perceived resolution (what the eye can see, as opposed to what is really present).

• *Cameras*. Portable and studio cameras will be all-digital. Tubes will disappear. CCD-based systems will provide greatly improved pictures over present-day thermonic device technology. CCDs will be used for HDTV cameras as well. The use of digital circuitry will all but eliminate calibration adjustments. Battery life for portable units will be extended greatly because of more efficient electronics and improved battery designs. Camera-recorder systems will become universal for field applications. White-balance and other operator controls will be eliminated. Enhanced lenses will weigh less and provide photographers with greater flexibility.

Interconnected computers will permit automatic generation of the operating log, cassette-pull list, invoices and more reports than you can shake a stick at.

Camera control units for studio systems will disappear because all parameters will be adjusted automatically. Fiber-optic cables will replace conventional copper cables for connection from the camera to the switcher.

Price will continue to drop for both portable and studio cameras because of extensive use of VLSI circuitry. Engineers will find it more cost-effective to replace a damaged field camera than to repair it (lens and VCR excepted).

• *Automation*. The TV station will be built around video library systems integrated into a computer network, which ties the entire station together. Interconnected computers will permit automatic generation of the operating log, cassette-pull list, invoices and more reports than you can shake a stick at. Automatic execution of the log will be commonplace. Programs subject to change, such as newscasts, will continue to be done manually, but with computer assistance.

Robotics will extend from the studio floor for preprogrammed camera moves to master control for spot playback. Newsroom automation systems will interface with master control to provide tape line-up information, still-store requirements and character-generator data. Some stations will place embedded commands in the on-air script to automatically start tape machines, bring up fonts and change stills. Most, however, will use the computer to prepare the needed elements, and leave it up to a human operator to *take* the video.

Newsroom automation terminals will become both text and video workstations. Reporters will be able to page through wire copy or archive scripts, view new or archived video, and prepare an EDL from their desks. Computers will be common in the field, and the familiar "reporter's notebook" will become a thing of the past.

Portable spot scheduling/availability computers will become effective tools for the station's sales department. The system will be an off-the-shelf portable PC with an internal expansion card that contains a cellular telephone. If a salesperson receives an order while visiting a client, the order can be entered into the station's main computer directly from the client's office. If availabilities are in question, time slots can be examined and finalized before the salesperson shakes the happy customer's hand and walks out the door.

• *Transmitters*. VHF broadcasters will look toward all-solid-state transmitters for increased efficiency and improved reliability. Many solid-state rigs will be sold, and performance will be good. However, most stations will stay with tube designs because of the simplicity that power grid devices provide.

UHF broadcasters will be taking bolder steps. The Klystrode tube and MSDC (multistage depressed collector) klystron and new tetrodes will take over the high-power transmitter market by the middle of the decade. The efficiency penalty faced by UHF stations will force engineering managers to choose more efficient rigs, based on these devices or something else still in the lab. Conventional klystron transmitters will be the mainstay of UHF broadcasters for the next two to three years; after that, high efficiency will be the name of the game.

The greatest concern of engineers will be how to transmit ATV. Because the FCC will select an ATV system that will fit inside a 6MHz channel, the performance of the existing transmitter, transmission line and antenna system will be of critical importance. The conversion to ATV will be similar to the conversion to color in the 1960s or to multichannel sound this decade. Some transmission systems will require more work than others to pass the ATV signals. This process will lead to wholesale upgrading of transmitting plants by both VHF and UHF stations. Many facilities are 20 years or older right now. The onslaught of ATV will provide a good excuse for replacing the old transmitter, transmission line and antenna.

As with radio, the method of delivering programming from the studio to the transmitter will change over the next decade. Stations will use fiber-optic lines if they are available, and digital radio links if they are not.

• *HDTV*. High-definition television is an extremely complex subject, but that won't stop us from offering a few predictions. For starters, broadcasters will participate in HDTV, really ATV, by 1992. By that date, a compatible 6MHz system will have been endorsed by the FCC and field tested. A few pioneer broadcasters will rush to put ATV on the air. Programming will be limited at first, using movies and other material shot on 35mm film and delivered by satellite from the program supplier or network. Certainly presenting a "Movie of the Week" in high definition will be as appealing to audiences in 1992 as "Bonanza" in color was in 1965.

The ATV system selected by the commission will be a hybrid of one or more of the systems currently being proposed. It will provide an improved picture with a 16:9 aspect ratio. There would be provisions in the ATV format for further image enhancement if additional spectrum became available. It will never become available, however, because the land mobile industry will grab it first. The lack of a second augmentation channel will not seriously hurt the implementation of ATV because *smart* receivers will provide progressive scanning, interline interpolation, noise reduction, ghost elimination and detail refinement. For the average TV viewer, ATV on a high-tech TV set will look spectacular. Purists and professionals will know the difference, but Ma and Pa Consumer will not.

Simulcasting of ATV and standard NTSC will not occur. This idea has been proposed as a way to effect an orderly transition from current technology to full-bandwidth HDTV. Although the goal is laudable, it will not be practical. There are too many demands on spectrum for the FCC to allocate still more to television.

The implementation of ATV will take off after the pioneers have discovered, and solved, the problems that are sure to surface. By 1999, 10 years from now, ATV will be transmitted by the majority of TV stations in the United States.

ATV will carry over-the-air television through the year 2000, when fiber-optic delivery of "real" HDTV will begin.

• *Film production.* TV people keep trying to bury film, but the stuff just won't die. Ten years from now 35mm film still will be the standard by which HDTV is judged. High definition will make few inroads in Hollywood to replace film, even though the technology will be improved over what we have seen to date. Producers view film as a stable format that can be transferred readily to whatever TV standard is required. Every time a new, improved VTR format comes out, producers are even more convinced that film is *the* universal recording and storage medium. VTR formats are transitory from their viewpoint. Meanwhile, the quality of film continues to improve, plus 35mm film is completely compatible with all existing production, editing and display equipment.

Once shot on film, however, most productions will use disc-based video systems to develop an EDL. Video editing will increase in popularity because of the speed that it affords and the ability to economically provide alternative versions of a scene for consideration by the producer.

• *General trends.* The bottom-line orientation of television will accelerate as cable and other services continue to erode the traditional stronghold of over-the-air broadcasters. Staff sizes will diminish as stations find, through automation, ways of doing more with less people. The business will, however, remain strong; and with the addition of ATV, stations will be able to compete with home movie rentals in HDTV and high definition via direct broadcast satellites (DBS).

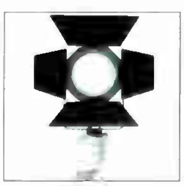
Although it is true that VCR movie rentals in HDTV will be capable of providing consumers with full-bandwidth video, over-the-air television has managed to survive for the past five years with lots of VCRs in the hands of consumers. The reason: programming. As long as TV stations provide programming that people want to watch, they will have an audience. The best product that any station has is what it generates locally. Localism is the key to survival in the future.

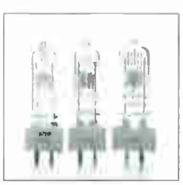
Beyond the year 2000, the outlook is uncertain. Fiber-optic technology is promising. Light-wave information exchanged is already firmly entrenched. Fiber-optic systems are free from interference and do not radiate. They provide the perfect method for distributing video programming.

Another potential source of competition for over-the-air broadcasting will come from the computer industry. Major players in the computer and semiconductor businesses have announced plans to develop *digital video interactive* (DVI) systems that would give consumers unparalleled freedom over what they see and hear. DVI will get off the ground and make inroads in the marketplace. It will not be sufficiently advanced by the year 1999 to have a serious impact on broadcasting. However, sometime after the year 2010, DVI may just turn the information business upside down.

Acknowledgment: Input for this article was provided by the following:
- Don McCroskey, BE consulting editor.
- David Oren, TASCAM.
- Charles Lipow, Charles J. Lipow Inc.
- Ruhama Lipow, Charles J. Lipow Inc.
- Andy Laird, KDAY radio, Los Angeles.
- Curtis Chan, consultant.
- Chip Morgan, Chip Morgan Broadcast Engineering.
- Background information on industry trends from Cubicomp and Ampex.
- Phillip Kurz, BE consulting editor.
- K. Dean Stephens, Amoz Gibson Centre, Arecibo, Puerto Rico.

One class beyond. More and even tungsten light. Sachtler Reporter 650H.





The new dimension in lighting.
Reporter 125D, 270D, 100H, 250H, 300H, 650H; Production 575D, 1200D.

Sachtler's new product line brings innovation in lighting. Built with worldwide known Sachtler quality.

The Sachtler Reporter 650H is setting new standards for 600–1000 watt tungsten lights. It achieves 3200 lux in spot setting (at a distance of 16.4 feet/5 m) and distribution remains extraordinarily even for the whole focusing range (1:6).

The lightweight, compact housing holds a 4-inch reflector with an integrated filter slot and barn doors.

The Reporter 650H set comes complete with three lamps; bulbs for 650 W, 500 W, and 300 W for the utmost creative flexibility in illumination; all in one case, including accessories.

The Reporter 650H set as if you had 3 kW.

sachtler®
corporation of america

55, North Main Street
Freeport, N.Y. 11520
Phone (516) 867-4900
Telex 140107 sac frpt
Fax (516) 623-6844

California office:
3316 West Victory Blvd.
Burbank, CA 91505
Phone (818) 845-4446

Circle (35) on Reply Card

The Ampex Digital Cart Machine . . .

COMPOSITE DIGITAL

It seems that nothing really good comes easy, but now our first ACR-225 customers have received their automated cassette systems. And they tell us they're glad they waited.

The birth of the ACR-225 was a longer process than we'd anticipated, and many video professionals exhibited patience and confidence in us throughout the extended shakedown phase of the ACR's development.

"It was worth the wait."

For that trust we'd like to say, "thank you!"

And for all of you who will someday own an ACR-225, we think you'll agree that the reliability and uncompromised signal quality of this advanced digital cart machine was worth every minute of the time it took to do it right.

Call us at **1-800-25AMPEX** for more information about the ACR-225 and other D2 composite digital recording systems.

AMPEX

- First long-distance intercity digital TV transmission sent via fiber-optic cable.
- NEC introduces the SPC-3 CCD camera.

1984
- RCA introduces CCD-1 solid-state camera at NAB.
- Varian/EIMAC introduces Klystrode tube as a product.
- FCC approves use of AM subcarriers for broadcast and non-broadcast functions.
- FCC eliminates programming guidelines, ascertainment, commercial rules and program logging requirements for commercial TV stations.
- FCC replaces the 7-station ownership rule with 12-station limits.
- Montage Picture Processor introduced by Montage Computer Systems.
- Lucasfilm/Convergence shows the Editdroid disk-based editing system designed to emulate film-style editing.

1985
- FCC adopts RF radiation protection standards for human exposure.
- Panasonic introduces M-II format at NAB convention.
- Nautel introduces first totally solid-state 50kW AM transmitter.
- U.S. Court of Appeals says the FCC's "must-carry" rules regarding cable television are unconstitutional.

The future for fiber

By Phillip Kurz, consulting editor

Even as the broadcast industry grapples to reach agreement on an HDTV transmission standard, the prospect of fiber to the home promises to change the high-definition equation completely.

You're spending a quiet evening at home with your family. Your son, a high school student, is talking on the phone to his girlfriend.

Your daughter, a second-year medical student, sits in her room studying at her personal computer, which is tapped into the medical school library and video archive. One window on her computer screen displays text describing the intricacies of spinal cord repair surgery. In another window, high-resolution video of the surgical procedure gives her a crystal-clear understanding of the dexterity needed to perform such a complicated operation.

In the next room, your wife, who's been thinking of ordering a compact disc, decides she needs a little sample of it before she buys. She picks up the phone, dials a music shop and listens to a high-quality cut from the latest release of the Rolling Stones' "Gray Sugar."

Meanwhile, you nestle down into your favorite easy chair, flip on your HDTV set, review the sports offerings under the major league baseball directory and choose a game between the Washington Policymakers and the Phoenix Sunbirds.

Welcome to 2020 A.D., 60 years deep into *the information age*. The nation and much of the world is afloat in a dynamic ocean of digital information — voice, video and data — and the spigots through which these streams of data pour are fiber-optic cables.

From the office to the home of the future, fiber optics, unlike the narrowband copper and coax systems of today, will put information from the most remote library to the most available video programming at the fingertips of users. And because of its wide bandwidth, optical communications will deliver information to an individual household or office from several sources simultaneously over the same fiber.

Back to the present

For nearly 13 years, engineers and researchers in the telephone industry and telecommunications departments of governments worldwide have been working on a set of standards to provide telephone users with a digital network that will extend the range of services offered to customers from a set of standard interfaces. These services, known as ISDN (*integrated services digital network*), include narrowband voice, wideband voice, data and low-resolution and slow-scan video channels, all of which can be delivered to customers over the installed base of copper telephone wire.

The significance of ISDN for the TV industry will become apparent when telcos, seeking to penetrate the consumer market with ISDN, commit to the establishment of *broadband* ISDN, also known in various circles as BISDN and IBN *(integrated broadband network*).

If certain regulatory barriers imposed upon telcos were removed, an IBN system would give local exchange carriers the bandwidth needed to deliver video programming — even wideband high-definition video signals — to the home.

Already, local exchange carriers have begun installing the delivery medium at the heart of a future IBN system, single-mode fiber-optic cable. In experiments from Leawood, KS, to Cerritos, CA, and from Heathrow, FL, to Perryopolis, PA, local exchange carriers plan to install, or have installed, fiber to the home for delivery of voice, video or both.

Even if telcos are prohibited, in the

D-2? OF COURSE.

Tektronix combines world-proven performance and up-to-the-minute technology in equipment to fit your operations, monitoring and maintenance requirements of the D-2 environment. Feature for feature, it's what you expect from Tektronix.

The 1730 D-2 Waveform Monitor features measurement quality D-2 decoding with Tek's own precision DAC. You get digital D-2 and standard analog input capability for NTSC applications. Both inputs can be viewed simultaneously. And decoded D-2 analog output can be displayed on-screen or routed from a rear panel connector to the location of your choice.

Also included are features that make the 1730 the world's most popular line of high-performance waveform monitors. Front panel recalls. Full line select. Dual filter, dual channel display. And add a 1720 Vectorscope for decoded D-2 vector display.

The TSG-170D Digital Composite NTSC Generator offers test signals and audio tone in digital and analog form, plus analog black burst for equipment synchronization. You get 12-character identification,

tape leader countdown and digital genlock with output timing offset. All in a cost-effective package.

Get the full story. Ask your Tektronix representative for a demonstration.

Of course!

Tektronix
COMMITTED TO EXCELLENCE

Circle (37) on Reply Card

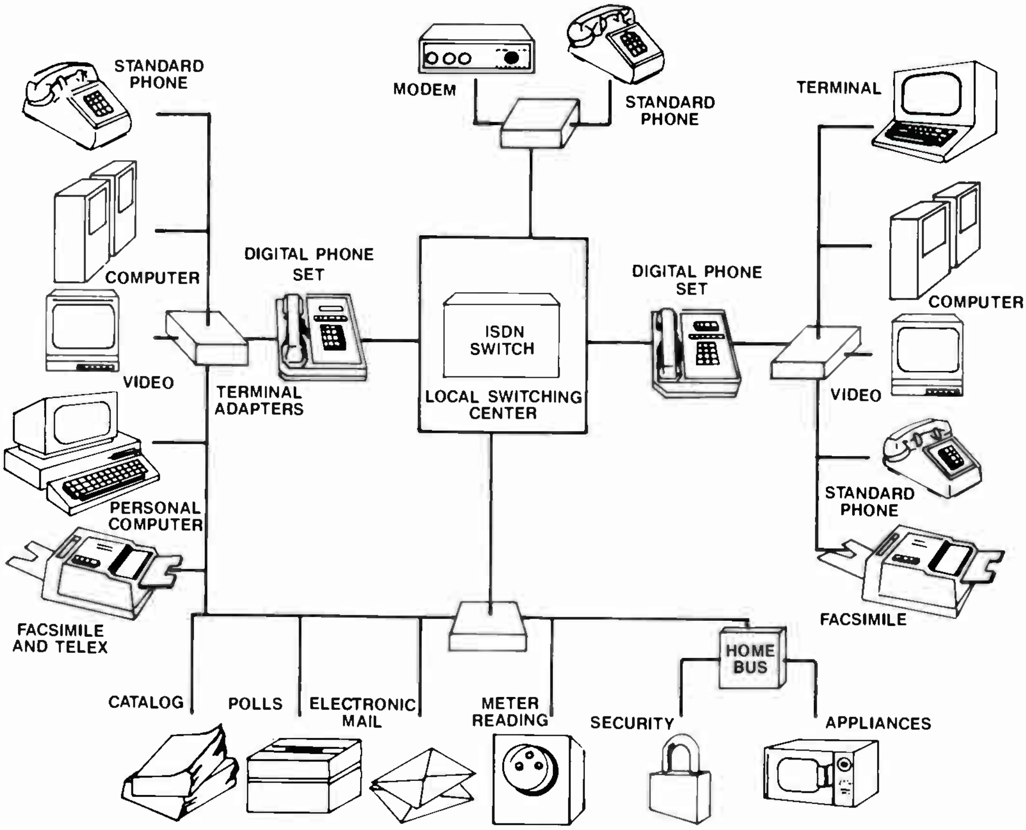


Figure 1. An integrated broadband network (IBN) would deliver a wide range of broad and narrowband services over fiber-optic lines to the home. These services could include standard- and high-quality phone service, computer database interface, NTSC and HDTV video, video telephone, meter reading, home security, electronic mail, catalogs and control of appliances.

The Essentials Defined.

Two-channels of SR and A-type noise reduction.

Three cards available: Cat. No. 300—SR and A-type module: Cat. No. 350—SR module only, and the Cat. No. 450—A-type module only.

Relay-controlled "hard" bypass of all circuitry.

Provides SR users with accurate verification of decode calibration levels and playback frequency response.

Multi-turn level controls on each channel for setting all levels.

Balanced transformerless input and output circuits.

Generates Dolby tone for A-type or Dolby noise for SR; also activates Auto Compare mode for SR alignment.

Allows checking of the non-decoded signal from tape during recording or playback.

Four element LED calibration displays.

Front panel control of record/play switching. Can also be switched under tape recorder remote control via connector on rear panel.

Toggle switches allow selection of A-type, no processing, or SR.

Model 363

Dolby

Circle (59) on Reply Card

short- to medium-term, from carrying video to the home because of regulatory battles and political struggles with the cable industry, they soon will move to fiber as the delivery medium of choice for POTS (plain old telephone service).

Clearly a major reason behind the telco interest in fiber to the home is cost savings. Copper wire continues to rise in price while the price of fiber is falling. Currently, Southwestern Bell (SWB), which serves about 11.5 million customers in Missouri, Kansas, Oklahoma, Arkansas and Texas, estimates the cost of running copper to the home at $800 to $1,200 per new residence. Fiber-optic cable and its associated hardware costs about $2,400 to $3,000 for a comparable installation. Estimates from SWB place the costs of running fiber to the home for POTS even lower.

...if current price trends continue, by the early to mid-1990s fiber to the home will be less expensive than copper. . . . .

SWB claims that the cost of fiber-optic cable has dropped 25% from last year's prices, and the price of associated electronics has fallen from 17% to 30%. In fact, one SWB study shows that if current price trends continue, by the early to mid-1990s fiber to the home will be less expensive than copper for the company to install for residential POTS applications.

A paper released in November 1988 from the FCC Office of Plans and Policy confirms SWB's projections. In fact, it speculated that, given the falling price of fiber and the rate at which new houses are being built, 18% of U.S. households could be served by telco fiber-optic cable by the turn of the century, regardless of whether telcos deliver video to the home.

Now add the delivery of a viable broadband service, such as video entertainment, to the equation. That changes all the educated guesses about when telcos will install fiber to the home and replace existing copper service with fiber. For example, Southwestern Bell's study showed that it could justify installing fiber to the home in 1989 and pay as much as a 25% premium over the cost of copper if it could also offer a broadband service, such as video programming.

But exactly when local exchange carriers begin installing fiber to the home on a large scale isn't nearly as important as the steadily declining cost of fiber-optic equipment. These trends clearly indicate that fiber-optic cable will be used for service to the home. In fact, some industry experts speculate that fiber will be run to every home and business in the United States within the next 20 to 30 years.

The technology of fiber

Since the introduction of the laser in the early 1960s, researchers have set out to develop a transmission medium for light. As recently as 20 years ago, signal loss along optical fiber was significant. At that point, only 1% of the light power introduced to a fiber-optic line would exit 20 meters away. By 1970, developments in fiber allowed 1% of light to be present 1km away from the light source. Today, 1% of light power is detectable 91km from the source.

All optical fibers consist of a pure, solid-glass core that is encased in a cladding of glass with a slightly different composition. The thickness of the optical fiber core varies from less than 10 microns in single-mode fiber to as much as 100 microns in multimode fiber.

An individual light pulse introduced into one end of multimode fiber travels through the medium in two different ways. Some of the light travels in a path parallel to the core strand while other rays reflect from edge to edge on their way to the end of the fiber.

As a result, various parts of the same

It's 5:53!
Where's Charlie, Jim and Jane?
There's nothing to worry about.
AutoCam's™ ACP-8000 has control.
STOP
EXIT
5.0 secs

light pulse entering multimode fiber reach the end of the fiber at different times. This results in what is known as *pulse broadening*, a limiting factor to the speed with which pulses can be introduced to the fiber.

In single-mode fiber, each light pulse results in a single ray of light traveling down the core. Because there is no pulse broadening, it is easier to pack light pulses more closely together on a single-mode fiber than on multimode. As a result, single-mode fiber has a broader bandwidth than multimode, and for this reason, those in the telecommunications industry generally agree that single mode will be the fiber of choice in any broadband network to encompass residential customers.

Among the broadband services that many local exchange carriers want to offer to customers is present-day NTSC video programming and HDTV video as material becomes available.

HDTV, IBN and fiber optics

Many experts have described optical fiber as the ultimate transmission medium for high-definition television, and a quick look at the numbers will demonstrate why. The 1125/60 production system for HDTV, although by no means universally agreed-upon as *the* high-definition system of the future for either production or transmission, does provide a point of reference for the amount of data that must be transmitted.

Many experts have described optical fiber as the ultimate transmission medium for high-definition television, and a quick look at the numbers will demonstrate why.

The system, which until recently was strictly analog, would require an analog-to-digital conversion before it could be sent digitally along a broadband IBN network. If 8-bit sampling is done on a 30MHz luminance signal and 15MHz each for R–Y and B–Y, plus headroom for audio, control and timing signals, the total data rate will be roughly 1.2Gb/s. (The new digital HDTV videotape recorders are capable of 1.18Gb/s.)

Currently, Canon/KDD (Japan), Telettra (Italy), Sony and others have prototypes or are working on the development of *codecs* that will compress this wideband HDTV signal to about 140Mb/s. This data rate conforms to the CCITT (Consultative

Committee on International Telegraphy and Telephony) 140Mb/s to 150Mb/s window recommended for an H_4 channel, which will become the backbone of broadband transmission on any first-generation IBN network.

What this means to the TV broadcaster and, more important, to the home viewer, is that perhaps 15 to 18 channels of HDTV video programming could be transmitted over a single 1Gb/s optical fiber. And if this seems to be too much of a limitation, a 10Gb/s system, which already has been displayed in Japan, could deliver 100 channels of HDTV.

...perhaps 15 to 18 channels of HDTV video programming could be transmitted over a single 1Gb/s optical fiber.

Although there have been no widespread demonstrations of codec technology for HDTV to date, a team of researchers from Bellcore has shown (at an HDTV workshop in Italy in March 1988) a simulation of what an algorithm devised for HDTV bandwidth compression could do. Using a technique known as *sub-band encoding* and DCT (*discrete cosine transform*), the researchers were able to compress a segment of moving HDTV footage, demanding in terms of color content, luminance bandwidth and contrast, into a 120Mb/s datastream. The demonstration was only a simulation; a codec dedicated to the compression function did not exist. The team used a general-purpose computer to run the algorithm on 4s of video.

In another trial, Canon and KDD currently are making their HDTV codec available to Comsat and Intelsat for daily transmission of HDTV from Washington, DC, to Tokyo. Other companies, such as Telettra and Sony, soon will be showing codecs that compress data for HDTV transmission via fiber-optic cable.

CATV and fiber

The telcos aren't alone in the use of fiber-optic communications. Increasingly, the cable TV industry will turn to fiber to meet the needs of the future. Currently, about 83% of all homes in the United States are passed by cable TV lines. Additionally, more than half the TV households are served by cable. The transmission medium of choice to date in the CATV business has been coax. But that's likely to change in the not-too-distant future as cablecasters face potential competition from telcos, and as they grapple with delivering broadband HDTV on their systems.

Just as broadcasters are trying to figure out how they will cram a broadband HDTV signal into 6MHz of bandwidth for terrestrial service, head-end cable operations are faced with the chore of making their systems adapt to wideband video. The obvious answer is fiber-optic transmission. The cable industry is likely to begin easing into a changeover from coax to fiber long before a transmission standard for HDTV is set because it can improve the quality of the video signal that the customer receives, and it will add bandwidth to the system.

With today's current cable systems, operators must rely on a large number of amplifiers — as many as 50 — between their head-end plant and the subscriber to deliver programming. Each amplifier introduces noise and degrades the signal as it travels from the head-end to the customer.

If, however, cable operators introduce fiber-optic cable into their operations, as

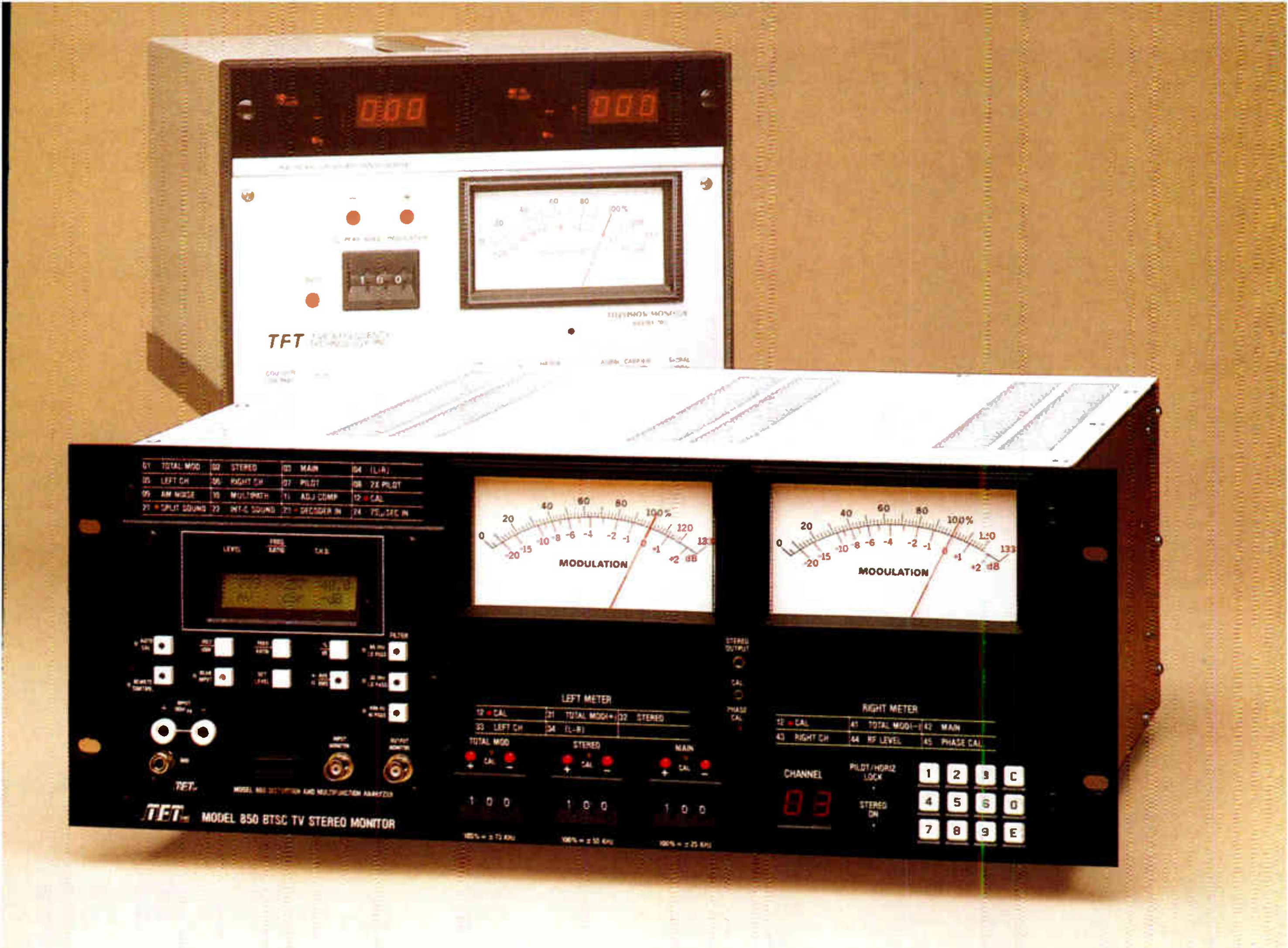
Courtesy of Corning Glass Works

The wide-bandwidth characteristics of optical fiber make it the ideal medium for transmission of high-definition television.

many as 90% of the amplifiers in today's system can be eliminated. In the process, system noise will be diminished, and channel separation can be reduced, freeing up more room for greater channel capacity. In the short run, fiber will give current subscribers clearer pictures and potentially more channels. In the future, fiber will allow head-end operators to pass HDTV signals and allow for 2-way communication between the subscriber and the head-end.

The cable industry is taking a long, hard look at a conversion to fiber-optic cable. A National Cable Television Association (NCTA) technical paper delivered last year estimates that it will cost the industry between $1.3 billion and $2.7 billion to switch out coax with fiber, depending upon how much of the system is replaced.

Many see conversion as a multistep process in which the coax cable trunk



Behind our new TV Stereo Modulation Monitor is the Industry Standard.

18 PLUS YEARS OF EXPERIENCE

TFT knows your needs in aural modulation monitoring. Our 850 Modulation Monitor was designed with all the experience we gained from the 701, the industry's standard for monaural broadcasting the last 18 years. Thousands are in use today.

MONAURAL COMPATIBILITY

Not only does the 850 meet BTSC Recommend Practices, it also ensures monaural compatibility for the majority of viewers who own monaural TV sets. Not all TV Stereo Modulation Monitors can do that!

BUILT-IN DEMOD AND AUDIO ANALYZER

The 850 is the only precision BTSC Modulation Monitor that permits comprehensive BTSC performance testing from RF, IF and composite baseband signal inputs without the need of an external demodulator. With the optional 860 Audio Analyzer plug-in, the 850 can easily make separation, distortion, noise and frequency response measurements.

THE NUMBER ONE CHOICE

Of 400 TV stations who broadcast stereo, 300 of these chose the 850 series.

Circle (46) on Reply Card

TFT INC

3090 Oakmead Village Drive, P.O. Box 58088 Santa Clara, CA 95052-8088
Tel: (408) 727-7272 FAX: (408) 727-5942 TLX: (910) 338-0584

from the head-end through the neighborhoods is first replaced, and cable drops to subscribers are changed over to fiber later on a gradual basis.

As a result, if regulatory barriers currently preventing the telcos from entering the video entertainment delivery business are removed, many future video consumers are likely to have not one, but two, sources of HDTV entertainment delivered to them over fiber.

In fact, an FCC Office of Plans and Policy report concludes that more than half the nation's homes will be served by wideband fiber, either from the telephone industry or the cable industry, within the next 20 years. And many of those households will be served by two fiber-optic cables — one each for the cable and telephone company.

Public policy and regulation

Before local exchange carriers are allowed into the video delivery business, they must overcome a number of legislative and judicial hurdles. Ironically, those hurdles were established, in many cases, to promote competition. Now, however, some argue they hinder a vigorous, competitive marketplace.

According to the 1988 FCC paper on IBN systems, three roadblocks will hamper the entry of telcos into video delivery. First, the Cable Communications Act of 1984 prohibits telephone companies from providing video programming to the public in its telephone service area. This prohibition on so-called cross-ownership in the cable and telephone arena is a codification of an FCC rule issued in 1970 that was designed to prevent telephone companies from "pre-empting the development of the cable television market."

Second, if the telcos are to enter the video delivery business in their telephone service area, they must seek a change of the Modified Final Judgment in the breakup of the Bell system. Currently, the court prohibits the seven regional Bell Operating Companies (BOCs) from providing "information services," and video entertainment can be argued to be an information service. Furthermore, the court ruling prohibits the operating companies from providing interexchange services. The Department of Justice has interpreted this to mean that the BOCs cannot be involved in the distribution of signals received via satellite over a cable television leasing channel service.

The third hurdle will be the requirement by the Cable Communications Act requiring franchises to be awarded by a local authority to anyone engaged in "cable service." Accordingly, use of broadband telco service to the home by a potential competitor of an existing cable system must first be granted a franchise — a serious impediment to any company seek-

Rack up twice the performance in the same amount of space.

The Problem

How to upgrade and increase your microphone mixing capability without sacrificing your valuable rack space or your budget.

The Solution

The new ELX-1R.

Here's Why

The ELX-1R is a portable, four-channel mic/line mixer.

It's half the size of our nearest competitor, the Shure M267, and fits into a single rack-mount space. Think of it. By utilizing two ELX-1R's, you can double your mixing capabilities in the same amount of space it takes to mount one M267.

Also, it's less expensive than the M267 because our rack mount is standard—you have to pay for theirs.

And it offers you the kinds of features that theirs doesn't . . .

Like half the distortion. Or individual input LED clip indicators. Or a 10-segment, three-color LED PPM bargraph display. Or ¼″ auxiliary phone connections, as well as professional XLR input-output. Or positive action push-button switching.

And last but not least—better specs across the board and a two-year warranty opposed to one.

You Decide

Naturally, we don't expect you to take our word on this . . . you have to see for yourself. Contact your local EV dealer today. Ask for our comparison chart and an engineering data sheet. Better yet, ask for a no-pressure demonstration.

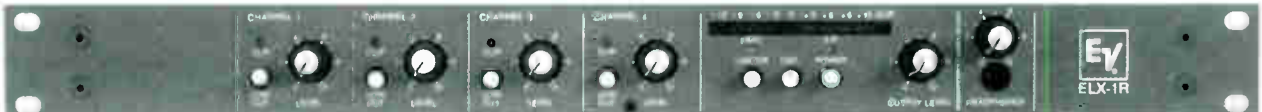
We think you'll be pleasantly surprised.

Electro-Voice®
a MARK IV company

600 Cecil Street
Buchanan, Michigan 49107
Phone: 616/695-6831

In Canada: P.O. Box 520
Gananoque, Ontario K7G2V1
Phone: 613/382-2141

Circle (48) on Reply Card



ing to put together a new national cable network delivered by telcos on a common carrier basis.

> ***...it is clear that the (telephone companies) will step up efforts to convince Congress to open up the video delivery marketplace.***

Despite the hurdles, the United States Telephone Association (USTA) is beginning to mount a campaign to change the existing laws. USTA representatives approached legislators on Capitol Hill in March to voice their desire to enter the video delivery arena. Reaction from members of Congress reportedly was mixed. However, it is clear that the association will step up efforts to convince Congress to open up the video delivery marketplace.

The prospects for any modification to the Cable Act in this session aren't good, according to a number of congressional aides. And although fiber optics is seen as a strong contender for the delivery of HDTV signals in the future, the House Telecommunications Subcommittee's work on setting policy for U.S. participation in the development of HDTV seems to be sidestepping the issue at this point.

Aides of Representatives Don Ritter (R-PA) and Mel Levine (D-MA) say discussion of the role of telcos and fiber-optic cable in HDTV delivery is being avoided to prevent the miring of crucial decisions about HDTV in the "firestorm" of debate surrounding the telco issue.

Meanwhile, the NCTA is mounting its own public relations campaign to attack the business practices of local exchange carriers. At a March meeting of the Consumer Federation of America and at a

Courtesy of Corning Glass Works

An integrated broadband network based on optical fiber could allow local telephone companies to deliver a wide range of broadband services, including NTSC video and HDTV, to the home.

separate meeting of the National Association of Regulatory Utility Commissioners, the NCTA attempted to brand the BOCs as anticompetitive and anticonsumer in their business practices. This battle between the telephone and cable industries is likely to intensify as the installed base of fiber-optic cable to the home grows, HDTV becomes a reality and telcos seek to use video entertainment as the hook to educate consumers about the broad range of services offered through IBN.

The telco role

There is no consistent vision of what the role of telephone companies should be in the delivery of video programming to customers. One group of operating companies sees its role as providing fiber-optic line service on a common carrier basis to existing cable companies and to new entrants to the market. However, others seek to provide NTSC programming in the short term and HDTV in the long run to customers as part of an IBN network based on the concept of "bit-rate on demand." Under this scenario, consumers would have access to perhaps a 600Mb/s or 1Gb/s fiber pipeline, and they would use what is needed when it's needed.

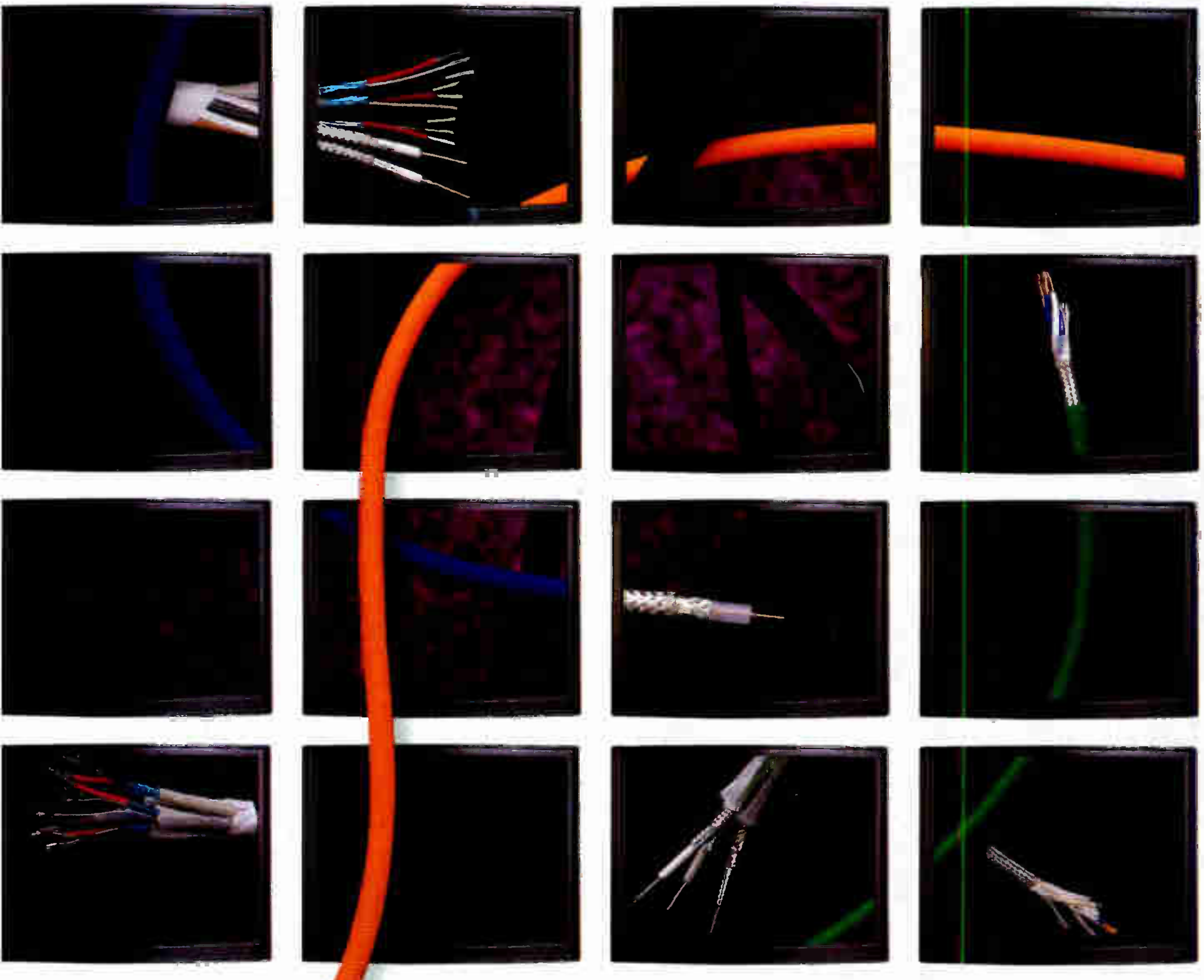
The problem for telephone companies is that the average consumer's eyes glaze over when the subject of integrated broadband network services is brought up. However, the consumer can identify with video entertainment over "wire." Indeed, many within the telephone industry, as well as observers of the industry, argue that the delivery of video entertainment is essential for the timely introduction and acceptance of IBN. Without video, telcos are hard-pressed to explain what services customers need that can't be delivered over the 2- and 4-wire copper system of today.

This, then, is the crux of the issue for broadcasters and the public. For better or worse, the vortex of change in telecommunications appears to be the local exchange carrier. Many different forces, including HDTV, fiber to the home, IBN and national communications policy, seem to be converging at the telco's front door.

This fact raises crucial questions for the local broadcaster. Is the delivery of a local broadcaster's HDTV signal to the home eventually going to become the first among equals in a broadband information network tied together by optical cable? If the future of broadcasting moves in the direction of delivery over fiber, how will local stations respond to photonic switching and other technological developments that will someday usher in the age of "video on demand"?

In an environment where thousands or millions of viewers make program choices from a menu of thousands or millions of

Continued on page 90



BELDEN BRINGS THE LIGHT OF INNOVATION TO BROADCAST CABLE

Just as no performer can stay on top without innovation, no company can retain its reputa-ion for performance without product innovation. The stan-lards we've set with our broadcast cables are a re-lection of our commitment to product innovation – something hat continues today with Brilliance®.

Named for the sound and picture brilliance obtainable hrough product innovation and improved signal integrity, Brilliance products range from exciting audio/video cable assemblies to the four new cable products below:

Soft, flexible Microphone Cables.

The debut of Belden's four-conductor microphone cable sets an industry standard. Fea-turing matte finish jackets in a wide range of colors, these new cables are designed to increase cable flexibility while enhancing performance.

High-Flex and CL 2 Rated Precision Video Cables.

To solve the problems of rack installations and CCTV sys-tems, Belden has developed a new 75 ohm precision video cable. High-Flex combines Belden® 8281 electrical per-formance with improved flexibility and longer flex life.

Audio Snake Cables.

Belden now offers a line of multi-pair snake cables. Featur-ing individually jacketed and shielded pairs, Belden snake cable provides maximum pro-tection against signal loss. Features include loose tube construction and a non-reflecting black matte finish.

Audio and Video Composite Cables.

For systems combining audio and video, Belden has specifi-cally designed cables for ENG and camera applications. They combine off-the-shelf availabil-ity with specialty design center technology and fiber/copper composition.

Call your local Belden distrib-utor for our Broadcast Catalog, or contact us directly:

BELDEN Wire and Cable
P.O. Box 1980
Richmond, IN 47375

1-800-BELDEN-4
(in Indiana, call 317-983-5200)

here is no equal.™

COOPER INDUSTRIES BELDEN

Circle (50) on Reply Card

WHEN YOUR STANDARDS ARE HIGHER THAN YOUR BUDGET.

If you refuse to sacrifice quality, you need Type IX.

That's Sony's expanded line of U-Matic SP™ equipment, and it now includes two new editing recorders, a new portable, a recorder/player, and a player-only deck.

The new editing decks make Sony's SP (Superior Performance) technology affordable to more production suites than ever before. SP means extended resolution, and a third-generation picture equiv alent to a first-generation picture from a conventional U-Matic™ system.

You can install optional time-code generator/readers t record and read SMPTE time-

code on the address track.

Superimposed dial menus give you on-screen display of time-code or CTL count. And you have RS-422 serial interface to provide an intelligent connection to RM-450 Edit Controller. And with Dolby® C noise reduction, tape hiss is dramatically reduced.

So even if you can't raise your budget, you don't have to lower your standards. Call Sony at 1-800-523-SONY.

SONY®

PROFESSIONAL VIDEO

Continued from page 86

program options, how does a local broadcaster piece together an audience that an advertiser would wish to buy?

And, if the pricing of video delivery over fiber optics excludes the poor and lower-middle class, will the audience left watching terrestrial broadcast HDTV be attractive to advertisers at today's commercial rates?

What fiber means for broadcasters

In the short term, the entrance of telcos into the video delivery business may be a welcome sight to many broadcasters.

How much will it cost?

The concept of a digital integrated broadband network (IBN) for the delivery of voice, video and data to the home and office has sparked the imaginations of planners, researchers and engineers alike. But for any technology to be successful with the public, it must offer the consumer some benefit, and it must be affordable. So the natural question linked to any discussion of IBN is: "How much will it cost?"

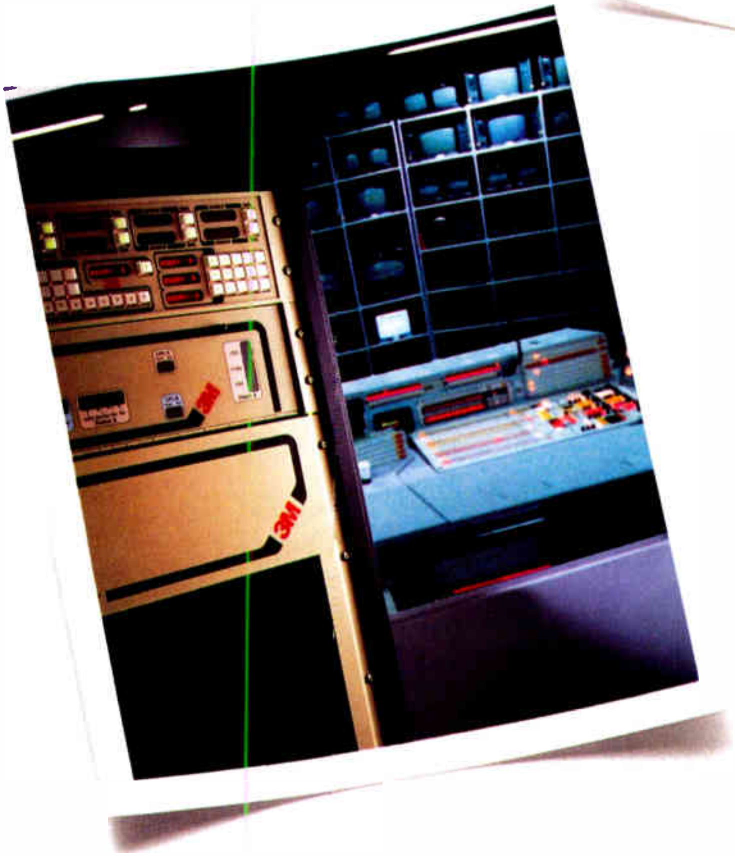
The simple answer is that nobody knows. Not only that, but nobody is even sure how to go about pricing it. Underlying the entire concept of IBN is the notion of "bit rate on demand." In other words, the home consumer who accesses information through the telephone system will buy services requiring various bit rates. A low-grade voice channel of 64kb would require only a fraction of the bit rate that an HDTV signal would require. But the consumer would have access to both simultaneously in an IBN system based on fiber-optic cable.

In its report on IBN, the FCC Office of Plans and Policy looked at the dilemma facing telephone companies, public service commissions and consumers when it comes to setting a price on IBN. The report said that traditional methods of charging for phone use won't work in a broadband world. If local telephone service were priced at a penny per minute for voice (64kb/s), then a 2-hour movie delivered at 45Mb/s over an IBN system would cost the customer $843.75. An HDTV movie delivered over a 140Mb/s channel would cost $2,625.

Conversely, if a fee of $15 per month — a common rate for basic cable TV service — were charged for the broadband video services, then the monthly local phone bills would amount to just two cents.

Clearly, some new method of determining pricing is appropriate for services offered on an IBN. But so far, no great ideas have been advanced.

Directing Traffic In The Heart Of NYC.



Directing Traffic In The Heart Of NBC.

NBC/New York needed a routing switcher for the 1988 Summer Olympics that offered 9 levels of switching and 182,464 crosspoints. They chose 3M. Later, they needed a routing switcher for their Visa Graphics facility in New York. Once again, they chose 3M.

For over 25 years, we've been surpassing the standard in the broadcast equipment business. Before you commit to any routing system, large or small, call us at 1-800-328-1008.

We'll help you get where you're going.

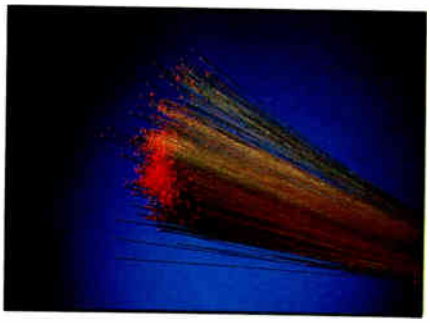
Broadcast and Related Products Division

3M

Circle (54) on Reply Card

Must-carry, channel reassignment and other issues have soured the relationships of many broadcasters with cable companies since the passage of the Cable Communications Act of 1984. A competitive force in the delivery of video over cable has the potential to bring about a more accommodating attitude on the part of the cable industry toward broadcasters.

In the long view, it is evident that if fiber optics becomes the delivery medium of choice for NTSC and HDTV programming to the entire nation, broadcasters will have some tough business decisions to make.



Fiber-optic communications promises to revolutionize the delivery of video information and entertainment to the home. Although this technology is not right around the corner, it is approaching.

Perhaps at some point in the distant future, a local broadcaster may choose to rely solely upon IBN and cable distribution of its programming and relinquish its license and its spectrum in exchange for being

Whatever the future holds, one thing seems to be clear. The technology of transmission is changing, and as an industry we are coming up on a transition from RF to lightwaves.

relieved of the responsibility of serving "the public interest, convenience and necessity." Such a dramatic restructuring of the broadcast business isn't right around the corner, but neither is it inconceivable when the full impact of fiber optics as a delivery medium is considered.

Back to the future

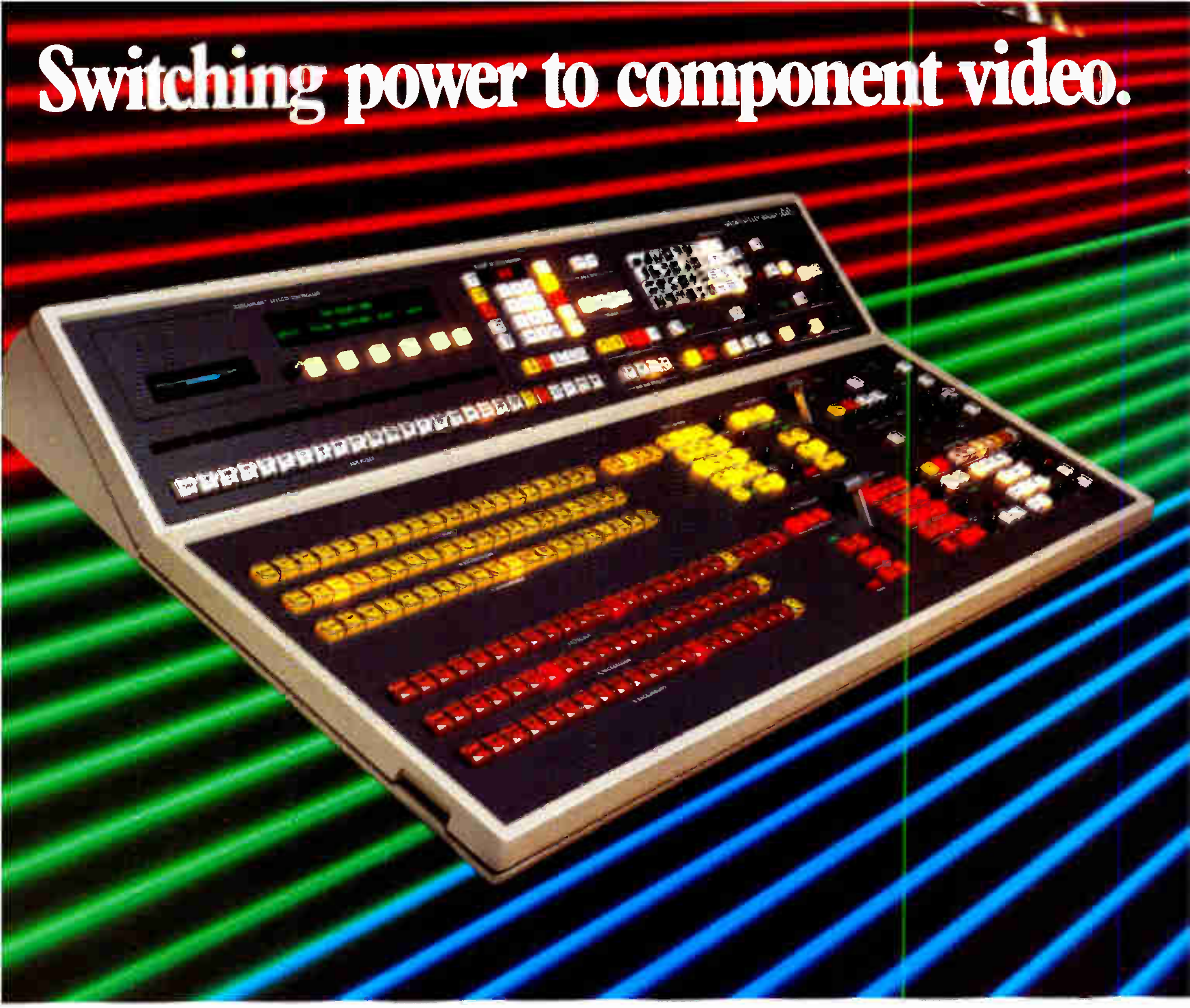
One can only wonder what the author of a piece on the future of fiber will be writing about in the 60th anniversary issue of **Broadcast Engineering** in 2019. By that time, photonic switching will be commonplace. Perhaps the telephone companies will be talking about delivering 1 terabit of data per second to customers as they consider the next generation of fiber installation to the home.

Maybe the consumers of 2019 will be reading press reports about the introduction of a holographic TV system that puts HDTV to shame. And, just maybe, the technical journals of the day will be questioning whether the holographic video signal can be transmitted at 1tb/s, or whether 10tb/s might not be more appropriate.

Whatever the future holds, one thing seems to be clear. The technology of transmission is changing, and as an industry we are coming up on a transition from RF to lightwaves. Perhaps the magic of the cat's whisker and the oatmeal box that attracted two generations of engineers to broadcasting has reached its zenith. A new magic is about to make its presence felt in video.

The author wishes to thank John Coleman and Myron Keller of Southwestern Bell; Robert M. Pepper of the FCC Office of Plans and Policy; and Hugo Gaggioni and Larry Thorpe of Sony for providing information for this article.

Switching power to component video.



Introducing the Model 200-2CV.

What if you could have the component video quality you want, together with the big switcher power you need — and get them both at a reasonable price?

Well now you can. It's called the Model 200-2CV. And with it you get the super picture quality of component video. Plus the powerful features and flawless control of GVG 200 Series switchers — already proven in hundreds of installations worldwide.

The Model 200-2CV sets a new standard for component video performance with two mix effects, five keyers, two background generators, and a wipe system offering a limitless spectrum of innovative options.

If you've been thinking about moving to component video, now you've got an even more powerful reason. For complete details on the Model 200-2CV, contact the Grass Valley Group office nearest you.

Grass Valley Group®

A TEKTRONIX COMPANY

THE GRASS VALLEY GROUP INC.

P.O. Box 1114, Grass Valley, CA 95945 USA
Telephone (916) 478-3000
TRT: 160432

OFFICES: New York (201) 845-7988; District of Columbia (301) 622-6313; Atlanta (404) 493-1255; Chicago (219) 264-0931; Minneapolis (612) 483-2594; Dallas/Fort Worth (817) 483-7447; Los Angeles (818) 999-2303; San Francisco (415) 968-6680; GVG International Ltd. (U.K.) +44-962-843939; Grass Valley Group Asia (HK) +852-3-7396632

Circle (57) on Reply Card

Telcos tiptoe into fiber and video

No one will get trampled in the stampede of telephone companies racing to experiment with video, HDTV and fiber optics. Although there is certainly interest in video over fiber, it is not overwhelming. To date, a number of companies, including Southwestern Bell, GTE, Southern Bell and Bell Atlantic, have participated in experiments and full-fledged installations of fiber to the home to gain experience from an operational standpoint with transmitting both standard video and HDTV over fiber-optic cable.

The most notable examples of HDTV so far over fiber include two experiments by Southern Bell and one by Southwestern Bell. During the Democratic National Convention in Atlanta last summer, Southern Bell transmitted HDTV from Sony cameras mounted in the Omni to selected hotel suites around the downtown Atlanta area. The transmission was done in analog RGB with no multiplexing. A separate fiber cable carried each of the color signals. Optical transmission and reception equipment were supplied by the Grass Valley Group (GVG).


Courtesy of Southwestern Bell

Perched high above the playing field at Busch Memorial Stadium, a dual-camera system provided both analog HDTV and NTSC video of a baseball game between the St. Louis Cardinals and the Philadelphia Phillies for a closed-circuit HDTV test.

In a second experiment, Southern Bell transmitted HDTV video coverage of the launch of the space shuttle Discovery in March of this year to receive sites at Cape Canaveral and Orlando, FL. The fiber-optic cable between the Cape and Orlando ran 110 miles. Again, Sony cameras and GVG transmitting and receiving gear were used.


Courtesy of A. F. Associates

Southern Bell and Bellcore joined forces in March to transmit the launch of the space shuttle Discovery live via fiber-optic cable. The switching and monitoring equipment was housed in this trailer near the launch site. The video signal was shipped via fiber-optic cables to monitoring points at the Kennedy Space Center and in Orlando, FL, 110 miles away.

NASA has considerable interest in HDTV for delivery of pictures from space and as a means of monitoring launches. Southern Bell asked Bell Communications Research (Bellcore) to get the project up and running, which it did with the assistance of A.F. Associates. The Bellcore facility included three HDTV cameras, video recording and editing equipment, monitors, a routing switcher and transmission gear.

In the summer of 1988, Southwestern Bell conducted its own display of HDTV video over fiber. A baseball game between the St. Louis Cardinals and the Philadelphia Phillies at Busch Memorial Stadium in St. Louis was transmitted via fiber to a downtown theater, where the press and Southwestern Bell business customers had gathered to see a side-by-side comparison of NTSC and HDTV video of the game.

This demonstration used separate fiber cables to carry analog RGB HDTV signals to the Fox Theatre, where it was projected for viewing. A standard field-production camera was mounted next to the HDTV camera at the stadium so that identical content of NTSC and HDTV video could be compared. Again, Sony and GVG equipment was used.

Beyond the HDTV trials, video cur-


Courtesy of A.F. Associates

Jim McGrath, technical director for A. F. Associates, checks out final details of the Southern Bell/Bellcore fiber-optic project. His company built the technical center for the project under contract to Bellcore.

rently is being delivered to the home over fiber-optic cable in Hunter's Creek and Heathrow, FL, by Southern Bell. Southwestern Bell has applied to the FCC for permission to work with a local cable head-end operator in Fort Worth, TX, to deliver video via fiber. Along the same lines, GTE has requested permission to work with a local cable operation in Cerritos, CA. Bell Atlantic also has sought FCC permission to work with a local cable franchise holder in Perryopolis, PA, to deliver two channels of video over optical fiber.

PEAK PERFORMANCE

Deliver the transparent audio you require with a MOSELEY PCL 6000 Series STL.

From high above the city lights, your transmitter is broadcasting the quality audio your listening audience demands.

Trust the delivery of the sound you've worked so hard to generate at the studio up to your transmitter with the virtual transparent audio characteristics of a Moseley 6000 Series STL. You can significantly increase your signal to noise ratio and stereo separation by replacing your Moseley 505 or other older STL with either a Moseley 6020 or a Moseley 6030. If you are one of the remaining telco customers, you get the additional benefits of a short payback time and continued relief from the monthly bills.

Choose between the Moseley 6020 and Moseley 6030 based on the 950 MHz congestion in your area. The Moseley 6030 is designed for excellent performance in extreme environments found in antenna farms on broadcast peaks around the country. Both systems feature full frequency synthesis and capability of handling either mono or stereo program material.

Best of all, these two STLs are Moseley STLs — price competitive and backed by both our two year parts and labor warranty and our knowledgeable service staff.

Moseley
111 Castilian Drive
Santa Barbara, CA 93117
805 968 9621
FAX: 805 685 9638

- FCC inquiry into Fairness Doctrine concludes the policy no longer serves the public interest.
- SMPTE working group on digital TV tape recording votes approval of the D-1 component digital format.
- The National Radio Systems Committee (NRSC) begins to study proposals for a standardized AM transmission pre-emphasis curve.
- Data transmission on vertical blanking interval authorized by FCC.
- Harris signs licensing agreement with rival Motorola on AM stereo transmission standard.
- CCIR approves D-1 digital component recording format for worldwide program exchange.

1986
- Sony introduces DVR-1000 digital videotape recorder based on CCIR 601 (D-1) standard.
- Ampex shows ACR-225 prototype composite digital cartridge VTR.
- Ampex, Thomson and Bosch sign manufacturing and marketing agreements with Sony to produce Betacam products.
- NBC announces purchase of M-II products from Panasonic.

AM radio: Regrouping for the 21st century

By K. Dean Stephens

The AM radio industry is in a world of hurt.

Of all the innovations of the present century, few have left a mark on civilization greater than that of AM radio. It is a rare place on the planet where this medium has had no influence. During the course of this day, some 15,000 medium-wave AM stations will broadcast to the residents of virtually every country, territory and island, radiating a combined power of 45 million watts. The United States alone hosts nearly 5,000 AM stations, about one-third of the world's total. And yet, in the United States and elsewhere, there are predictions that AM radio may not survive to see the year 2000.

What has brought "standard broadcast" to this point? Is this proud communications medium soon to become a museum curiosity, displayed alongside exhibits of the gramophone, town crier and ear trumpet? Can AM radio survive? Is it worth saving? Stay tuned.

Boiled frogs, stewed broadcasters

To boil a frog, place him in a large pot of cool water. Then warm the water ever so slowly, making him bloated and lazy. He won't even notice when the water becomes hot, slowly succumbing in his complacency....

Stephens is professor of development communication at the Amoz Gibson Centre, Arecibo, Puerto Rico.

For decades, AM radio was king. Everybody was listening to its dramas, comedies and variety shows. And the money rolled in. When television arrived on the scene, it gave visual action to such programming, so radio stations shifted away from their former fare into music, news and information. Although television took its toll during prime evening hours, AM kept daytime listeners and found new audiences with portable and mobile receivers. The money kept rolling in.

Like the frog, AM broadcasters grew fat and complacent. Programming stagnated, and equipment deteriorated. The water was getting warmer.

FM radio, so long in AM's shadow, began to come into its own in the 1960s. Long at a disadvantage, FM broadcasters put their best foot forward, placing great emphasis on equipment quality and audio fidelity. Fortuitously, home high fidelity was becoming something of a rage at this time, and hi-fi enthusiasts quickly added FM tuners to their systems. The advent of FM stereo added fuel to the fire, and the water got hotter.

Soon, AM/FM receivers proliferated. More sophisticated circuitry begat high-quality FM car radios, table radios with no outside antenna and portable sets. On a roll, FM broadcasters offered specialized musical fare to capture target audiences: pop, concert, jazz, easy listening and country.

The strategy worked. In 1975, FM listenership in the United States was 36%, compared with AM's 64%. Four years later, AM and FM had equal audience shares. By 1986, FM shares had increased to 72%, with AM dropping to 28%.

Can AM radio survive? It can. But broadcasters will have to make a number of dramatic adjustments, and quickly. Is the medium worth saving? Absolutely. With the proper equipment and programming in place, medium-wave AM can compete, listener for listener, with FM and sound nearly as good in the process, using about one-tenth the spectrum space required by FM. AM radio is too efficient to cast aside, but it does need some overhauling.

Harris Solid-state VHF TV Transmitters

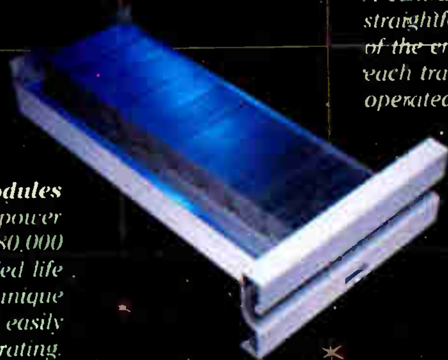
Setting new standards for VHF technology and reliability

Harris' revolutionary 1 kW through 60 kW ***Platinum Series***™ VHF solid-state transmitters look different because they *are* different. Quite simply, these rugged, modular transmitters provide unequalled system redundancy to keep your station on the air.

Parallel operation of conservatively-rated, solid-state PA modules, multiple power supplies and an exclusive distributed cooling system ensure a level of reliability that questions the need for a standby transmitter.

What's more, these transmitters are the most user-friendly you'll find. Easy-to-use controls and status displays, front access to components, and high stability to minimize adjustment requirements mean that virtually *any* person can operate the transmitter with very little training.

Control Panel/User Display
A central control panel provides straightforward pushbutton control of the entire transmitter. In addition, each transmitter cabinet can be operated independently. The user display offers immediate and comprehensive system status — digitally and with bar graphs.



Solid-state PA Modules
Conservatively-rated 1 kW visual and aural power amplifier modules with individual MTBFs of 280,000 hours are identical and interchangeable. For extended life and reliability, each high-silicon module features a unique heat sink. "Hot-pluggable" modules can be changed easily and safely while the transmitter is operating.

The transmitter shown is Harris' HT 30LS 30 kW low band solid-state model, configured with the optional spare exciter and 20% aural option.

To learn more about Harris solid-state VHF TV transmitters, phone TOLL FREE:

1-800-4-HARRIS
Extension 3017

HARRIS

Circle (98) on Reply Card

The first item on any broadcaster's check list is a thorough cleanup of the station. Begin at the microphone, and don't stop until you've reached the antenna. Radio's stock in trade is its sound on the air. Broadcasters must attack technical faults as though the survival of their stations is at stake, a concept not far from the truth.

Replace equipment that:

• cannot be repaired or adjusted to perform satisfactorily.

• would be more costly to repair than replace.

• will not meet modern broadcast requirements or specifications.

Within the last category comes ease of operation, noise immunity, frequency response and such options as stereo and pre-emphasis. AM owners must not compromise here: Take out a loan if money is tight. It is far better to invest an additional 10% in the station than to lose it entirely.

Poor fidelity is the biggest complaint of would-be AM listeners. Contrary to what a lot of people think, low fidelity is not built into AM's 10kHz channel limitation. If the entire system can pass frequencies up to the limit, there are few listeners who can tell AM from FM fidelity on a good receiver. And "good receivers" will appear as if by magic after AM broadcasters clean up their act.

AM fidelity problems typically stem from equipment passing neither sufficient lows nor highs, resulting in the telephone-like quality so annoying to listeners. Often, the radiating system is at fault. Check all antenna connections, ground radials, antenna tuner and transmission line; then adjust for ±10kHz bandpass.

Contrary to what a lot of people think, low fidelity is not built into AM's 10kHz channel limitation.

The AM transmitter also can rob fidelity. Adjust the transmitter for maximum fidelity with minimum harmonics and other distortion, rather than maximum power or efficiency. The modulation monitor must be accurate and reliable. The station's processing equipment can significantly affect the overall fidelity of the station. Problems such as poor frequency response in studio equipment should be corrected, not hidden by the processor.

The landline or microwave link between the studio and the transmitter is a common source of low fidelity. The link must be transparent, exactly passing the signal entering from the studio without rolloff, noise or other degradation. Often, a processor or line driver is placed at the input of the link; check it for transparency as well. One or more mixers will feed programs to the transmitter. Each should pass a clean, high-fidelity signal from every input to every output, including record and monitor buses.

Next check studio sources: turntables, carts, tape decks and microphones. Are mic cables frayed? Connectors loose? Tape heads dirty, worn or misaligned? Turntable styli worn or broken?

Signal quality does not end here. Screen all program material for quality, and discard or replace it if it's worn, poorly recorded or scratchy. Quality microphones must be selected for studio and control-room use, sometimes even matched to individual announcers. Listeners don't care whether it is the transmitter, mixer or microphone that makes the station sound so fuzzy; they just stop listening.

Hum and noise are nearly as ag-

Continued on page 101

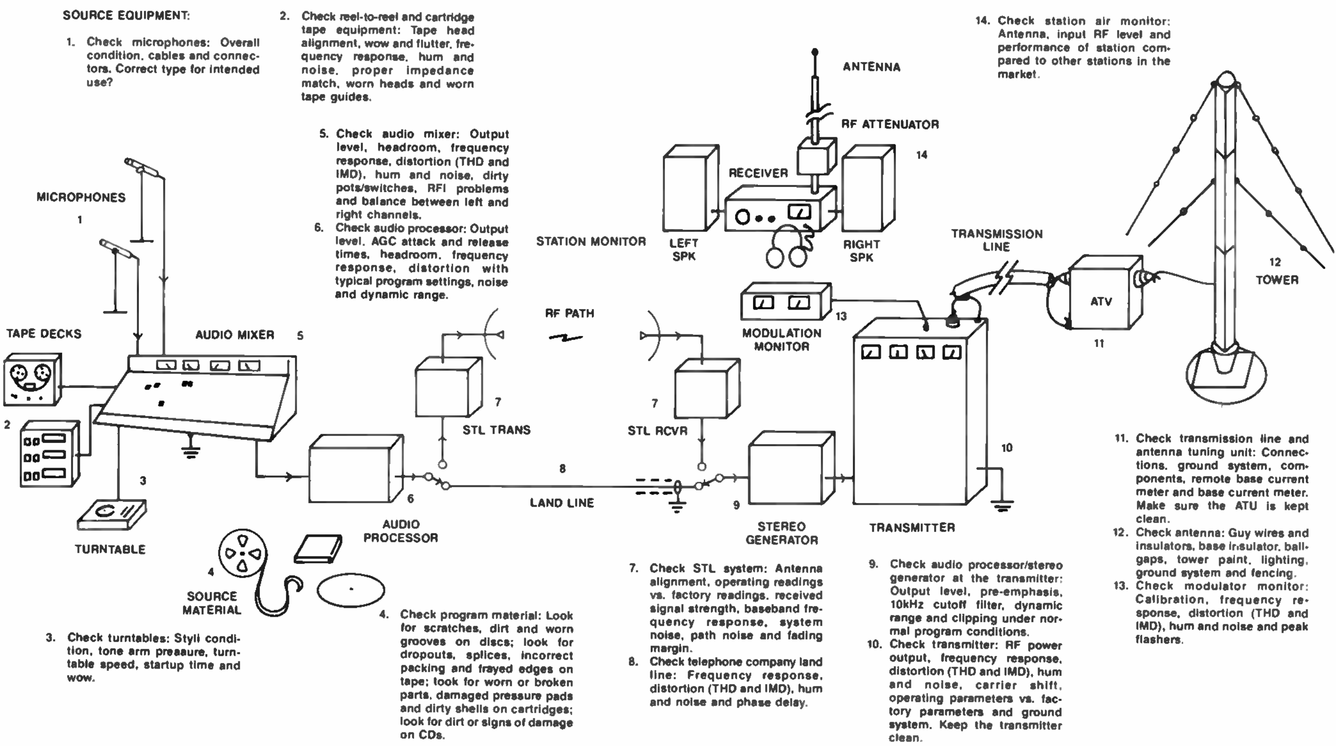


Figure 1. *Preparing an AM station for the challenges of the 1990s requires attention to every detail of the physical plant. This diagram provides a starting point for checking the equipment at your station.*

Continued from page 98

gravating as poor fidelity. Look for these problems as well in your studio-to-antenna check. Hum often is caused by poor shielding or improper grounding, but it also may be traced to one or more components. Noise pickup can be reduced through good shielding and grounding practices. Equipment made a generation ago may not be adequate for today's high-quality broadcast requirements. Replace marginal items with up-to-date gear.

Check for distortion at every point in the studio and transmission chain. Distortion may be introduced in the radiating system, transmitter, processor, STL link, mixer or program sources. Some distortion, such as the fuzz and other effects on certain recordings, is built in. A special case of distortion comes in the form of processing, a necessary evil to maintain average program modulation in the 70%-100% range. Too much compression of dynamic range to achieve a "louder, more competitive" sound, however, is counterproductive and a turnoff to listeners. Here are three remedies to processor-induced headaches:

1. Install state-of-the-art processing equipment for maximum input-output transparency.

2. Referring to the equipment manual, carefully adjust the processor for the best compromise between high average modulation and dynamic purity and range. Listen for processing artifacts — "swishing," "pumping," "phasing" and "breathing" sounds — as well as equalization problems.

3. Determine the amount and type of processing to be used through agreement with key station personnel, including the general manager, program director and chief engineer. Together, listen to the station and competing stations on a good receiver. Agree on a processor setting, and lock it in. No further adjustments allowed. Period.

The last point implies the existence of a quality off-air monitor capable of accurately reproducing the station's signal, an acquisition deserving top priority in the battle to make AM competitive. A typical monitor includes a small outside antenna and RF pad to prevent overdriving, a high-fidelity (preferably stereo-capable) receiver with good selectivity and adequate shielding to reject signals not entering through the antenna (disconnect any internal antenna), and high-quality speakers and headphones. The station monitor allows program, production and engineering personnel to hear their station on the air, noting not only standing defects and poor operator practices, but also deviations in quality.

Next on the technical checklist comes pre-emphasis. The National Radio Standards Committee (NRSC), made up of broadcast groups and receiver manufacturers, has recommended a 75μs pre-emphasis curve for AM transmission much like that in use by FM, but including a bandstop filter at 10kHz to eliminate interference to stations two channels removed. As broadcasters adopt the NRSC curve, receivers will incorporate a complementary 75μs de-emphasis network. For the listener, the result will be a higher-quality signal with less noise. Listeners may just give AM another go!

Medium-wave AM broadcasters also have propagation problems to contend with. Interference, particularly at night, causes havoc on the standard broadcast band. One solution already mentioned comes from the bandstop filter at 10kHz (9kHz in the Eastern Hemisphere) to eliminate modulation *chatter* from stations two channels removed.

Another solution is to use antennas that emphasize low-angle ground- and surface-

← Circle (62) on Reply Card

Circle (63) on Reply Card

- SMPTE forms ad hoc group on high-definition studio systems to document specifications for 1125/60 HDTV.
- Ampex submits its composite digital format (D-2) to SMPTE for standardization.

1987
- Superchannel DBS service begins in the U.K.
- Abekas introduces the A-64 digital disk CCIR 601 recorder.
- NEC introduces SR-10 solid-state video recorder.
- Dolby introduces SR noise-reduction system.
- Advanced Television Systems Committee announces plans to conduct over-the-air tests of HDTV transmission formats.
- FCC issues a Notice of Inquiry to determine the status of advanced TV systems.
- Enforcement of the Fairness Doctrine ends.
- SMPTE working group on HDTV approves 1125/60 standards document.
- NRSC announces voluntary standards to reduce AM band interference.
- NAB forms HDTV technology center to study future of television.
- Super VHS (S-VHS) introduced.

1988
- FCC refuses to reconsider marketplace decision on AM stereo.

UHF-TV: Breaking new efficiency records

By Jerry Whitaker, editorial director

High efficiency is the name of the game.

Improvements in power-device technology have made it possible to dramatically reduce the cost of operating a UHF-TV transmitter. Improvements in ac-to-RF efficiency continue to be made as new devices come into production, and as new tuning and pulsing techniques are perfected. The driving force behind this work has been economics. UHF broadcasters use high transmitting power to provide adequate coverage to their service areas, and that high power costs money.

The workhorse of UHF broadcasting today is the klystron. Much effort has been directed toward making the klystron a more efficient device. Parallel development has occurred for tetrode-based systems, which offer good efficiency and straightforward design. Power levels of 25kW and more are now practical with tetrodes. For higher powers, the Klystrode tube and the *multistage depressed collector* (MSDC) klystron show great promise. Although totally different designs, the two devices provide essentially the same result: a 2-to-1 efficiency improvement over conventional klystrons.

Editor's note: The Klystrode tube is a registered trademark of Varian/EIMAC.

Comparing efficiency

Comparing the efficiency figures of TV transmitters is complicated by the variables involved. Any examination of efficiency must be tempered with an understanding of the measurement parameters. Some manufacturers specify overall transmitter ac-to-RF efficiency, including the cooling system. This number is really what the end-user needs to know. With klystron-based transmitters, the efficiency of the final amplifying stage is also important because that is where most of the energy is expended. When evaluating different device technologies and transmitter designs, be sure you are comparing apples and apples.

Because the klystron is a class A device, the average dc input power does not vary significantly with picture content. The FOM is defined as:

$$\text{Figure of merit} = \frac{\text{RF peak power output}}{\text{average dc input at 50\% APL}}$$

$$\text{Peak-of-sync efficiency} = \text{FOM} \times 100\%$$

The work accomplished in the past two decades to ease the burden faced by UHF stations has been evolutionary. Early klystrons for TV service had a FOM of between 0.30 and 0.40. The introduction of mod anode pulsing enabled FOM performance of greater than 0.40 to be achieved using these tubes. Improved designs and new methods of tuning, which traded gain for efficiency, brought the basic tube FOM to more than 0.40. External cavity klystrons of this efficiency that were fitted with a pulsed *annular control electrode* (ACE) further improved the FOM to between 0.50 and 0.60. The latest generation of external cavity klystrons has achieved a basic FOM of 0.50. When they are pulsed, the FOM may be raised to between 0.60 and 0.75, and integral cavity ACE tubes are now in service with a potential FOM in excess of 0.80.

A high-efficiency klystron, fully pulsed and tuned with full linearity compensation, may be expected (under ideal conditions) to achieve a FOM 1.69 times its out-of-the-box performance.[1] For a tube that has a basic efficiency of 50%, a pulsed peak-of-sync efficiency of 84.5% is the best that can be achieved. These levels are not, however, seen in actual broadcast

- NRSC issues second voluntary national standard (NRSC-2) for AM radio.
- Ampex and Sony introduce D-2 digital composite tape machines.
- Harris introduces DX-25 digital solid-state AM transmitter.
- First Klystrode-equipped 60kW UHF transmitter goes on the air in Wrens, GA.
- FCC rules that advanced television systems designed to deliver improved pictures to consumers must be compatible with existing NTSC receivers.
- Europe's Eureka 95 HDTV system demonstrated at IBC in Brighton, England.
- NBC proposes a 1050/59.94 HDTV system with the backing of ABC, Zenith, Thomson Consumer Electronics, North American Philips and others.
- Philips laboratories demonstrates HDTV system designed for satellite transmission (HDS-NA).
- Advanced Television Test Center announces plans to begin over-the-air tests of proposed advanced- and high-definition TV systems.

1989
- American National Standards Institute (ANSI) gives final approval to 1125/60 HDTV production standard.
- Varian/TVT announces plans to install multistage depressed collector (MSDC) klystron transmitter.

operation because fully pulsed linearity correction is difficult to achieve on a stable basis. Practical values of 60% to 70% are common.

The next step up the efficiency ladder is revolutionary, not evolutionary. The Klystrode tube — the first true high-efficiency, high-power UHF transmitting device to go into regular broadcast service — and the MSDC klystron, which is set to go into service late this summer, achieve a dramatic leap in FOM.

The Klystrode tube

The Klystrode tube made its on-air debut on June 5, 1988, at WCES-TV, channel 20, in Wrens, GA. This 120kW installation was followed in October by a second 120kW transmitter at WABW-TV, channel 14, in Pelham, GA. WCES and WABW are operated by the Georgia Public Telecommunications Commission. Additional installations include a 10kW common amplification air-cooled system at WHTJ, channel 41, operated by the Central Virginia Television Network, and an 80kW common amplification parallel system at WIIB-TV, channel 63, Bloomington, IN. (These four transmitters were designed and installed by Comark.)

The next step up the efficiency ladder is revolutionary, not evolutionary.

The increased efficiency provided by the Klystrode tube makes high-power air-cooled transmitters practical. This year's NAB convention saw the introduction of an air-cooled device (by Varian/EIMAC) that will deliver 40kW in visual service or 30kW in common amplification service. A companion line of transmitters using air cooling also was introduced (by Comark and TTC). This development permits the installation of air-cooled UHF transmitters up to 90kW in common amplification service (using three tubes). Full-diplexed configurations using air cooling are practical for power ratings up to 80kW in both passive and active reserve. Air cooling eliminates the cost and complexity associated with heat exchangers, plumbing and pumps.

Inside the tube

As its name implies, the Klystrode tube is a hybrid between a klystron and a tetrode. The high reliability and power-handling capability of the klystron are due, in part, to the fact that the electron beam dissipation takes place in the collector electrode, quite separate from the RF circuitry. The electron dissipation in a tetrode is at the anode and the screen grid, both of which are an inherent part of the RF circuit and must, therefore, be physically small at UHF frequencies. The tetrode, on the other hand, has the advantage that modulation is produced directly at the cathode by a grid so that a long drift space is not required to produce density modulation. The Klystrode tube offers a similar advantage, namely high efficiency in a relatively small package.

The Klystrode tube is shown schematically in Figure 1. The electron beam is formed at the cathode, density-modulated with the input RF signals by a grid, then accelerated through the anode aperture. In its bunched form, the beam drifts through a field-free region and interacts with the RF field in the output cavity. Power is extracted from the beam in the same way as in a klystron. The input circuit resembles a typical UHF power grid tube. The output circuit and collector resemble a klystron.

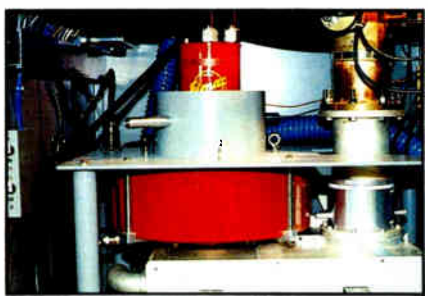
One of the Klystrode tube visual amplifiers in operation at WCES-TV, channel 20 in Wrens, GA. The double-tuned output cavity can be seen in the center of the photo.

The fundamental advantage of the Klystrode tube is its ability to operate class B. The result is significantly higher efficiency when compared with a conventional klystron. The production version of

The fundamental advantage of the Klystrode tube is its ability to operate class B.

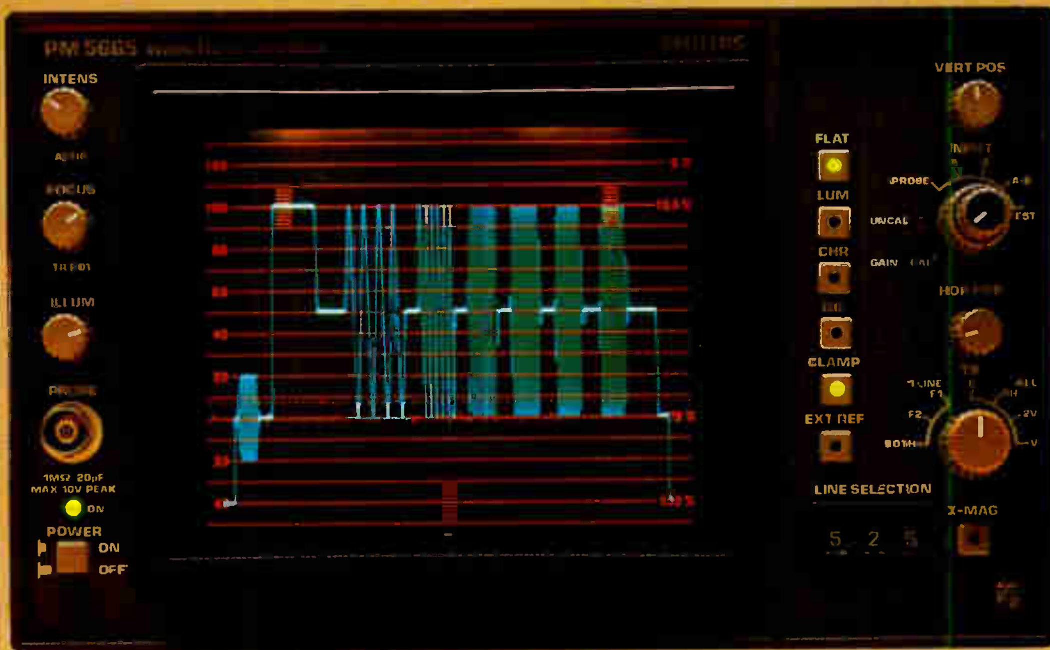
the 60kW device is shown in Figure 2. Double-tuned cavities are used to obtain the required bandwidth. The load is coupled at the second cavity (see Figure 3). This arrangement has proved to be an attractive way to couple power out of the device because no coupling loop or probe is required in the primary cavity, which can be a problem at the high end of the UHF band.

The potential for failure of the Klystrode tube's pyrolytic graphite grid has received a good deal of attention from designers. Protection of the grid begins with the basic tube geometry. The grid is placed in a location away from potential arc paths. Protection external to the tube is centered around a fast, high-current crowbar system that limits the energy that can be delivered to transmitter components during an arc or other fault.



A Klystrode tube installed in one of the visual sockets of the WCES transmitter. The red focusing magnet and RF output connector can be seen above the output cavity.

If our 14-day free trial



doesn't convince you...

...our special introductory price will!

For a limited time only, you can evaluate your choice of Philips waveform monitors and vectorscopes in your facility for two full weeks at no cost or obligation. Compare the accuracy, versatility and ease-of-use of our instruments against the established brand, or whatever you've been using.

Then, check the price of ours against what you'd pay for theirs. We think you'll find ours the justifiable choice on both price and performance. To find out whether we're as good as we say, call Townsend now at 704-547-TEST to arrange for your free evaluation.

TOWNSEND
TEST & MEASUREMENT, INC.

PHILIPS

Townsend Test & Measurement, Inc., 8927 J. M. Keynes Drive, Charlotte, North Carolina 28213

Circle (122) on Reply Card

Two tubes cover the UHF-TV band, with the dividing point at channel 35. The low-band version of the tube differs only in the height of the output cavities and the length of the input circuit. Measurements on the low-band tube are similar to the high-band version and indicate good bandwidth, efficiency and power gain.

Because the Klystrode tube provides both beam power variation during sync pulses (as in a pulsed klystron) and variation of beam power over the active video waveform, it is capable of high efficiency. The device provides full-time beam modulation as a result of its inherent structure and class B operation. The FOM has been consistently measured at 1.20 or higher.

Field experience

As of this writing, four Klystrode tube-equipped transmitters are on the air. The pioneer was WCES in Wrens, GA. Redundancy was a key element in the WCES installation. A block diagram of the 120kW system is shown in Figure 4. The transmitter uses three 2KDW60LA (EIMAC) water-cooled tubes (two visual and one aural), two independent high-voltage power supplies and two separate heat exchangers with backup pumps and manual switchover. A *magic Tee* RF system permits operation of the 60kW visual tubes in parallel or separately. It also permits operation of the visual-2 tube as an aural amplifier, and multiplexed operation of either visual tube separately or combined.

Linearity correction in the modulator is required to deal with non-linearities at both white and black levels. The system independently corrects:

- Low-frequency linearity.
- Differential gain.
- Differential phase.
- ICPM.
- In-band response flatness.

The modulator includes the capability for sync reinsertion and transmitter output power control. The power AGC system uses a sample of the transmitter output signal for comparison against a preset power reference.

The WCES transmitter and all the other installations that followed it easily met FCC proof-of-performance specifications. (See Table 1.) The most interesting parameter — and the one of most importance

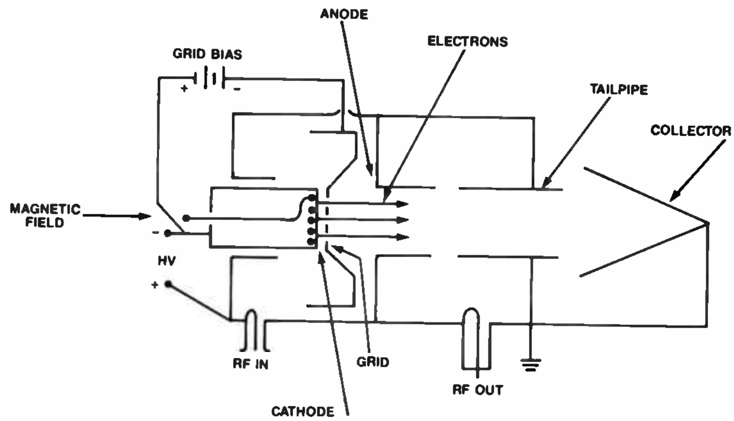
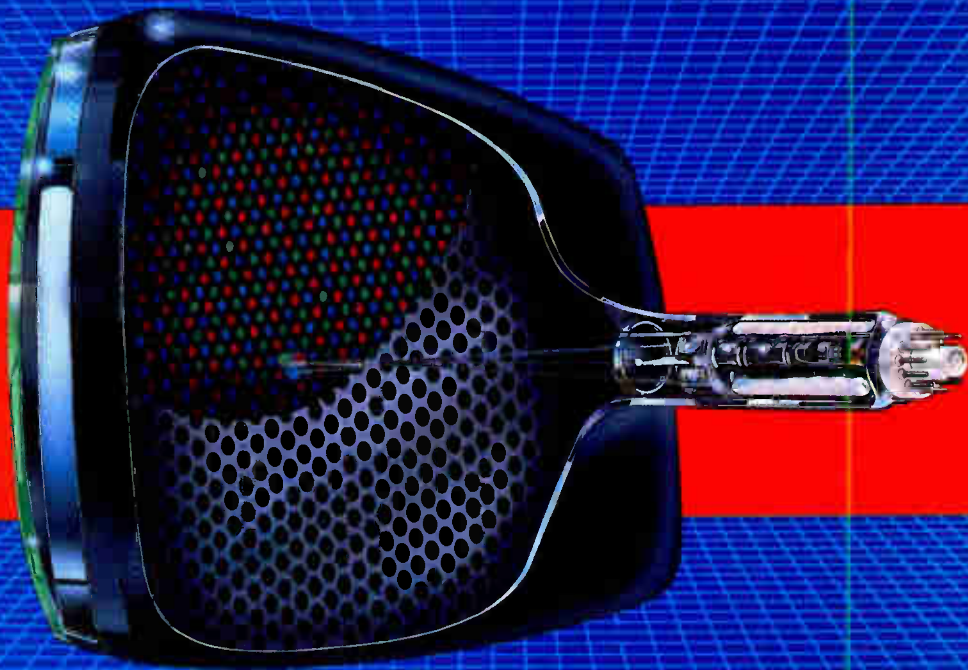


***Figure 1.** Simplified schematic diagram of the Klystrode tube. The device combines the cathode/grid structure of a tetrode with the drift tube/cavity/collector structure of a klystron.*

HIGH RESOLUTION COLOR TUBES



YOUR SOLUTION TO HIGH RESOLUTION COLOR TUBE REPLACEMENT...

VIDEO DISPLAY CORPORATION

VDC inventories new high resolution color tubes for off-the-shelf delivery. Overnight, if necessary! These tubes carry the manufacturer's warranty and are exact replacement parts.

If your hi-res color type has been discontinued by the OEM, **VDC** will remanufacture using your glass. Remanufactured types carry the same warranty as new tubes and the savings are substantial!

VDC also stocks over **4,000 different types** of monochrome tubes! Tubes for every application!

OUR ONLY BUSINESS IS CATHODE RAY TUBES!

Call: 800-241-5005, 404-938-2080, Fax 404-493-3903

OR SEE YOUR LOCAL AUTHORIZED VDC DISTRIBUTOR.

VIDEO DISPLAY CORPORATION

1868 Tucker Industrial Dr.
Tucker, GA 30084

VDC

Circle (67) on Reply Card

PARAMETER	MEASURED VALUE WCES	WABW	WIIB	WHTJ
Operating channel	20	14	63	41
Power output	120kW	120kW	80kW	10kW
Operating mode	SPLIT	SPLIT	COMMON	COMMON
Cooling method	WATER	WATER	WATER	AIR
Figure of merit (50% APL)	1.20	1.31	1.20[1]	0.80[2]
Months on air[3]	10	6	4	1
Number of sockets	3	3	2	1
Hours per socket[3]	>6,000	>4,000	>2,500	[4]
Lower sideband rejection	−30dB	−28dB	−30dB	−22dB
Upper sideband rejection	−35dB	−42dB	−40dB	−38dB
In-band flatness	0.5dB	0.5dB	0.5dB	0.75dB
−750kHz response	−0.4dB	−0.7dB	+0.8dB	+0.5dB
−1.25MHz response	−40dB	−30dB	−36dB	−24dB
Low-frequency linearity	2%	3%	4%	8%
ICPM	2°	2°	1°	2°
Variation of output	2%	1.5%	2%	<1%
Differential gain	4%	4%	1.5%	1%
Differential phase	±1°	±1°	±1°	±1.5°
Out-of-band spurious				
Visual carrier − 4.5MHz	—	—	−62dB	−62dB
Visual carrier +9MHz	—	—	−63dB	−63dB
In-band intermodulation				
10dB A/V (60kW)	—	—	−53dB	—
16dB A/V (80kW)	—	—	−56dB	—
13dB A/V (10kW)	—	—	—	−54dB

[1]See the text.
[2]This FOM, although lower than expected, appears to be typical of low-power operation. In any event, the lower FOM has a proportionately smaller effect on overall transmitter ac-to-RF efficiency because of the power level involved.
[3]Hours as of 4-10-89.
[4]No significant numbers as of 4-10-89.

Table 1. *Operational data and performance comparison of the four Klystrode tube-equipped transmitters now on the air. (Data courtesy of Comark.)*

to TV engineers — is efficiency. To use WCES as an example, the average beam current at 50% APL and 104% peak RF output was 1.65A per tube. At black level, the beam current was 2.31A per tube. Combined with a beam voltage of 31.5kV, the measured FOM was 1.20, and the total beam power was 104kW. As a means of comparison, for a fully pulsed advanced-design klystron transmitter, the power consumption of the output visual klystrons at 50% APL would have been at least 192kW. This is based on an assumed 46% efficient klystron using pulsing to raise the peak-of-sync efficiency to 65%. Higher efficiencies can be achieved, but they may not remain stable over long-term operation.

It is interesting that the measured FOM for the second Klystrode tube transmitter installed (WABW) was 1.31. Although this represents an 11% improvement over the WCES system, the operating cost savings as a result of this extra measure of efficiency were minimal. Figure-of-merit performance above 1.20 does not result in significant additional power savings because of the law of diminishing returns. At approximately 1.20 FOM, the support circuitry power requirements (driver, power-supply losses and cooling system) begin to have a significant effect on overall transmitter efficiency.

Figure-of-merit performance above 1.20 does not result in significant additional power savings because of the law of diminishing returns.

A different approach to reduced cost-of-ownership for a UHF station is reflected in the installation at WIIB-TV, channel 63. The transmitter uses a pair of Klystrode tubes in common amplification service. The good linearity of the 2KDW60LA device and use of a versatile linearity corrector permit multiplexed operation with excellent results. Figure 5 shows a block diagram of the WIIB system. Two tubes are used in the rig, each operating at 40kW and combined in a magic Tee for 80kW RF output. Key operating parameters are summarized in Table 1. Data was taken at both a 10dB and 16dB aural/visual ratio. Final operation was set at 80kW and 16dB A/V.

At 80kW peak visual output, the total beam power drain of the Klystrode tubes was 55.2kW at 50% APL. Black picture

MSDC klystron mounted in a 60kW transmitter. The tube is identical to a conventional klystron except for the collector assembly.

THE UBIQUITOUS STANDARDS CONVERTERS

ME 8800
BI-DIRECTIONAL
NTSC, NTSC 4.43, PAL, PAL-M, PAL-N AND SECAM

- The world's only *complete* range of standards converters; featuring more than ten models – from simple unidirectional models to multi-standard, multi-featured 4-field machines and HDTV for the most demanding broadcast applications.
- Total upgrade path through the converter families – when your needs grow they grow with you.
- Six machines in one. Besides offering broadcast quality conversion, MSW converters also serve as time base correctors, synchronizers, color correctors, enhancers and as powerful noise reducers.
- All fully supported by our range of grade-one multi-standard decoding and monitoring equipment.
- The confidence and reliability of the best selling most trouble free professional standards conversion available.

Designed, built and serviced by broadcast professionals

MERLIN SNELL & WILCOX

... EMBARCADERO ROAD, PALO ALTO, CA 94303 TEL: (415) 856-0900 FAX: (415) 858-2302

Circle (72) on Reply Card

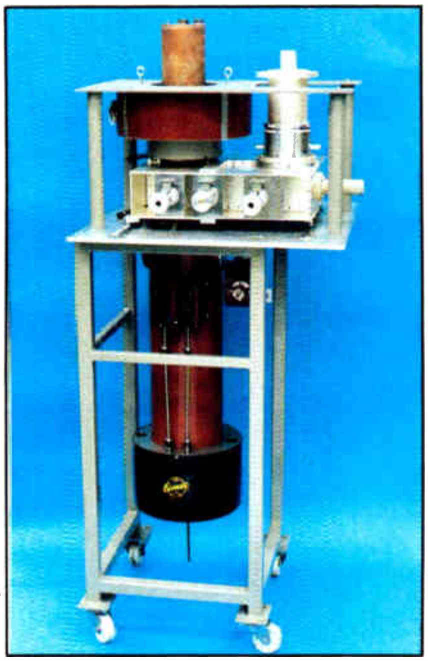

Courtesy of Varian/EIMAC

Figure 2. The 60kW Klystrode tube mounted in its support stand with the output cavity attached.

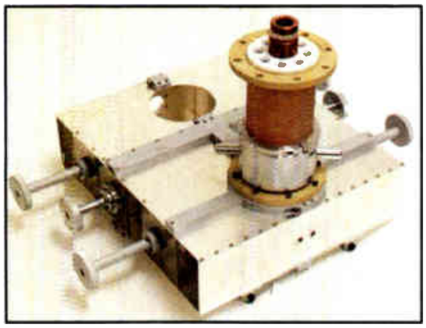

Courtesy of Varian/EIMAC

Figure 3. A close-up view of the double-tuned output cavity of the Klystrode tube.

power drain was 83kW. White picture power drain was 42.5kW. The beam voltage was 28.6kV. This translates into a FOM of 1.45, but this number does not consider the aural power output from the tube (16dB A/V ratio). At 10dB A/V ratio and 60kW peak visual output power, the measured FOM approached 1.20. This performance approximates the efficiency numbers achieved with separate visual/aural amplification. It is significant to note, therefore, that the Klystrode tube offers the ability to operate in a common amplification mode, without performance and efficiency penalties. The linearity of the device is such that the bias point of the tube can remain the same for split or combined amplification of the visual and aural signals.

Of the four sites currently on the air, one operational tube failure has been reported. The failure occurred at WABW in Pelham, GA, during a lightning storm. Three tubes were replaced during the course of installation and initial testing procedures at WCES on serial number 1. Replacements were the result of:

- ceramic damage.
- shipping damage.
- socket arcing not related to the tube itself.

Of the problems noted, all were traceable to causes other than flaws in the tubes.

MSDC klystron

The multistage depressed-collector klystron began as a joint project of NASA, NAB, PBS, several transmitter manufacturers and Varian Associates. The MSDC device has potential for both broadcast and non-broadcast applications. NASA originally became involved in the project as a way to improve the efficiency of satellite transmitters. With limited power available onboard a space vehicle, efficient operation is critically important. Such transmitters traditionally operate in a linear, non-efficient mode, as do UHF-TV rigs.

At least four transmitter manufacturers (Harris, Townsend, TTC and Varian TVT) have introduced high-power UHF systems built around an MSDC klystron. Units are currently under construction, with the first delivery scheduled for late summer.

Researchers took an off-the-shelf klystron and added a new collector to it.

The MSDC device is almost identical to a standard klystron, except for the collector assembly. Researchers took an off-the-shelf klystron and added a new collector to it. This approach was important for several reasons, one being that it provided a device with essentially one variable. Any research project can become needlessly lengthy and complicated if several variables are changed at once. Use of existing technology in the new device also provided a measure of assurance that the MSDC klystron would operate in current transmitter designs. A wealth of technical data exists on klystron operation and performance in the field.

MSDC tubes have been built around both integral-cavity and external-cavity klystrons. Cooling for the MSDC is more complicated than for a conventional device. The trade-off, though, is that there is less heat to remove because

INTELLIGENT BY ANY STANDARD

Setting the standard for High Resolution Broadcast Monitors, Barco Industries provides an intelligent choice with its CVS and CVM monitors. Both provide absolute color temperature stability (AKB) and excellent raster size stability. And both permit adapting to different video formats and new technology.

CVS Auto Setup Monitors, used by networks, major cable systems and leading production facilities, provide **total digital control** of all display and control functions in a Grade I monitor.

CVM High Performance Broadcast Monitors deliver full broadcast features, outstanding stability and exceptional brightness - all for less than $3,000.[1]

Barco Industries received the 1988 Emmy Engineering Award ...its all-digitally controlled CVS monitor - the first broadcast ... to be so recognized.

(1) Price at time of publication.

BARCO INDUSTRIES

Barco Industries Inc.
472 Amherst Street, Suite 16
Nashua, NH 03063
East Coast: (603) 880-1430
Central: (312) 213-3114
West Coast: (408) 370-3721

INTELLIGENCE RUNS IN THE FAMILY

Circle (74) on Reply Card

higher efficiency of the tube. Water cooling is provided on each electrode of the MSDC collector.

From an electrical standpoint, the more stages of a multistage depressed-collector klystron, the better. The trade-off, predictably, is increased complexity and subsequent higher cost for the product. A point of diminishing returns is reached as additional stages are added to the depressed-collector system. After analysis of these factors, a 4-stage device was chosen. Beyond four, additional stages result in proportionally smaller improvement in efficiency.

From an electrical standpoint, the more stages of a multistage depressed-collector klystron, the better.

Figure 6 shows the mechanical configuration of the 4-stage MSDC. A "V" shape was found, through computer studies, to provide the best "capture" performance, minimizing electron feedback. The electrons sort themselves out in a predictable manner, as shown in Figure 7, which illustrates electron trajectories at 50% saturation (approximately the blanking level). The number of electrons attracted to electrodes 2 and 3 increases as modulation is increased. Notice the arc that is present on many electron traces. The electrons tend to penetrate the electrostatic field of the collector, then are pulled back to their respective potential.

Power savings is realized because the electrostatic forces set up in the MSDC slow down the electrons before they contact the copper collector. The energy that would be dissipated as heat in the collector is, instead, returned to the power supply. In theory, peak efficiency would occur if the electrons were slowed down to zero velocity. In practice, however, that is not possible.

Preventing feedback within the MSDC device was a potential problem area for designers. Feedback would occur if electrons in the collector not attracted by any of the electrodes were to return to the drift tube area. Such an occurrence would seriously distort the linearity of the device. Particular attention was given to ensuring that the mechanisms that could lead to feedback within the MSDC tube did not occur. Other areas of concern involved suppression of secondary electrons, collector cooling and RF radiation.

Suppression of secondary electrons was accomplished both through the mechanical design of the collector, and through the use of special materials on the collector surfaces. Materials were available that exhibit low secondary yield, such as carbon. But carbon is known to absorb gases, a potentially serious problem in a vacuum tube environment. The solution was to apply only enough carbon to keep secondary electrons at a low level. If the carbon coating on the collector assembly was kept thin, only a small volume would be available to absorb gases.

To achieve the necessary thin carbon layer, a *sputter-coating* system was used.

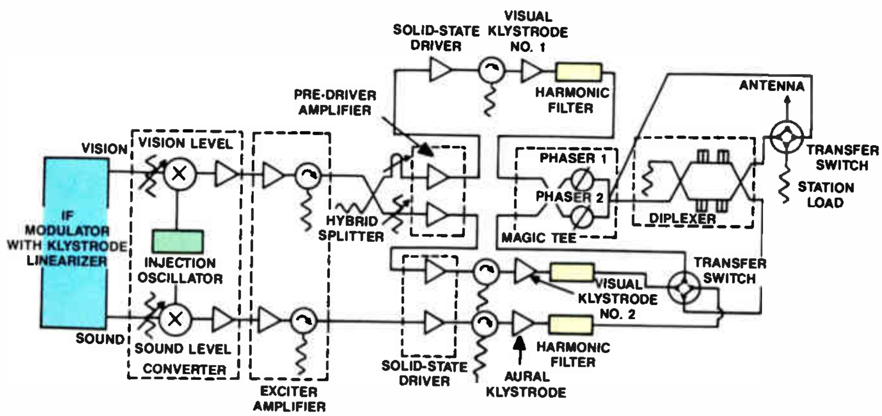


Figure 4. *Block diagram of the 120kW SK-series (Comark) transmitter installed at WCES-TV in Wrens, GA. Redundancy was a primary concern in the design of the system.*

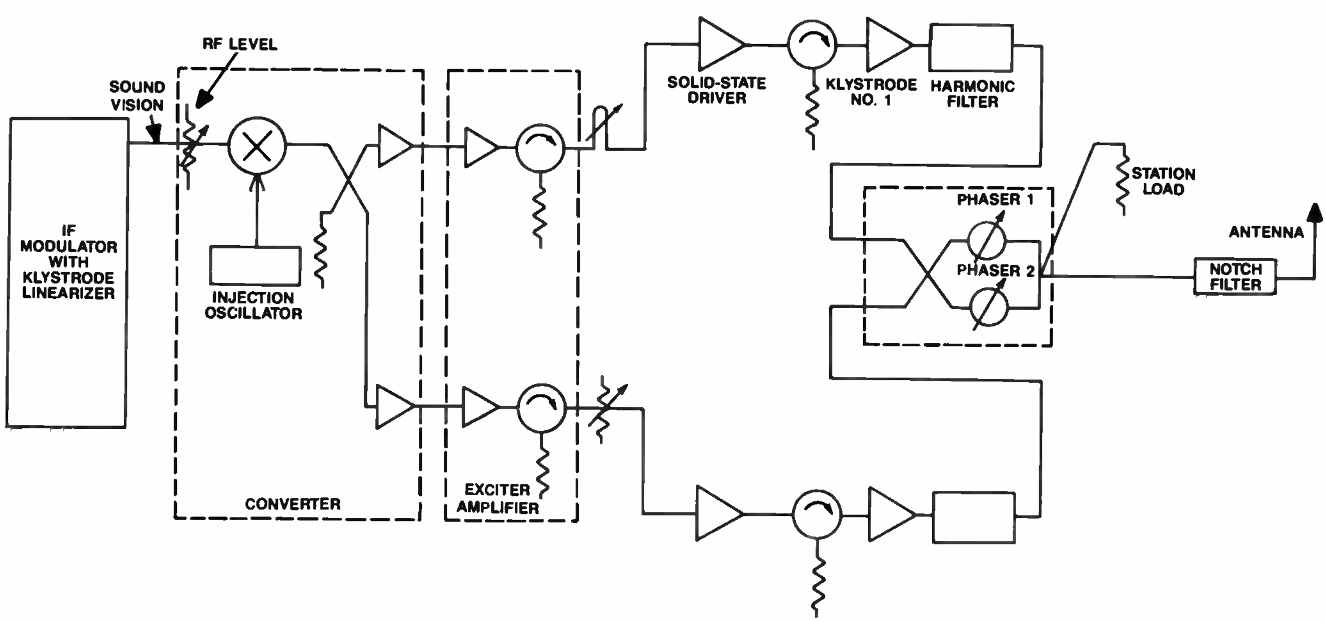


Figure 5. *Simplified block diagram of the 80kW common amplification Klystrode tube transmitter installed at WIIB-TV, Bloomington/Indianapolis.*

Our Network Ratings Are In.

—*Dana Geiken, DMB & B*

—*Merle Welch, Foote, Cone and Belding*

We have become accustomed to the
receiving commercial spots via satellite
impressed

—*Karl Hagnauer, KPLR*

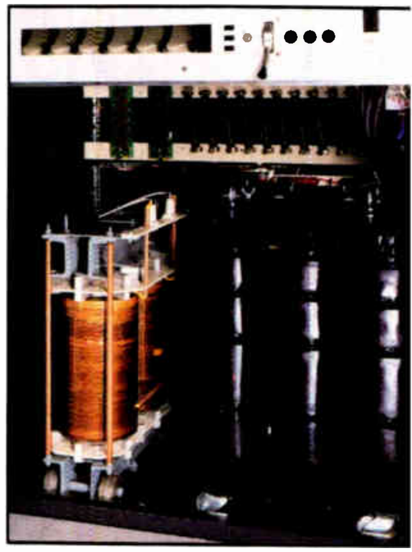
—*Robert Strutzel, WGN-TV*

—*Jim Martin, WOAY-TV*

If you haven't already joined the Cycle Sat spot delivery network, check out the reception we're getting from those who have. We guarantee network quality transmission of your spots, along with standardized traffic instructions. For service that's out of this world... Call 1-800-274-2728.

CYCLE-SAT, INC.
A COMMUNICATIONS NETWORK
A SUBSIDIARY OF WINNEBAGO INDUSTRIES, INC.

Circle (76) on Reply Card



Power-supply section for a new MSDC tran: mitter. This design uses a single transformer t supply the required stepped collector voltage: The transformer can be seen on the right. Th power supply choke is on the left. (Details c this design are described in the text.)

Such equipment, originally designed fo use in producing semiconductors, applie the thin carbon coating with good un formity. Each element of the collector i coated separately, then assembled.

> ***In theory, peak efficiency would occur if the electrons were slowed down to zero velocity.***

Design criteria for the collecto power-supply system provides a mixe bag of requirements. The critical param eter is the degree of regulation betwee the cathode and anode. The relative dif ferences between the elements of the col lector are not particularly significant. Tw approaches can be taken to the collecto supply, as illustrated in Figure 8, whicl shows a power supply using a parallel ar rangement of the power units, and Figur 9, which shows a series-constructe system. Note that in both cases, the col lector electrodes are stepped at a 6.125k potential difference for each element.

Efficiency measurements on prototyp 60kW MSDC tubes show a typical FOM o 1.32 when pulsed. This represents an ef ficiency of more than twice that of a con ventional klystron.

The Audio Zealot Prevails Again! NEW Aphex Aural Exciter® Type III

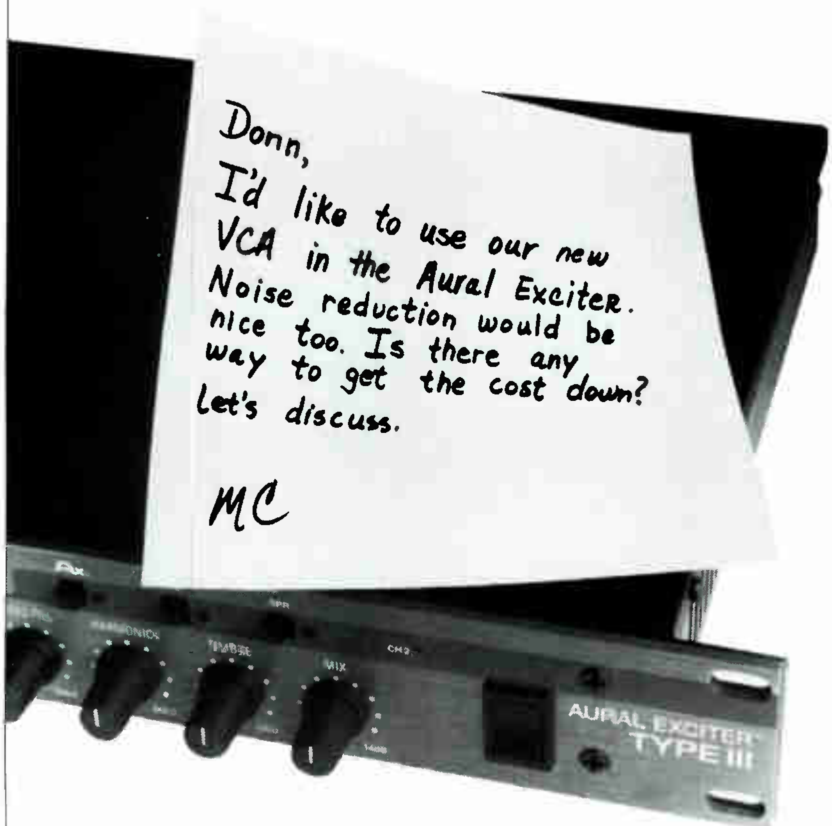
When the engineers got Marvin Caesar's memo, they said "@!%#" (impossible to themselves), but went to work. And, as usual, they delivered. In spades!

The result of their efforts is the Aural Exciter Type III loaded with exciting new features:

- Faster and easier to use
- Adjustable harmonics mixing
- Two modes of noise reduction
- *SPR™ Spectral Phase Refractor* to restore bass clarity and openness without adding any amplitude EQ or "bass boost"
- Overall quieter operation
- Servo balanced, transformerless I/O
- Null fill
- Remote controllable
- Sleek 1-RU chassis

Aural Exciters have become a standard in the recording, broadcasting and sound reinforcement industries. The Aural Exciter Type III offers a truly unique method to achieve clarity, definition and dimensionality in reproduction of sound. Program material literally "opens up", possessing more detail, intelligibility, as well as greater apparent frequency and dynamic range.

Audition the exciting new Aural Exciter Type III today. You will agree that at its low price, the Aphex engineers have created another work of magic.



APHEX SYSTEMS LTD.

13340 Saticoy Street

North Hollywood, CA 91605

(818) 765-2212 • TWX: 910-321-5762

FREE! *The Aphex Experience* Videotape. Send $5 to cover shipping and handling to our address in this ad. Be sure to include your name, address and phone number. Allow 4-6 weeks for delivery.

Made in U.S.A.

Circle (81) on Reply Card

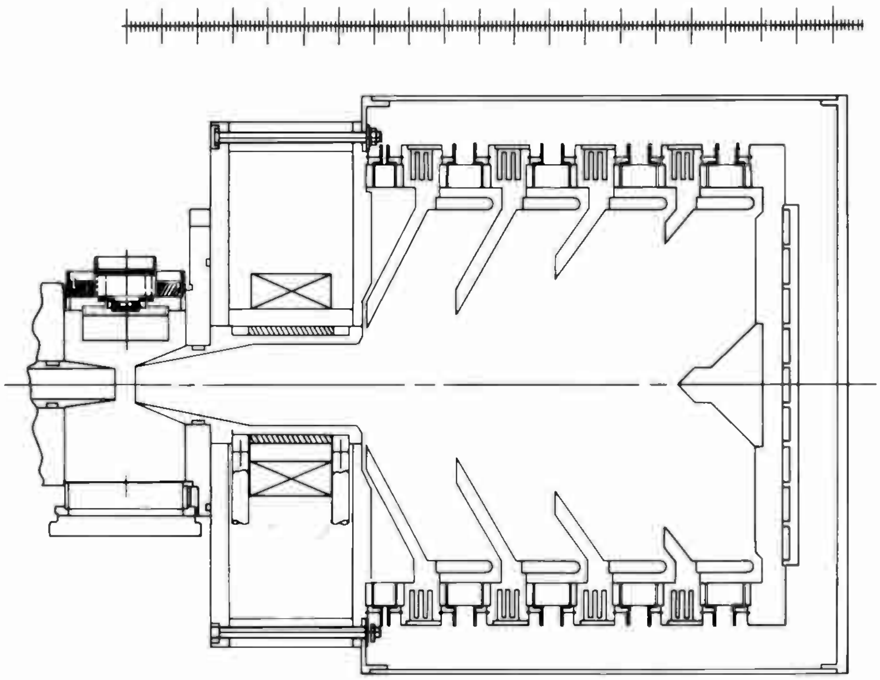


Figure 6. Mechanical design of the multistage depressed collector assembly. Note the "V" shape of the 4-element system.

Applying the MSDC

At least three transmitter manufacturers are planning to install MSDC-equipped rigs this year. A block diagram of one system (Varian TVT) is shown in Figure 10. The 60kW transmitter (Vista model 1891) incorporates two external-cavity MSDC klystrons, one for the visual and another for the aural. Design of the transmitter is basically identical to a non-MSDC system, with the exception of the power supply and cooling system. The efficiency available from the MSDC makes further device improvements subject to the law of diminishing returns, as in the Klystrode tube system. Support equipment begins to consume an increasingly large share of the power budget as the output device efficiency is improved.

Tuning of the MSDC klystron is the same as for a conventional external-cavity klystron, and the same magnetic circuit is used as well.

The power-supply arrangement for the example MSDC system is shown in Figure 11. A series beam supply was chosen for technical and economic reasons. Although the current to each collector varies widely with instantaneous output level, the total current stays within narrow limits. Using a single transformer for all supplies,

Figure 7. Collector electron trajectories at 50% saturation, approximately the blanking level. The last three electrodes (2, 3 and 4) share electrons in a predictable manner, as depicted in this computer simulation plot.

therefore, minimizes the size of the iron core required. A 12-pulse rectifier bank provides low ripple and reduces the need for additional filtering. The size and complexity of the rectifier stack are increased little beyond a normal beam supply because the total potential of the four supplies is similar to a normal klystron transmitter (24.5kV to 27.5kV).

The collector stages are water-cooled by a single circuit that loops through each electrode element. The high voltage on the individual elements places extra requirements on the purity of the water. A 2-stage system is used with a water-to-water plate heat exchanger separating the primary and secondary systems.

Tetrodes

New advancements in vacuum tube technology have permitted the construction of UHF transmitters based on tetrodes at record power levels. Such devices are attractive because they inherently operate in an efficient class A-B mode. At least one 25kW tetrode-based transmitter is now on the air (built by Acrodyne) in common amplification service. The entire rig, operating at 25kW peak-of-sync with 2.5kW aural, consumes a total of 46.3kW (including the cooling system) at 50% APL.

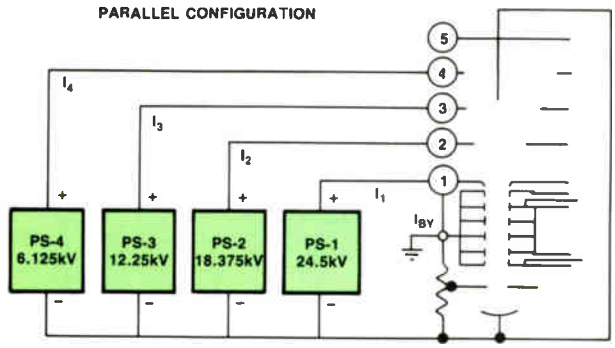


Figure 8. Parallel configuration of the MSDC power supply. Note that each power-supply section has an output voltage that is an integral multiple of 6.125kV.

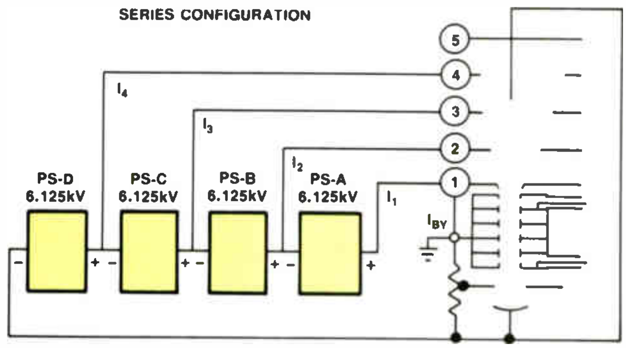


Figure 9. Series configuration of the MSDC power supply. This arrangement uses four identical 6.125kV power supplies connected in series to achieve the needed voltages.

At black picture, total ac consumption is 54kW. The tube, a Thomson TH563, is capable of 35kW peak-of-sync power output in split operation.

UHF tetrodes operating at high power levels provide essentially the same specifications, gain and efficiency as tubes operating at lower powers. The anode power supply is much lower in voltage than the collector potential of a klystron- or Klystrode tube-based system — 8kV is common. The tetrode also does not require focusing magnets.

The key to making a tetrode practical at high power levels is to efficiently remove heat from the device.

The key to making a tetrode practical at high power levels is to efficiently remove heat from the device. The TH563 and lower-power versions use water cooling. Air cooling at these levels is impractical because of the fin size that would be required. Also, the blower for the tube would have to be quite large, reducing the overall transmitter ac-to-RF efficiency.

The expected lifetime of a tetrode in UHF service is shorter than that of a klystron of the same power level. Typical lifetimes of 8,000 to 15,000 hours have been reported. It must be noted, however, that the replacement cost of a tetrode is much less than for a klystron or Klystrode tube.

Work is under way on methods to extend the operating limits of the tetrode while retaining the benefits of its inherent class A-B operation. Tetrodes designed for 50kW peak-of-sync operation have been considered by at least one tube manufacturer (Thomson).

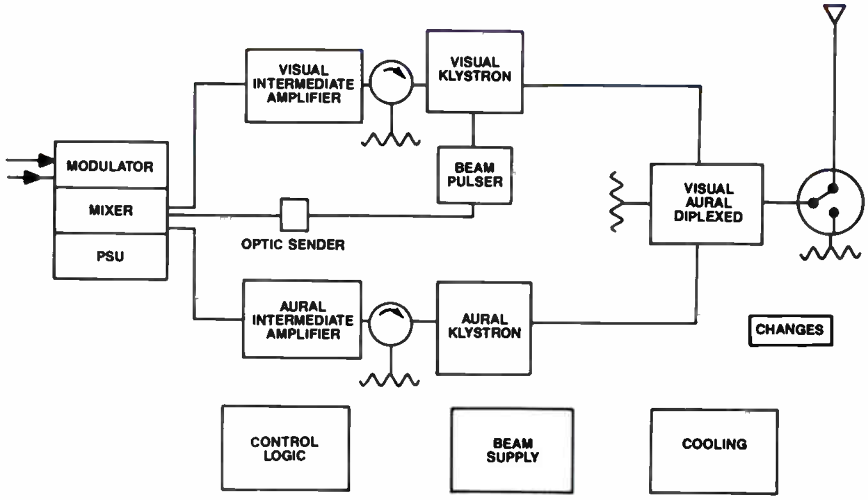


Figure 10. Simplified block diagram of a 60kW (Varian TVT) MSDC transmitter. The aural klystron may use a conventional or MSDC tube at the discretion of the user.

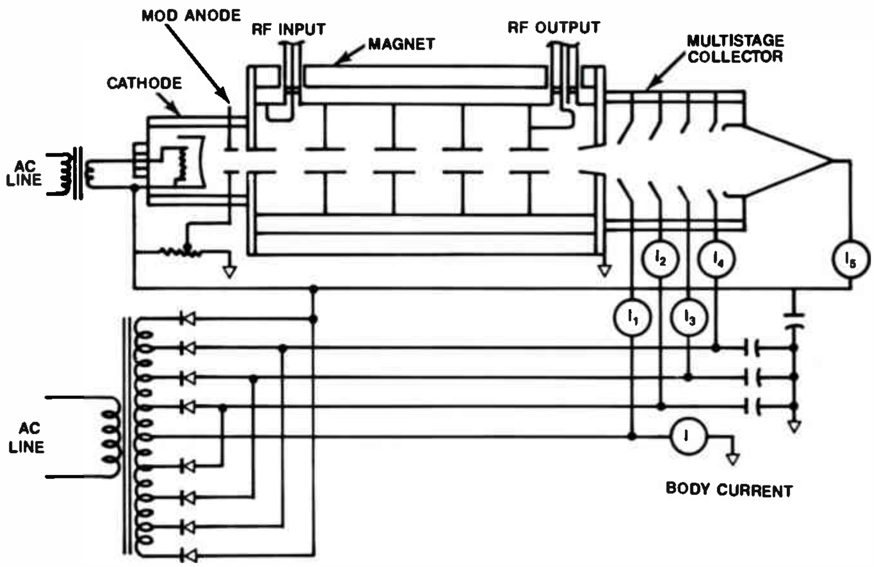


Figure 11. Simplified schematic diagram of the power supply for a new MSDC klystron transmitter. Note that a single high-voltage transformer with multiple taps is used to provide the needed collector voltage potentials.

The future

It is clear that high efficiency is the name of the game in UHF transmitter design. Technologies such as the Klystrode tube, MSDC klystron and high-power UHF tetrode offer broadcasters the potential for significant savings in operating costs. Further refinements of these products are likely as more field experience is obtained.

Aside from these technologies, other avenues are open as well for UHF broadcasters looking for greater efficiency. Tube manufacturers are looking for additional ways to boost the efficiency of transmitters based on conventional klystron designs. There also is the promise of solid-state high-power UHF transmitters utilizing a sophisticated — perhaps digital — modulation process to achieve greater efficiency. In fact, a new digital amplitude modulation system specifically designed for TV service has just been patented (developed by Acrodyne).

Any way you look at transmitter technology today, it's an exciting time to be a UHF broadcaster.

Bibliography

1. Ostroff, Whiteside and Howard. "An Integrated Exciter/Pulser System for Ultra High-Efficiency Klystron Operation." *Proceedings of the NAB Engineering Conference*, 1985.

Badger, George. "The Klystrode: A New High-Efficiency UHF-TV Power Amplifier." *Proceedings of the NAB Engineering Conference*, 1986.

Ostroff, Kiesel, Whiteside and See. "Klystrode-Equipped UHF-TV Transmitters: Report on the Initial Full Service Station Installations." *Proceedings of the NAB Engineering Conference*, 1989.

Technical background information on the Vista line of transmitters, Varian TVT.

Technical background information on UHF tetrode operation, Dr. Timothy Hulick, Acrodyne.

McCune, Earl, "Final Report: The Multi-Stage Depressed Collector Project." *Proceedings of the NAB Engineering Conference*, 1988.

the
SOURCE

Just what gives us the nerve to say no other transmitters are in our league?

he simple fact that no other transmitters back up the claim like the Toshiba 000 Series VHF Transmitters.

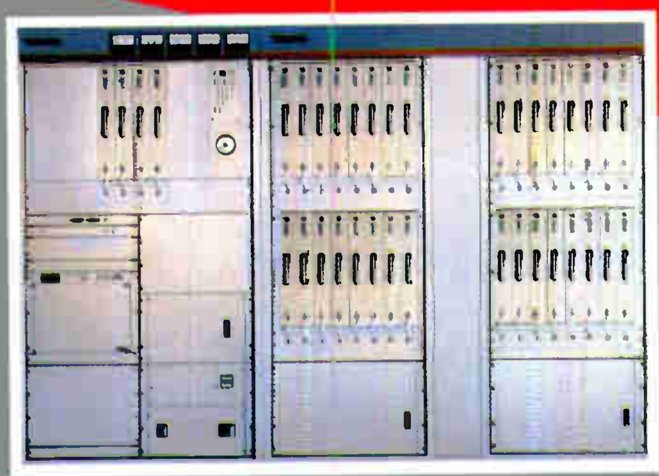
ecause while others are busy introducing their first generation solid state esign, Toshiba is years ahead with the introduction of their second eneration. The most transparent available.

ecause no other transmitters come with Toshiba's 35 years of proven xperience and unsurpassed reliability.

r Toshiba's remarkable high tech design features. Like our exclusive new F Power MOSFET Progressive Air Cooling System. One-to-one power ipply-amplifier redundancy. And superb MTBF ratings.

r Toshiba's in-house production of all key components. For cost-efficiency ou can take to the bank. From the front access, lightweight plug-in iodules to the last rivet and weld, the 2000 Series concept focuses on both ie obvious efficiencies of purchase price and the more subtle efficiencies f designed-in high stability to minimize adjustments and training

Vrap it up with outputs that range from 5KW to 64KW – as well as technical ipport, service and parts from Midwest's centrally-located headquarters – nd we think you'll agree, it doesn't take nerve to say we're in a league all ur own… it just takes a firm grasp of reality.



32KW 2000 Series VHF TRANSMITTER

For complete information on the Toshiba 2000 Series, call the sales representative in a league all his own. Call Midwest.

TOSHIBA

MIDWEST
Communications Corp
One Sperti Drive
Edgewood, KY 41017
(606) 331-8990

Circle (97) on Reply Card

The 10,000 series Arrakis consoles

By Dennis Ciapura

The industry best knows Arrakis for its line of mixing consoles for radio broadcast applications. Since 1979, the company has worked hard to forge a product image based on value and simplicity of design. It recently produced a new series of consoles designed to broaden its product line and meet the needs of stations looking for more versatility. To successfully break into the competitive premium console market calls for top performance and quality construction at an attractive price.

Basic features

The Arrakis 10,000 series of consoles ranges from a basic 12-channel mixer to a 30-input/8-output production device. This model contains almost every type of feature a station might need: EQ, a slate tone, gated compressor/limiter, aux send/return, 5-station intercom, telco module with mix-minus for four hybrids, nine VU meters, a clock and a timer. An array of master, submaster and summing modules also is available. The company also can provide custom mainframes in multiples of six channels.

We were anxious to see just how good the new console was. At our request, Allied Broadcast Equipment arranged to have a sample 10,000 detoured to our lab for a few days of extensive testing and quality evaluation.

Internal design

Every console is a reflection of the designer's philosophy about such things as passive or VCA mixing and active or transformer coupling. There are good and bad examples of each approach with about an equal sprinkling of each among the best-selling models. Those who advocate the audio on the pots and switches feel strongly about the relative ease of troubleshooting. Proponents of VCA attenuation and FET switching are attracted to the audio isolation and options for logic control that active circuitry affords. A block diagram of a broadcast configuration is shown in Figure 1.

Ciapura is vice president of technical operations for Noble Broadcast Group and president of TEKNIMAX Telecommunications, a San Diego-based technical management consulting firm.

Performance at a glance

- *Frequency response: ±0.5dB 20Hz to 20kHz*
- *Noise: mic −75dB below +8dBu Line −85dB below +8dBu*
- *Distortion: 0.01% (30kHz filter)*
- *Four output buses*
- *Stereo cue bus*
- *Two stereo aux send buses*
- *Mono or stereo-tracking EQ on individual modules*
- *Pan/balance controls on stereo and mono inputs*
- *Balanced patch points*
- *dc control of audio functions*
- *15 optional module positions within mainframe*

There was a time when the use of VCAs was simply a way to get around expensive audio attenuators, and active coupling was seen as a way to eliminate expensive transformers. But that's not necessarily true today. The 10,000 uses the same Penny & Giles 4000 series slide attenuators as the finest "audio on the pot" boards. The difference here is that the pots handle control voltages for the VCAs, not audio.

The console uses ITT Schadow switches and Allen-Bradley conductive plastic element pots along with active-balanced inputs and outputs. Clearly, the design is targeted at broadcasters who are shopping for a high-performance board. The console also should meet the needs of those

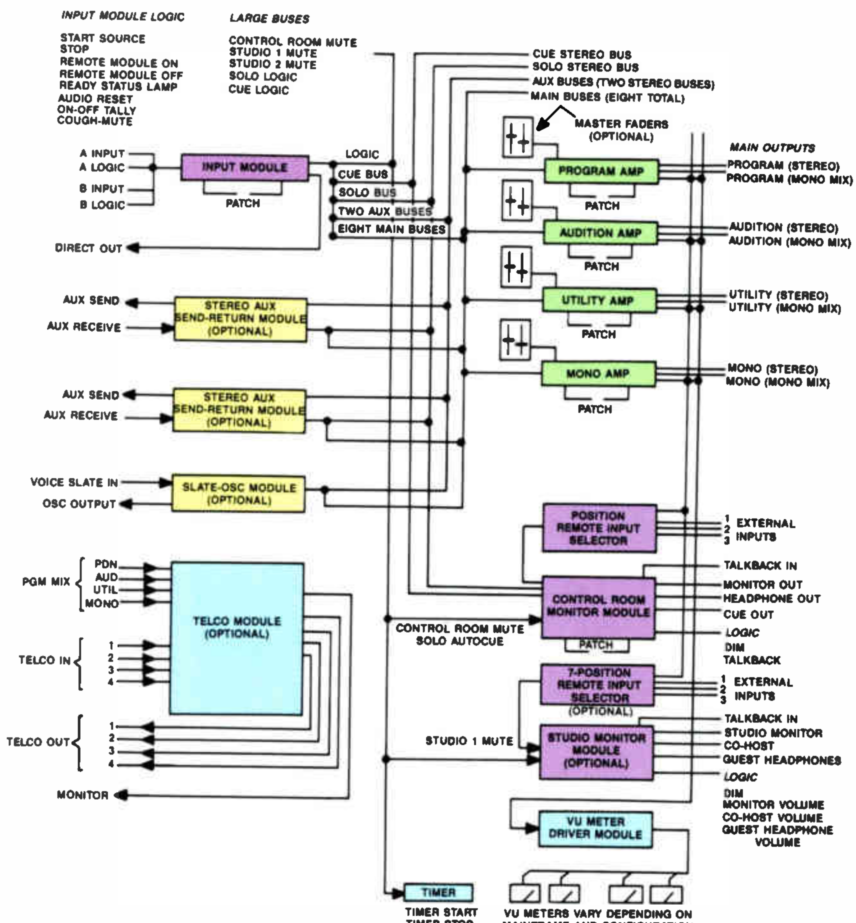


Figure 1. Basic block diagram of a typical broadcast-configured console. The versatile design provides for configurations that can adapt to any need, up to a 30×8 model.

who prefer an active-coupled, VCA-based console.

The mechanical construction of the 10,000 is well-planned. The console opens up like a clamshell, with the top part containing all the electronics. The top is supported by piston-and-strut air springs so that it stays in the open position for installation wiring or service. Once it is open, there is unrestricted access to the motherboard assembly. The status of the four supply rails for the audio and logic circuitry is indicated by LEDs.

All input/output connections are made through large AMP-style, 6-pin and 9-pin ML connectors on the motherboard. If you prefer, other types of connection schemes can be installed by the factory. All modules pull out from the top in the usual manner, and PCB guides are provided to ensure correct mating with the motherboard. Two external rack-mounted power supplies complete the installation.

One of the advantages of a VCA-controlled and FET-switched console design is that the active attenuators and switches can be located near the audio circuits while the long cable runs to the mechanical pots and switches use dc. Arrakis makes good use of this feature, and the audio runs in the 10,000 are kept

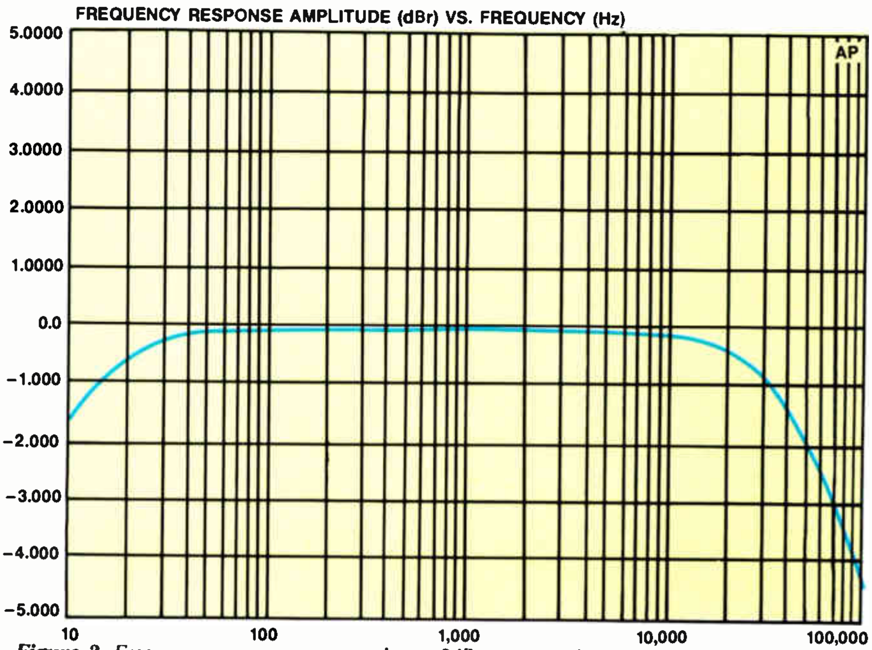
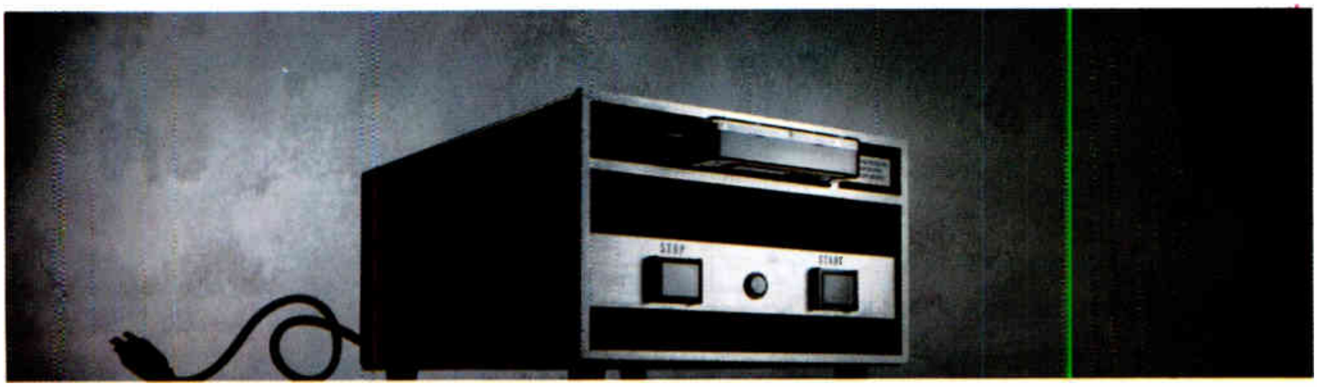


Figure 2. Frequency response measured at +8dBm using a line-level input.

It's withstood nineteen years of raps, bops, swings and hits.



Reliability. It's what ITC audio cartridge machines are all about, even after years of pounding and playing. In fact, you'll find many of our original models still in use today. Like this one from KOMA-AM radio in Oklahoma City.

The reason is ITC cartridge machines have always been engineered to withstand heavy-duty use day in and day out. That includes today's latest models. It's reliability like this which has made ITC the undisputed leader in cartridge machines around the world.

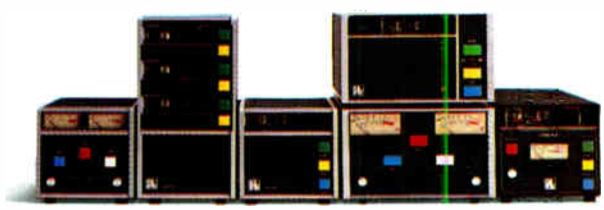
And our reputation doesn't just end there. Engineers tell us ITC also offers the undeniably best support in the business. With toll-free technical consultations. Fast turn around on repairs and replacement parts. And our 2-year warranty on factory labor and all parts, including motors, heads and solenoids.

No wonder, then, more stations buy ITC machines than any other brand. And keep coming back for more.

There's an ITC cartridge machine for every need. Including the 99B Master Recorder with the patented ELSA cartridge preparation system. The DELTA Series, the most popular cartridge machine in the last five years. And the economical OMEGA Series offering affordable performance.

To find out more, or for a list of ITC dealers, call International Tapetronics, 3M Broadcasting and Related Products Department toll-free at 1-800-447-0414. (In Illinois and Alaska, call collect, 309-828-1381.)

Tell them you heard about it from a reliable source.



3M

short. This, along with the shielding provided by the bottom half of the clamshell enclosure, should serve the console well in high-RF environments.

Measured performance

Satisfied that the 10,000 was mechanically tough enough to last at least twice as long as the accountant's depreciation schedule, we hooked it up to our automated test equipment to explore the performance envelope. We live in a wonderful age of monolithic technology, in which signal-to-noise ratios near the theoretical levels are attainable if the overall system design is right. The console's performance is close to those limits.

The frequency response measured through the line inputs at operating level is shown in Figure 2. The response was down 0.5dB at 20Hz and 0.3dB at 20,000Hz. The 3dB point occurred at 65kHz. Because the console is an active-balanced input/output design, the rolloff frequencies are a function of coupling and feedback parameters and, therefore, quite controllable. The console's response is typical of the current broadcast practice of rolling the response an octave or two above the audio band to reduce RF sensitivity while continuing to provide tran-

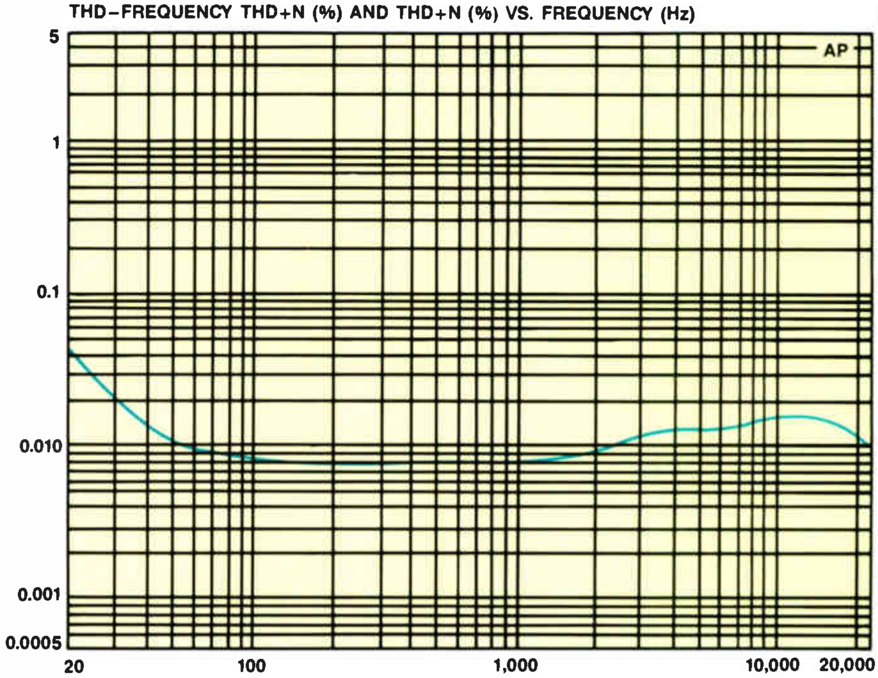
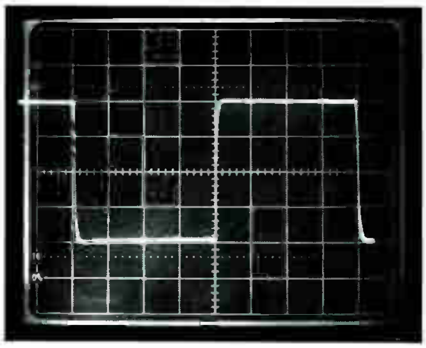


Figure 3. Measured THD through line inputs at +8dBm. Distortion dropped as low as 0.008% at approximately 200Hz.

sient response faster than any source or transmission system.

The THD at operating level, shown in Figure 3, was typically about 0.01% over most of the audible range and dipped to 0.008% in the lower mid-range. The 20kHz bandpass unweighted noise floor is approximately −85dB (0.006%). No spectrum analysis was performed to accurately discriminate the distortion components from the noise because both levels were negligible for broadcast applications. The SMPTE IMD was 0.018% at operating level.

Noise in the 20Hz-20,000Hz band measured 85dB below the +8dBm



The 2kHz square-wave response measured at +8dBm.

operating level through the line inputs. The S/N ratio measured through the microphone input was 77dB (referenced to 50dB gain), producing an equivalent input noise of −127dBm. This is within 1dB of the manufacturer's specification and within about 3dB of the theoretical limit of 150.

Figure 4 shows the noise distribution vs. frequency for both microphone and line inputs. Program-to-program and program-to-auxiliary crosstalk was −80dB. There were no artifacts of the VCA action present in the output.

The compressor/limiter and equalizer modules worked exactly as advertised, and we found the board easy to use, with no poorly placed controls or switches. (In fact, in an effort to find something to criticize, we decided that the lettering on the channel on/off switches was too large, but Arrakis tells us that it's being changed.)

Most broadcasters probably would want to order the 10,000 series console configured for +4dBm rather than +8dBm to maintain 20dB of headroom. Because the overall S/N for the board is set by the VCA S/N, the lower operating level has negligible impact on the output S/N. We repeated the S/N tests at +4dBm and found only 1dB of degradation for a 4dB increase in headroom. The console is available in any gain structure you desire.

By the way, ever wonder where the

Downlink Double Feature...

Upgrade with our new VDP-8400 frame store synchronizer or our field-proven VDP-8000.

Lock up and synchronize noisy satellite and microwave signals for uninterrupted operation with our two high-performance frame store synchronizers.

The new VDP-8400 has the same reliable front-end circuitry as the dependable VDP-8000. And both come with outstanding features to match. Like a processing amplifier to enhance picture quality even in the freeze mode. Clean "hot switching" of non-synchronous sources, and a line select that lets you observe individual lines of video on any waveform or picture monitor. What's more, a blackburst output allows you to use each of these units as a stand-alone sync generator. Want more? How about a price that's thousands less than the competition.

What's really uplifting about our down-link duo is their freeze-field/frame storage capabilities. The VDP-8000 lets you store two different fields or one field continuously, without interruption of live video. While the powerful VDP-8400 gives you enhanced storage capability of up to four fields.

So if you want to be in total sync, check out the VDP-8400 and VDP-8000 at your Videotek dealer today.

Line Select lets you observe individual lines of video on any waveform or picture monitor.

Multi-storage capabilities.

Display field or frame.

Processing amplifier controls with presets for video gain, pedestal, chroma gain and chroma phase.

VIDEOTEK INC.
American-made technology.
And value.

243 Shoemaker Road, Pottstown,
Pennsylvania 19464 • (215) 327-2292
TWX 710-653-0125 • FAX (215) 327-9295

Circle (94) on Reply Card

name Arrakis originated? No, it's not a Greek word for loud. Mike Palmer, the founder, reveals that the company is named after the planet in author Frank Herbert's "Dune" trilogy.

Overall, the Arrakis 10,000 series appears to have the potential to compete effectively with the top contenders in the marketplace. It's well-designed and built and is priced to provide excellent value.

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

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

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

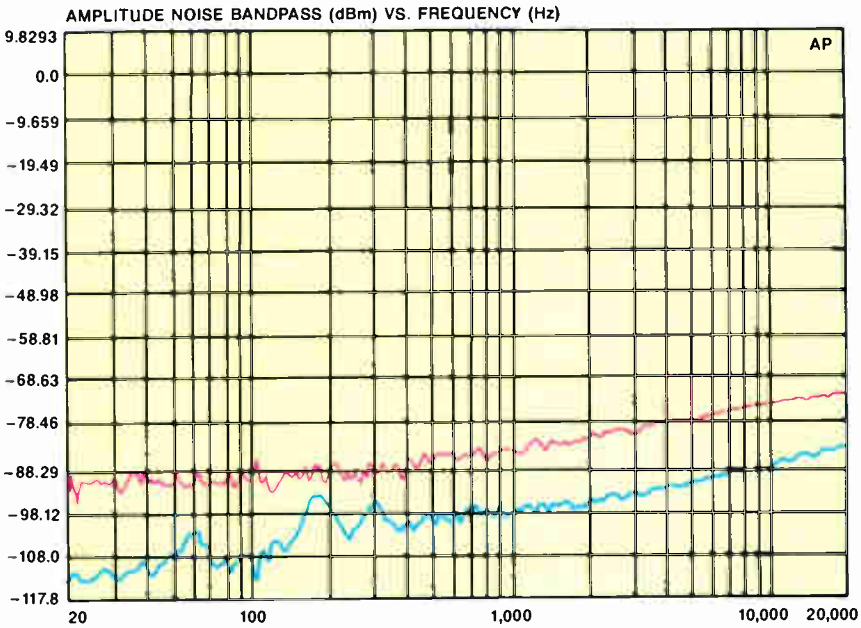
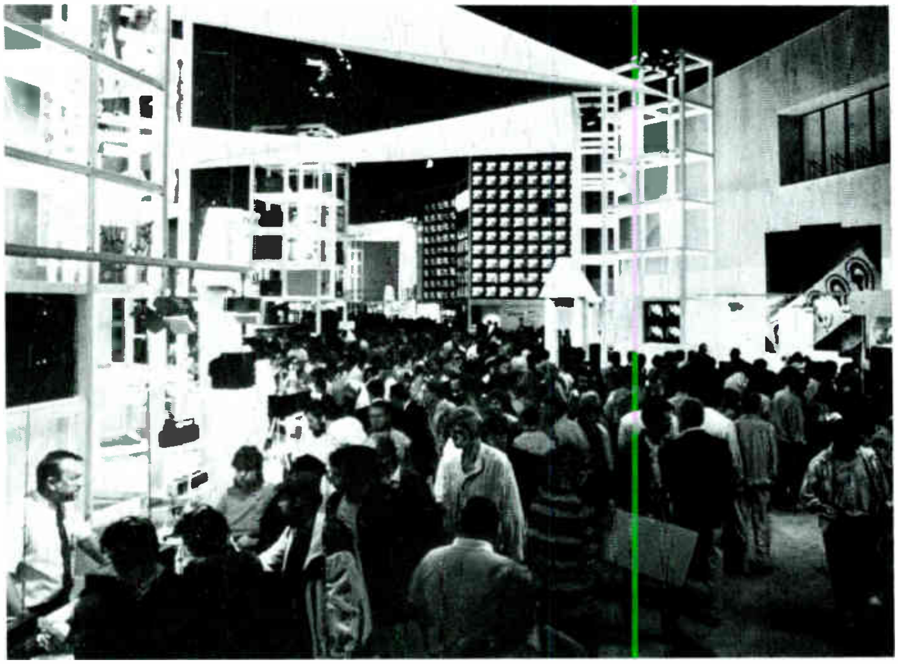


Figure 4. *Noise vs. frequency. The upper curve represents a microphone input; the lower curve represents the performance of a line input.*



International Audio and Video Fair Berlin 1989 Aug. 25. - Sept. 3

The world fair for consumer and communication electronics

No. 1 throughout the world: the International Audio and Video Fair Berlin 1989 is unique in its combination as world market place for consumer electronics, a venue for placing orders and launching new items, and a great display for the public.

This world event offers everything for the viewer and the listener, and for communications too. It displays the entire range of advanced technologies and is acknowledged throughout the world as the most important center for contacts and information among experts from every sector of consumer electronics.

Live from the fair: public and private radio and television networks, and the German Federal Post Office.

Once again, there will be a Trade Visitors' Center, and for the first time, a Meeting of European Dealers on August 31, 1989.

Organiser:

MVU

Messe-Veranstaltungsgesellschaft Unterhaltungs- und Kommunikationselektronik (MVU) mbH

Executive company:

AMK Berlin

AMK Berlin Ausstellungs-Messe-Kongress-GmbH
Postfach 19 17 40 · Messedamm 22 · D 1000 Berlin 19
Tel. (30) 30 38-0 · Telex 182 908 amkb d · Teletex 309 711 = amkb d · FAX (30) 30 38-23 25

Our representative: AMK Berlin, 150 North Michigan Avenue, Suite 1225, Chicago, IL. 60 601
Tel.: (312) 781-62 56, Tlx.: 6871 209 swetrcg, FAX/Télécop.: (312) 346-06 83

Circle (96) on Reply Card

Continued from page 4

McKinney named ATSC chairman

James C. McKinney, former chief of the FCC's mass media bureau, has been named chairman of the U.S. Advanced Television Systems Committee (ATSC). The committee is involved in the effort to develop voluntary U.S. standards for advanced TV systems, including high-definition television (HDTV).

McKinney's most recent position was that of deputy assistant to the president of the United States (military affairs). In his White House post, he served as a delegate at all presidential summits, including those held in Moscow, London, Mexico City, Helsinki, at NATO and at the United Nations.

During his FCC career, McKinney was named chief of the field operations bureau and the private radio bureau. He has been active in the International Radio Consultative Committee (CCIR) and has served as a delegate to several International Telecommunications Union (ITU) conferences.

He succeeds E. William Henry, who has chaired the ATSC since its formation in 1983.

News from Europe

By John Blau, European correspondent

Flat antennas simplify satellite reception

British Satellite Broadcasting (BSB) plans to have a direct broadcast satellite operating by the end of this year. It will have three transponders and make use of D2-Mac. To win over British viewers, BSB plans to offer extremely inexpensive reception equipment. It already has reached an agreement with the Scottish Fortel company to push its small-sized round and flat antennas instead of the common parabolic dish. The estimated cost is about $400.

Rupert Murdoch wants to be even cheaper. He recently leased four transponders aboard the Astra medium-power satellite, which is PAL-compatible.

Portuguese, Soviets reach agreement

The Portuguese public service RTP broadcaster and Soviet broadcasting authorities have reached an agreement to exchange programs and offer technical assistance for TV crews traveling both countries.

Philips to install Davos system in Turkey

The Holland-based Philips Kommunikations Industrie has won the bid to supply and install its digital audio-video optical system (commonly known as Davos) in Turkish state-run broadcasting studios. The system transmits high-quality analog TV pictures, digitally, from one TV studio to another. The laser version of the system, which also is planned for Turkey, can be installed later without difficulty. Installation will begin in the first quarter of this year.

Circle (97) on Reply Card

Convention will sport some changes

By Bob Van Buhler

The 1989 SBE Convention and **Broadcast Engineering** Conference promises to be the radio and TV technical event of the year for the broadcast engineer. Unlike other trade shows that cover many non-technical issues, this one focuses on providing practical, hands-on technical information.

Another strength of the SBE national convention is that it is the only fall gathering for both radio and TV engineers. Other fall events are separated into radio or TV topics. It's difficult and expensive for a TV engineer to attend more than one event, but the SBE convention solves that problem.

This year's schedule includes the topics of automation and robotics for TV cameras and tape systems, personal computer applications and remote control. Other areas to be discussed include the following: CD players, R-DAT recording, fiber optics, MIDI audio production and other new technologies for radio and television. Electronic news gathering (ENG) is expected to receive a lot of attention at the seminars. Papers are proposed on ENG camera maintenance, ENG training, new ideas for radio ENG, and the use of cellular phones in broadcast applications.

Manufacturers' workshops

A new feature is being added to this year's convention: manufacturers' workshops. These sessions, usually conducted at the factory or regional office locations, will be presented on Sunday immediately following the convention. They will be similar to the training provided by manufacturers at their factory schools.

Workshop topics are likely to include transmitters, VTR maintenance, computer-based troubleshooting, directional antenna systems and engineering management. The day-long sessions will provide intensive instruction on broadcast equipment maintenance. Although most sessions will be free, the company providing the training has the option of charging a reasonable fee.

This cost-effective approach allows you to combine factory training with convention attendance, and also lets you receive manufacturer training on the equipment your station owns. Additional time away from the station and extra transportation and lodging costs can be avoided. If you need help justifying convention attendance or want to receive factory training on your equipment, don't miss this event. The workshops, conducted under the auspices of the Ennes Foundation, are being coordinated by Don Borchert, director of engineering at WHA-TV, Madison, WI.

Additional product-specific training will be available during exhibit hours from the exhibitors. Some companies will provide special hands-on mini-sessions so that attendees can more closely examine and become familiar with their equipment. This not only benefits the exhibitors, but also helps broadcast engineers become better informed about their equipment purchases.

Seminar schedule

This year's seminars and workshops are being scheduled around exhibit hours. No longer will attendees be forced to choose between the seminars and the exhibit floor. The current convention schedule provides 23 hours of seminars and 12 hours of exclusive exhibition time. Additional information on topics to be presented at the seminars will be provided in upcoming issues of **BE**.

Professional licensing

SBE counsel Chris Imlay and vice president Bob Van Buhler met with Arthur Schwartz, counsel for the National Society of Professional Engineers (NSPE), in Alexandria, VA, on March 20 to discuss NSPE's position on the controversy over professional licensing.

According to Schwartz, the original position of the NSPE was to oppose actively the use of the term "engineer" by anyone other than a state-licensed professional engineer. The current position is that actions against persons other than professional engineers using the title of engineer always are taken through state licensing boards, and not by NSPE. Schwartz indicated, however, that the NSPE is a federation rather than a monolithic organization. This means that the member state associations are not controlled by the NSPE and may act independently.

SBE has been able to discover only a handful of complaints made to state licensing boards regarding telecommunications engineering. Few of these complaints involved broadcast engineers; most involved independent contractors who were practicing telecommunications engineering in non-broadcast areas.

One case did involve an Arizona contract broadcast engineer with more than 20 years' experience. His right to submit applications to the FCC was challenged by a Colorado professional engineer whose competing application was unsuccessful in an FCC proceeding. The broadcast engineer later was required by the state of Arizona to change the name of his business to include the term "broadcast engineering." He continues to prepare successful applications for broadcast stations in several states, which the commission accepts for filing.

Defending such actions can prove expensive. According to the engineer involved, legal fees to defend his right to do business were about $6,000. If you become involved in a similar situation, contact the national office for guidance.

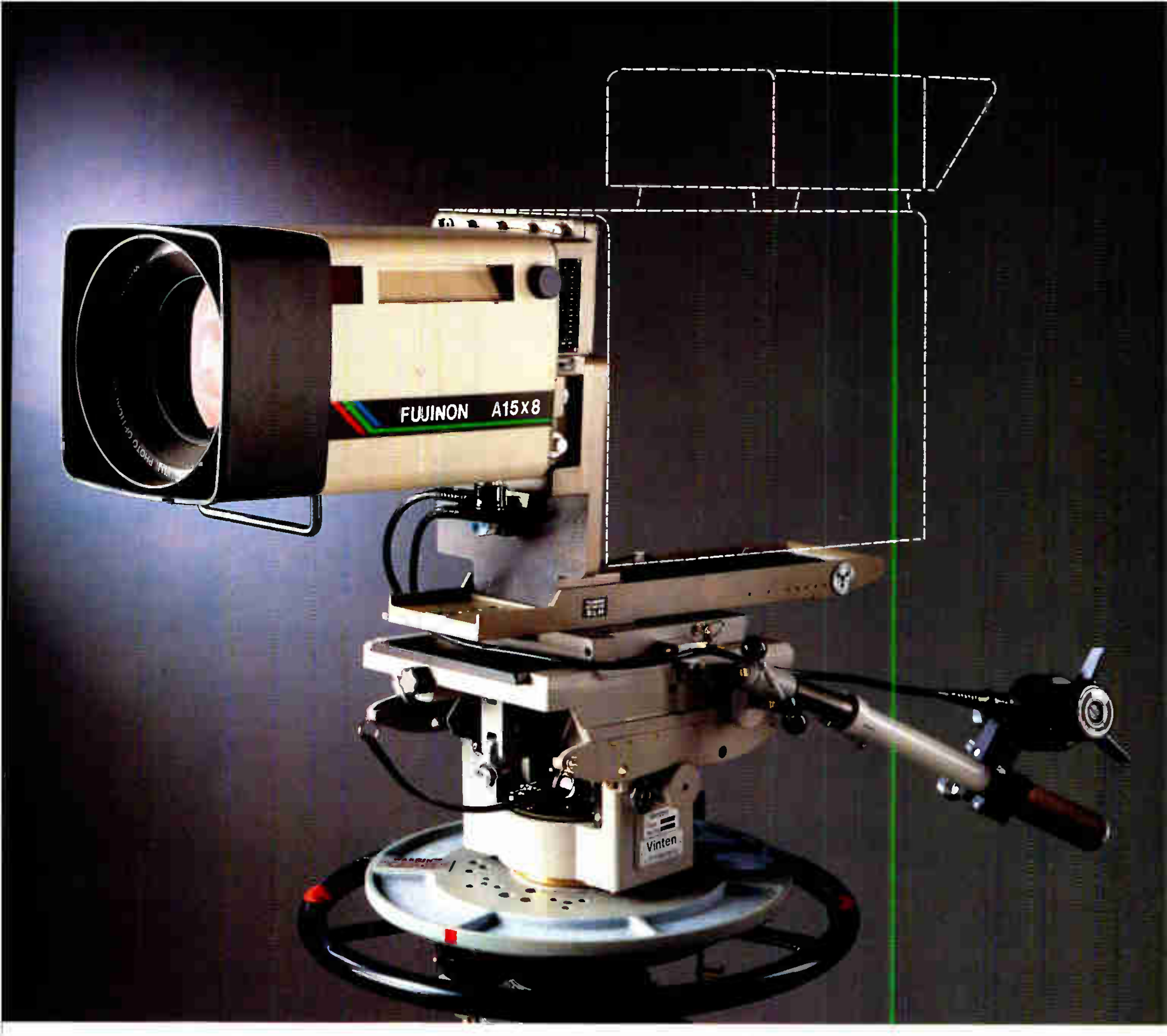
Nominations for national office

Nominations for national directors and officers are due June 1, 1989. A slate of proposed candidates will be published by July 3. Any SBE-certified member in good standing may run for officer and director positions.

The bylaws provide a procedure for introducing candidates who are not selected by the nominating committee. A person may be nominated by petition to the national office. The nominating petition must be received in the Indianapolis office by August 4. The ballots will be mailed by Sept. 1, and the return deadline is Oct. 2. Election results will be announced at the national convention in Kansas City, MO, Oct. 5.

Editor's note: For additional SBE information, GO BPFORUM on CompuServe.

Van Buhler is a broadcast engineer in Randallstown, MD.



READY NOW FOR THE NEXT GENERATION OF CCD CAMERAS.

FUJINON has created an entire line of studio and field lenses that meet the highest optical requirements for CCD cameras. Not only today's most advanced CCD cameras, but cameras still in development.

By working with camera manufacturers, establishing new standards for glass materials, building the prisms and creating systems to assure the critically precise placement of chips on the prisms, FUJINON has been able to achieve performance breakthroughs along the entire optical path.

The A15 × 8 ESM, shown here, has the lowest longitudinal chromatic aberration of any studio zoom. Results include the most accurate color and focus-tracking, higher MTF, and sharper corner resolution. Its F1.5 maximum aperture is absolutely flat from 8mm to 114mm (F1.7 at the full 120mm). But this is typical of all the FUJINON CCD studio and field lenses—A18 × 8, A20 × 7, A34 × 10, A34 × 20.5, A44 × 9.5 and the new A55 × 9.5.*

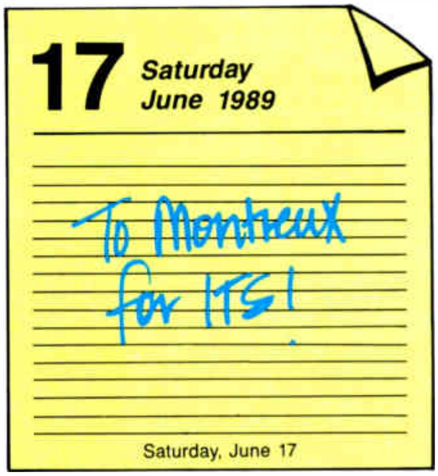
Regardless of camera generation, there's no gap. Conforming to the identical standards, these lenses are performance matched for total compatibility and interchangeability. For more information or a demonstration, call your nearest FUJINON location.

*Except for the A34 × 20.5 ESM, these 2/3" format lenses are also available in 1/2" format.

Circle (128) on Reply Card

FUJINON INC. 10 High Point Drive Wayne, New Jersey 07470 (201)633-5600
Southern 2101 Midway, Suite 350, Carrollton, Texas 75006 (214)385-8902
Midwestern 3 N. 125 Springvale, West Chicago Ill. 60185 (312)231-7888
Western 129 E. Savarona Way, Carson, California 90746 (213)532-2861

FUJINON
FUJINON A subsidiary of Fuji Photo Optical Co. Ltd



ITS to showcase HDTV festival

By Rick Lehtinen,
TV technical editor

Soon broadcasters and other video professionals will converge on Geneva, Switzerland, and make the 30-minute trip to the small town of Montreux, nestled on the shores of Lake Geneva. This biennial trek marks the occurrence of what might be called the European NAB. The 16th International Television Symposium and Technical Exhibition is scheduled for June 17-22.

Once again, the symposium has endeavored to attract the most qualified and innovative technical specialists from around the world. In addition, the symposium will operate concurrently with the Second International Electronic Cinema Festival, which is a showcase for the best high-definition TV productions.

Opening exercises

The symposium will open Saturday morning, with a welcome by the ITS committee chairman, E. Schwarz, followed by comments from the mayor of Montreux and the patron of the symposium. After various addresses, including a tape-recorded address by NAB president Eddie Fritts, the 1989 Montreux Achievement Gold Medal will be presented. The symposium reception will follow the opening exercises.

The Second Electronic Cinema Festival will open late Sunday afternoon, followed by the first of the festival screenings. Subsequent screenings will be scheduled throughout the symposium. The creators of high-definition TV productions will participate in a round table discussion on Thursday, the last day of the festival. The awards ceremony will follow. The Astrolabium Awards, named after the astrolabe, an ancient navigational tool that guided early seafarers, will be presented to outstanding HDTV filmmakers in several categories.

About the program

The technical sessions will be divided into two main tracks: broadcast and CATV. An HDTV system session and two highlight sessions also will be presented. Debuting at Montreux this year will be a series of early-morning workshops, intended for specialists, that will deal with topics of interest to a limited number of people. The workshops, which will be held Monday through Wednesday mornings before the main sessions, will cover technical characteristics of film for future TV production, conditional access for CATV and technical training.

About the exhibition

Central to each Montreux Symposium is the equipment exhibition. The exhibition space has been expanded. This year, 183,000 square feet of interior display and 107,000 square feet of space outside the building will be available to showcase the wares of more than 300 vendors. The city of Montreux recently has committed 9.5 million francs to improve the air conditioning in the Maison de Congress, an investment that should result in a cooler environment on the exhibit floor than in previous years.

Exhibit areas will be open on Saturday, June 17, from 11 a.m. to 6 p.m.; Sunday through Wednesday from 10 a.m. to 6 p.m.; and on Thursday from 10 a.m. to 2 p.m.

Spouse programs

The spouse program includes travel to local points of interest. On Monday, a full-day excursion by train and coach will include a visit to the Muse du Vieux Pays-d'Enhaut, dedicated to preserving regional arts and handicrafts from the Middle Ages to recent times. On Wednesday, a coach excursion to the Abegg Foundation, Riggisberg, will be offered. The foundation specializes in the conservation and restoration of ancient woven textiles. The fees, which include coffee break and lunch, will be 90 and 80 francs, respectively. Registration for spouse tours should be made immediately upon arrival in Montreux at the Spouse Program desk, ground floor lobby, Montreux Palace.

Free shuttle

Symposium badges and exhibition visitor cards will allow their bearers free transportation on the trolleys and buses of the Montreux-Vevey area public transportation services. A special discount fare for rail transport from Geneva-Cointrin airport is available through advance purchase from symposium management. Trains will run twice hourly from 6 a.m. to 11 p.m.

ITS program schedule

Saturday, June 17

Morning
Opening ceremony (P-1)

Afternoon
Systems session:
"HDTV Production: Today and Tomorrow" (P-2)

Sunday, June 18

Morning
Highlight session:
"The Commercial" (P-3)

Afternoon
Opening of Second Electronic Cinema Festival

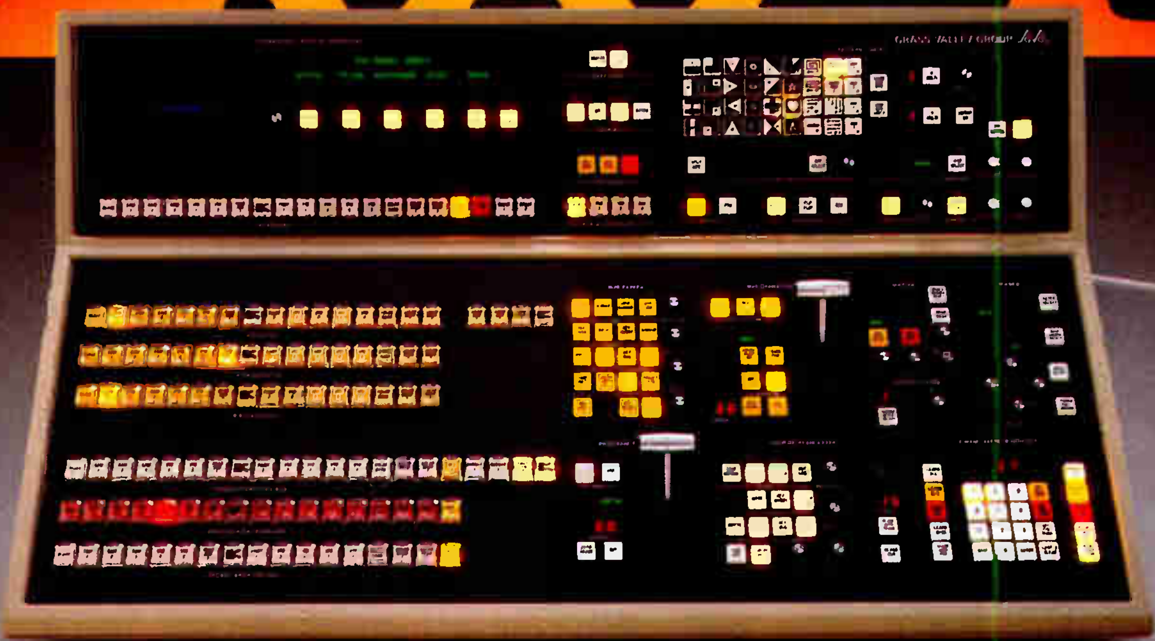
Monday, June 19

Morning
Broadcast sessions:
- Systems session (A-1) "Advanced Television Emission Systems"
- Systems session (B-1) "Recent Developments in Electronic News Gathering"

Afternoon
Broadcast sessions:
- Systems session (A-2) "HDTV Production Equipment"

Introducing the Power to Perform...

Model 200-1



...at an irresistible price.

You're looking for a one mix effects switcher. Yet you don't want to sacrifice big switcher power and performance.

We've got the perfect solution. The new Model 200-1 has the power to create many effects associated with larger, more expensive switchers. Power unmatched by any other one mix effects switcher:

- 20 inputs
- E MEM® Effects Memory System
- Three powerful keyers
- True linear keying in each keyer
- Most powerful key masking available
- Program/preset flip-flop mixer
- Powerful options including: Borderline® key edger with transparent shadow, Streamline™ effects controller with disk storage and timeline sequencing, safe title generator, 4 fully timed AUX busses, analog and matrix pattern expansion, and more.

UNDER $26,000

Big switcher power at a small switcher price. The Model 200-1 is the perfect solution.

For complete details on the Model 200-1 production switcher, contact the GVG office nearest you.

Grass Valley Group®
A TEKTRONIX COMPANY

THE GRASS VALLEY GROUP INC.

P.O. Box 1114, Grass Valley, CA 95945 USA
Telephone (916) 478-3000
TRT: 160432

OFFICES: New York (201) 845-7988; District of Columbia (301) 622-6313; Atlanta (404) 493-1255; Chicago (219) 264-0931; Minneapolis (612) 483-2594; Dallas/Fort Worth (817) 483-7447; Los Angeles (818) 999-2303; San Francisco (415) 968-6680; GVG International Ltd. (U.K.) +44-962-843939; Grass Valley Group Asia (HK) +852-3-7396632

Circle (102) on Reply Card

- Systems session (B-2)
  "Terrestrial Transmission Equipment 525/625"

CATV session:
"Advanced Television Systems on Cable" (C-1)

Tuesday, June 20

Morning

Highlight session:
"The Entertaining Screen — The Future" (P-4)

CATV session"
"CATV Network and Plant Design" (C-2)

Afternoon

Broadcast sessions:
- Equipment session (A-3)
  "Signal Origination in 525/625"
- Systems session (B-3)
  "TV Digital Bit-Rate Reduction"

CATV session:
"Optical CATV Transmission Progress" (C-3)

Wednesday, June 21

Morning

Broadcast sessions:
- Systems session (A-4)
  "Production Systems Analog and Digital 525/625"
- Systems session (B-4)
  "HDTV Standard Conversion — Production to Transmission"

CATV session:
"CATV Subscriber Premises Design" (C-4)

Afternoon

Broadcast sessions:
- Equipment session (A-5)
  "Recording Equipment 525/625"
- Round table (B-5)
  "The Impact of New Television Technology Worldwide"

CATV session:
"CATV Research and Development Topics" (C-5)

Thursday, June 22

Morning

Broadcast sessions:
- System session (A-6)
  "Post-Production Systems Analog and Digital 525/625"
- System session (B-6)
  "DBS Systems and Communication Satellites for Public Reception"

CATV session:
"Building the CATV Market" (C-6)

Afternoon

Broadcast sessions:
- Equipment session (A-7)
  "Processing and Editing Equipment 525/625"
- Equipment session (B-7)
  "Equipment for Satellite Transmission"

CATV session:
"New CATV Services" (C-7)

Nigel Spratling has been named Southern regional sales manager for AF Associates, Northvale, NJ. He will operate from a regional office that the company is establishing in Norcross, GA. The appointment represents a transatlantic transfer for Spratling, who had been based in London as marketing manager for Pegacom Electronics, a subsidiary of AF Associates.

Andrew H. Kryworuchenko and **Frank L. Rankel** have been appointed to positions with BTS, Salt Lake City. Kryworuchenko is national manager of group accounts. Rankel assumes sales and managing responsibilities for the Southeast region.

Frank J. Weissgerber and **Judith Knott** have been appointed to positions with Cablewave Systems, North Haven, CT. Weissgerber is Eastern regional sales manager. He is responsible for all sales of microwave antenna and transmission line systems to the military, commercial OEM customers and utility and telecommunication end-users. He also oversees the manufacturer's reps in the territory. Knott is manager of sales administration. She is responsible for coordinating the inside and outside sales force and overseeing the quality of customer service.

Paul S. Lines and **Edward Culkin** have been appointed to positions with Dielectric Communications, Raymond, ME. Lines is Western regional broadcast sales representative. He represents the company in Washington, Oregon, California, Montana, Nevada, Alaska, Hawaii and Idaho. Culkin is Western regional sales manager for dry air products/cable pressurization equipment. He is responsible for serving the Pacific Bell and US West territories. He also will be involved in designing and troubleshooting systems.

Walt Lowery has joined the broadcast marketing department at Gentner Electronics, Salt Lake City. He is responsible for training dealer sales people. He also will work closely with radio station engineering staff.

David N. Walton, Neil E. Neubert, John O. Brown and **Michael Messeria** have been appointed to positions with JVC Professional Products Company, Elmwood Park, NJ. Walton is marketing manager and is responsible for the creation and implementation of an overall marketing strategy that will include analysis of existing and potential markets for the company's products. He also will oversee communications, the sales program, product information to the field, sales training, customer tracking and advertising and public relations.

Neubert is manager of engineering. He is responsible for the technical evaluation of products as well as study and analysis of engineering and design-related technical issues. He also is responsible for product application engineering and video system integration assistance to users and customers. Additionally, he will oversee product operation, technical service and repair training and regional field service engineers.

Brown is national manager of market development. He is responsible for the development of new markets and will instruct and assist district marketing representatives in calling on these markets.

Messeria is national field manager. He

is responsible for supervision and coordination of field sales activities in the United States.

Joseph Ward and **David Tearle** have been appointed to positions with LEE Colortran, Burbank, CA. Ward is director of Canadian sales for LEE Colortran Canada. He is responsible for overseeing all sales of the company's products in Canada. Tearle is Western regional sales manager for LEE Filters, a division of LEE Colortran. He is based at the Burbank facility and is responsible for all LEE Filters' sales activity in the motion picture and theatrical markets in the western United States. He also will manage the filter product line working closely with the LEE Filters' manufacturing operation in Andover, England.

Telex Communications, Minneapolis, MN, has reorganized its sales and marketing staff. **Dan Dantzler** has been promoted to vice president of sales for professional audio, aviation and RF communications products as well as OEM sales. **Don Mereen** is executive director of marketing. He is responsible for new product and market planning, marketing services and technical customer service for all business segments except the hearing instruments group. He also will serve as acting director of strategic planning and corporate development. **Ted Nemzek** is senior director of sales for the audio-visual products group.

Austin Basso is the TV Americas Sales and marketing manager for Tektronix television division, Beaverton, OR. He is responsible for the U.S. sales force and marketing and also will coordinate TV sales and marketing activities with Tek subsidiaries in Canada, South America and Mexico.

Jeffrey Clarine has been appointed central regional sales manager for LDL Communications, Laurel, MD. He is responsible for the sale of LARCAN TV transmitters, Alan Dick antenna systems and LeBlank & Royle towers throughout the central United States.

Fred Himelfarb has been retained by the Panasonic Broadcast Systems Company, Secaucus, NJ, as full-time consultant. He is responsible for technical and demonstration support for broadcast cameras and will serve as an adviser in the development of future products.

Brett Samuels and **Brent Bullock** have been appointed to positions with ROSCOR, Mount Prospect, IL. Samuels is project coordinator. Bullock is branch manager of the Milwaukee office.

Mark Grasso and **Tom McDonough** have been appointed to positions with Schwem, Pleasant Hill, CA. Grasso is a regional sales manager responsible for the eastern United States and Latin America. McDonough is a regional sales manager in the western United States.

Eunice Davis and **Randy Opela** have been appointed to positions with HM Electronics, San Diego, CA. Davis has been promoted to pro audio general sales manager. She will direct all pro audio sales activities domestically and internationally. Opela is marketing product manager. He is responsible for new product development, product research and product introductions of the pro audio line.

Amek offers data sheets

Amek/TAC, U.S. Operations, North Hollywood, CA, has produced a series of data sheets to help broadcasters keep up with current trends. The information is assembled partly from the company's own experience and also from practicing broadcasters. The emphasis is on the techniques of broadcast production with particular emphasis on the needs of stereo television.

These sheets can be obtained by individual engineers, and also are available for use as training material by production and broadcast companies who don't have time for formal training programs.

Copies of these data sheets are available free of charge and can be obtained by writing to Peter Harrison at Amek/TAC U.S. Operations, 10815 Burbank Blvd. North Hollywood, CA 91601.

GML contracted to automate NEVE VR console

GML, Van Nuys, CA, has announced that Conway Recorders has become the first company to contract with GML to implement the GML series 2000 automation system into the Neve VR resettable console. Technically, on-line and off-line data will be manipulated up to 16Mbytes of RAM and will continue to be stored on the GML standard 40Mbyte hard disk. Also standard, and to maintain compatibility with several other console automation systems, data will archive to both 8-inch and 3.5-inch floppy disks.

Midwest opens office in Chicago

Midwest Communications, Edgewood, KY, has opened a branch office in Chicago. The address is 971 Busse Road, Elk Grove Village, IL 60007; telephone 312-981-1107.

Radio Systems opens new headquarters

Radio Systems has commenced business operations at its 33,000-square-foot headquarters in Bridgeport, NJ. The address is 110 High Hill Road, P.O. Box 458, Bridgeport, NJ 08014-0458; telephone 800-523-2133.

Solid State Logic and Quantel pool West Coast facilities

Quantel, sister company of Solid State Logic within the UEI Group, is to operate alongside SSL in its extended sales and service center in Los Angeles.

The office has been expanded by an extra 1,500 square feet for office, stores and demonstration studio use. A 500-square-foot demonstration studio houses an SL 4000 G Series multitrack console, complete with multitrack audio and video machines. These will be supplemented by Quantel systems and by SSL's ScreenSound digital audio-editing system.

Varian opens East Coast SATCOM service center

Varian Microwave Equipment Division, Palo Alto, CA, is expanding its satellite communications uplink power amplifier customer-support operation with the opening of its latest regional service center in Orange, NJ. The center provides local parts repair, installation and training service. The regional service center is located at 179 Lincoln Avenue, Suite L1, Orange, NJ 07050; telephone 201-674-9141.

Vision mixer and keyer

Polar Video has introduced the following products:

- The PVM-2 vision mixer includes 4×S-VHS (YC) inputs and S-VHS/highband dub outputs.
- The PCK-2 keyer comes in NTSC versions. It is a YUV/RGB chroma-key and linear downstream keyer with switch selection of the color or color-difference inputs and can be used for keying from pre-recorded component material.

Circle (350) on Reply Card

Digital effects system

Ampex Video Systems Division has introduced the ADO-100, a low-cost video effects system. The 2-D system with Z-axis spins, 3-axis rotation, mosaics, flips, rolls and tumbles can be upgraded to 3-D. Designed to integrate with Vista switcher systems, the effects equipment includes Digi-Matte key processing, keyframe editing, AutoCube and selectable types of motion. The 32-bit processing serves NTSC, PAL or PAL-M standards from 13.5MHz, 4:2:2 sampling architecture. The programmable system can be controlled from an internal system or from any MS-DOS PC.

Circle (351) on Reply Card

Crosspoint switch devices

Gennum has introduced the 4×1 GX434 crosspoint switch device that offers a flat response beyond 30MHz in video-routing switcher systems. The IC device, which is contained in 14-pin DIP or 16-pin SOIC packages, includes four analog video switches, 2-to-4 address decoder and chip-select logic for paralleled operation in a switching matrix. Group delay is rated ±0.3° with differential phase of 0.012° and differential gain of 0.03%.

Circle (352) on Reply Card

Digital effects system

James Grunder & Associates and *CEL Electronics* have introduced the P164 series that combines digital effects with TBC/framestore functions. Based on 8-bit, 4:2:2 sampling, the units accept up to four composite, as well as component, YC, YUV and digital inputs. Operable with the Maurice touch-screen controller, the infinite window TBC and 5-field framestore unit provides flips, mirrors, skew, ripple, cropping, zoom, perspective and other effects.

Circle (353) on Reply Card

Hands-free DMMs

Beckman Instrumentation Products has introduced the 200 series digital multimeters that include a 3-digit display and provide hands-free operation through audible signal indications. With auto-ranging, the meters also have a self-resetting fuse on current ranges. A voltage-to-frequency converter generates a tone proportional to the magnitude of the reading.

Circle (354) on Reply Card

Circle (110) on Reply Card

With Our Digital Effects Systems, You Can Smoothly Negotiate Every Flip, Tumble or Turn.

Top performance in a digital effects system means dynamic multiple effects, ultra-smooth transitions, user-friendly operation and more. Until now, a system with these features has been a luxury few could afford.

MF-2000 MULTIFEX Digital Effects Generator

With the MULTIFEX MF-2000, FOR-A has brought Digital Effects within much easier reach. At the post-NAB price of *$17,500*, the MF-2000 provides an impressive range of two-dimensional effects with substantial memory for storage and recall. Compression, multimoves, variable borders, mosaic, paint, negative, mirror, window, flip, tumble and more. With the smoothest transitions in the industry, and optimum picture quality thanks to FOR-A's unique anti-aliasing circuitry.

Engineering-wise, the MULTIFEX features a reliable, user-friendly membrane control panel plus the best signal-to-noise ratio and widest bandwidth of any digital effects generator available today.

We've done our homework and passed the test in digital effects. First with our FA-440, a top notch TBC with Video Effects generator and programmable memory. Next with our FA-740, a powerful independent channel freeze plus a dazzling array of digital and switcher effects for professional A/B roll editing. And now with the MULTIFEX MF-2000. A lot of performance for the money.

FA-740 Parallel Effects TBC

And every FOR-A product is backed by a full two-year parts and labor warranty. The industry's best.

So whatever your challenge—in broadcast, post-production or corporate TV—FOR-A can help you from start to finish.

FOR-A Corporation of America
Nonantum Office Park
320 Nevada Street
Newton, MA 02160
Main Office (617) 244-3223
Chicago (312) 250-8833
Los Angeles (714) 894-3311

We're with you every step of the way.

FOR.A®
INNOVATIONS IN VIDEO and AUDIO TECHNOLOGY

Circle (111) on Reply Card

Time Base Correctors • Digital Effects Systems • Video Production Switchers • Character Generators • Color Correctors • Signal Processors

VTR control system

American Broadcast Systems has introduced the MicroCart 200 VTR sequencer. The controller allows configuration as a single- or dual-channel playback system using existing VTRs, TBCs and monitoring equipment. The system is complete with computer, terminals, switching, sync distribution, interfaces, printers and cable harness to operate eight VTRs.

Circle (355) on Reply Card

Effects and crossover systems

Industrial Strength Industries has announced the R-16 digital audio effects processor and CN-40 stereo crossover network. The R-16 system uses a 16-bit processor with 32-bit numeric processing to produce 30 preset sound effects with additional capability of 69 programmable effects. All parameters and changes may be accomplished through a full MIDI control interface. Spectrum analysis, FFT and 3-D plotting PC and Atari diagnostic software are included. The CN-40 from NIH Labs shows the crossover frequency with a digital readout and can be set up for various stereo and mono configurations. The network features a 10Hz-100kHz response with 24dB/octave slopes.

Circle (356) on Reply Card

Metal particle degausser

Audiolab Electronics has introduced the model TD-5 degausser, designed for use with metal particle videotape. For high-coercivity media, the system accepts Beta SP, M-II, D-I, D-2 DAT and 8mm formats as well as 2-inch reels to 16 inches in diameter.

Circle (357) on Reply Card

Computer security equipment

B & B Electronics has introduced the model 232MSD modem security device, for use with most stand-alone modems compatible with the AT command set. Calls received by an auto-answer modem are intercepted by the device, which requests a password from the caller. If the password is valid, the unit waits for the caller to hang up, then calls the phone number stored with that password, allowing access to the computer.

Circle (358) on Reply Card

PS/2 interface

Philips Test & Measurement has introduced the PM 2201 and PM 2202 interface cards for IBM PC/XT, PC/AT and PS/2 personal computers. The board requires one expansion slot and allows the PC to be used as a controller for GPIB/IEEE-488 instrumentation or measurement systems. No hardware settings are required. Initialization in the PS/2 computer is handled by the integral programmable option select facility of the PS/2 microchannel operating system.

Circle (359) on Reply Card

Modular video DAs

Avitel Electronics has announced the 3200 series of modular video DAs. A 3RU frame contains 15 DA modules. Each module can be upgraded in the field to any TV standard as well as HDTV. Options include cable equalization, black-level clamping, sync detection and plug-in video delay modules.

Circle (360) on Reply Card

Fractal image system

The science of chaos is the basis for "natural-looking" fractal geometry images created by *Iterated Systems* vector recurrent iterated function system (VRIFS). The nature of the data required to produce the fractal images allows 1,000 complex images to be stored in 1Mbyte of disk space. The software, capable of generating standard graphics, fonts and maps, is available for SUN 3 and SUN 4 workstations.

Circle (361) on Reply Card

Modified Si-target vidicon

BURLE Industries has introduced the 1-inch Ultricon vidicon. Based on silicon-target technology, the camera pickup tube target has been modified to produce approximately the same spectral response of a Newvicon tube and can be used as a direct replacement. The response is 10% higher in red and infrared, while the silicon target material allows burn resistance during operation in direct sunlight.

Circle (362) on Reply Card

Throat microphone

Dynatech Tactical Communications has introduced the TM-2 throat microphone. Particularly useful in noisy environments, for use with protective clothing or with breathing apparatus, the throat mic picks up speed through vibrations in the larynx at normal speech levels and uses a bandpass filter to reduce low-frequency resonance. The unit comes with neckstrap, earshell receiver, VOX/PTT radio adapter and radio connector.

Circle (363) on Reply Card

A-V processing, DA modules

FSR has announced the EZ Box Line, a

series of modular units for audio and video functions. Current modules of the series include NTSC-to-RGB, video and audio DAs, RGB DA, audio-summing amplifier and phantom-powered mic pre-amp. For computer users, two converters provide RGB from VGA and CGA graphic board outputs.

Circle (364) on Reply Card

Circle (112) on Reply Card

Digital satellite terminal

LNR Communications has introduced the DAVSAT, designed for communications with remote sites or backhaul program audio. It can be configured for a mix of data and voice or stereo audio signals. Signal integrity at 256kbits/s BPSK or 512kbits/s QPSK simplex or duplex operation is assured with forward error correction. The system is available for C- or Ku-band frequencies.

Circle (365) on Reply Card

No holes RF coupler

Electron Processing has introduced three models of the WPO RF couplers, which include one each for UHF and VHF transmission and one for VHF/UHF reception. WPO-VHF and WPO-UHF are rated for 25W with 1.5:1 VSWR across a 10MHz section of the band. A coupler consists of two 3×3×1.5 weatherproof boxes that mount on either side of a pane of glass. Transmission line connects to each box through BNC, PL-259 UHF or F-type connectors. No holes through the wall or window are required. Transmission loss is approximately 2dB, while reception loss is approximately 8dB.

Circle (366) on Reply Card

Lens protection

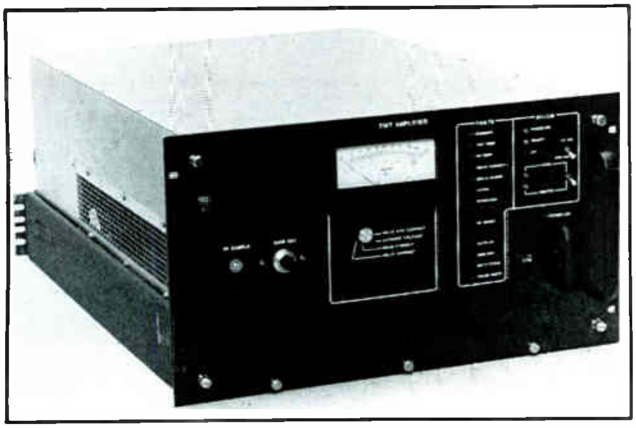
Nalpak Video Sales has introduced the LC-5 folding lens cap, held in place by an elastic band. The soft protective cover folds for convenient storage in the camera operator's pocket.

Circle (367) on Reply Card

Circle (113) on Reply Card

TWT HPA system

Keltec Florida has introduced the Series 640 high-powered pulse amplifiers that produce output powers to 10kW in the frequency spectra of 1-18GHz. The TWTbased amplifiers are mounted in racks with internal forced-air cooling, a solid-state power supply and TWT protection. Along with nine standard models, the systems can be custom-configured.



Circle (368) on Reply Card

Image database management

PCM/PC Manager has introduced a complete image database management system called PC Album Network. For any PC networking system, the package allows capture of images from cameras or recorded video sources and software management of full-color images with textual data information. Record and file locking features provide security from unauthorized access by other system users.

Circle (369) on Reply Card

Fiber-optic products

Math Associates has introduced the AGC-PLUS automatic level control circuit. For use with the Fibervision fiber-optic transmission systems, this option maintains a 1Vp-p video signal output that is independent of fiber-optic cable attenuation, aging of the transmitting LED, degradation caused by splices or other factors that affect optical attenuation. Systems using the AGC option exhibit 10MHz bandwidth independent of attenuation and full compatibility with NTSC, PAL, SECAM and D2MAX baseband video protocols.

Circle (370) on Reply Card

Transient protection system

MCG Electronics has introduced the metal oxide varistors (MOV) in the Surge Master B that act in less than 5ns time following transient overvoltages transmitted along power lines. The modular system includes triple redundancy of the protection devices. Front-panel indicators include status and a transient event counter to monitor the overvoltage occurrences in a given time period.

Circle (371) on Reply Card

Circle (119) on Reply Card

Circle (126) on Reply Card

Dual-channel oscilloscope

Leader Instruments has introduced the 20MHz model 1021 oscilloscope. It provides front-panel selection of a variety of triggering options including variable trigger hold-off, TV sync separators, LF and HF reject and line triggering. The 2-channel instrument has a 1mV sensitivity of signals for display on an 8×10cm CRT using an internal graticule with autofocus.

Circle (372) on Reply Card

Hybrid cables

Chromatic Technologies has introduced a line of cables that include six optical fibers of any type along with four twisted-copper pairs. Each fiber is protected by its own jacket. An oval shape keeps electrical conductors and optical fibers separated for easier field installation without special breakout kits.

Circle (373) on Reply Card

Amiga interface card

Users of the Amiga 2000 series from *Commodore Business Machines* can now use an A2286D bridgeboard to bring the Amiga 2000, 2000HD or 2500 personal computer up to MS-DOS compatibility. The co-processor card requires one expansion slot, but allows the computer to continue to perform multiple applications through multitasking without losing the graphics capability of the computer. The board includes an 8MHz 80286 CPU chip, 1Mbyte RAM and 80287 socket. After installation, several AT-compatible hardware cards can be used in the Amiga and a single hard disk can be shared between MS-DOS and AmigaDOS applications.

Circle (374) on Reply Card

Lighting accessories

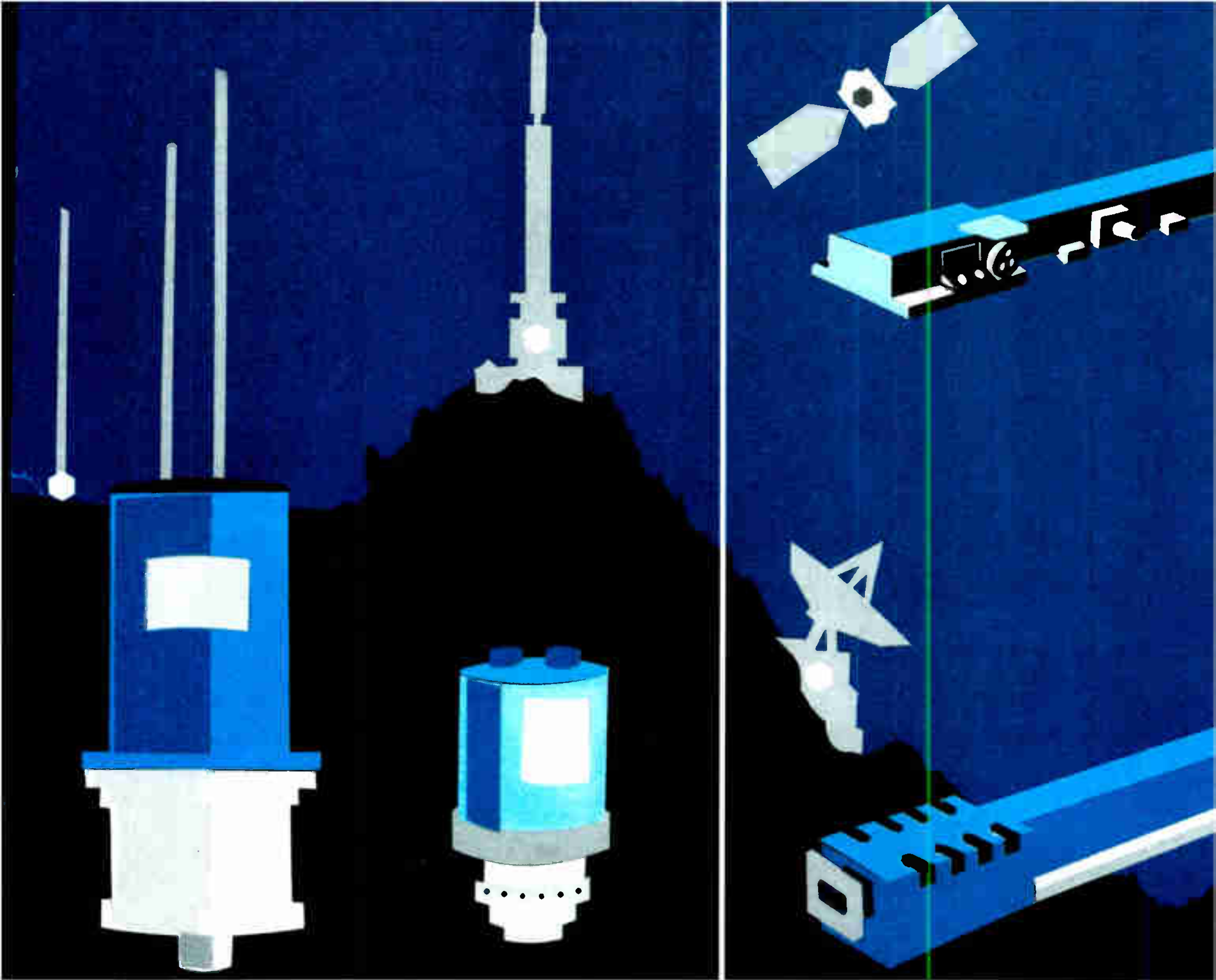
William A. McIntire Enterprises has introduced a series of accessory lighting units. The Magic Box series includes dimmer units, flicker generator/dimmers, light-effects units and power controllers. All are portable for on-site use and include carrying handles. Packaging for the units is designed to withstand the hard use of portable operation.

Circle (375) on Reply Card

Camera headset

Nady Systems has introduced the NHM-220/200 camera operator headset with boom mic, allowing hands-free narration by the operator. Dual connectors plug into the camera headphone jack and external mic or onboard mic jack of the camera.

Circle (376) on Reply Card



WHO'S AT THE HEART OF BROADCAST PERFORMANCE?

Thomson Tubes Electroniques!

A world leader in electron tube technology, our tetrodes benefit from advanced Thomson technologies such as Pyrobloc® pyrolitic grids and Hypervapotron® cooling. They deliver the power you need: up to 50 kW for television, up to 1.2 MW for radio. Thomson tetrodes are technical and price performers. Indeed, our 500 kW TH 558 tetrode has been providing problem-free radio transmission worldwide for more than 15 years. And it's been chosen by Voice of America and other demanding customers.

For VHF and UHF television transmitters and translators, you'll find a range of tetrodes featuring reliability and precision. Each tetrode is available with its cavity.

For DBS, we can equip the entire Ku-band transmission chain with top-performance earth station tubes, as well as a full range of satellite TWTAs from 70 W to 130 W ready today for next-generation transmissions.

On earth or in space, we're at the heart of radio and television transmitting with the performance you depend on!

THOMSON TUBES ELECTRONIQUES

Circle (36) on Reply Card

France: BOULOGNE-BILLANCOURT
Tel.: (33-1) 49 09 28 28
Fax: (33-1) 46 04 52 09

Inde: NEW DELHI
Tel.: (91-11) 644 7883
Fax: (91-11) 644 7883

Brasil: SAO-PAULO
Tel.: (55-11) 542 47 22
Fax: (55-11) 61 50 18

Italia: ROMA
Tel.: (39-6) 639 02 48
Fax: (39-6) 639 02 07

Canada: MONTREAL
Tel.: (1-514) 874 00 88
Fax: (1-514) 874 40 76

Japan: TOKYO
Tel.: (81-3) 264 63 46
Fax: (81-3) 264 66 96

Deutschland: MÜNCHEN
Tel.: (49-89) 78 79 - 0
Fax: (49-89) 78 79 - 145

Sverige: TYRESÖ
Tel.: (46-8) 742 02 10
Fax: (46-8) 742 80 20

España: MADRID
Tel.: (34-1) 405 19 15
Fax: (34-1) 404 60 02

United Kingdom: BASINGSTOKE
Tel.: (44-256) 84 33 23
Fax: (44-256) 84 29 71

Hong-Kong: WANCHAI
Tel.: (852-5) 865 32 33
Fax: (852-5) 865 31 25

U.S.A.: TOTOWA, NJ
Tel.: (1-201) 812 9000
Fax: (1-201) 812 9050

TDR fault locator

Riser-Bond Instruments has introduced an LCD waveform display on the model 1210 time-domain reflectometer system. It indicates the location of opens, shorts, faulty connections, water ingress and impedance discontinuities in any type of metallic-paired cable. The portable unit, powered by NiCad batteries, includes a thermal printer, allowing permanent copies of waveforms and other data. Accuracy of the measurements is ±0.01%.

Circle (377) on Reply Card

Speaker cables and CD rings

Monster Cable has introduced two audio products. The MΣ series includes the M•Sigma 2000 audio interconnect cables, terminated with T-series connectors that provide secure mechanical and electrical contact with a 24K hard-gold ground contact. M•Sigma 2 speaker cable is a multibundle network configuration with alternating positive and negative conductors around a solid center with pressure-fused spade connectors pre-attached. CD SoundRings are high-density material rings that create centrifugal force on the outside edge of a compact disc to stabilize the rotational speed and reduce vibration and flutter.

Circle (378) on Reply Card

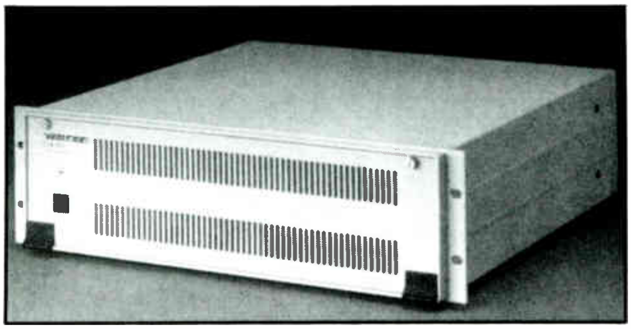
Data line protection

Transtector Systems has introduced the DLP series data line protector devices. For 9-, 15- and 25-pin RS-232 connections, the user can select which of the data pins are to be protected from transient voltage surges that could damage delicate computer-based equipment. Using a silicon technology, the DLP units respond to transients within 5ns and provide peak power dissipation to 15kW.

Circle (379) on Reply Card

Scan converters

YEM and *James Grunder & Associates* have introduced three scan converter units. The CVS-450A real-time converter accepts inputs from computer-graphics systems operating from 32kHz to 80kHz and uses 8-bit processing to produce RGB video with HD/VD and sync signals. The CVS-900A accepts input scan rates 15kHz to 38kHz from VGA, MAC II, PGC 640×480 to produce NTSC RS-170A or EBU outputs for S-VHS, ED-Beta, Beta/M-II, Y/R−Y/B−Y as well as composite and RGB. CVS-950A accepts 48kHz to 80kHz inputs with automatic locking from high-resolution, non-interlaced workstations and uses 8-bit processing with aspect ratio, picture positioning and flicker elimination to produce Beta/M-II, S-VHS, composite and superimposed outputs.



Circle (380) on Reply Card

Solid-state message announcer

DINET has introduced the DVA 1000 for automatic telephone answering, display narration or public address announcements. It uses solid-state technology to answer six telco lines and features up to nine minutes of message storage. All callers hear a stored message from its beginning, even during heavy calling periods. In other applications, 10 outgoing messages may be programmed independently or linked into complex messages of which small segments can be individually edited as needed, rather than re-recording an entire message.

Circle (381) on Reply Card

Fiber-optic transmission

PCO has introduced the PCO-5050 miniature, portable fiber-optic audio-video transmitter. BNC and XLR input connectors link video and audio to the battery-operated unit. The 1,300nm multimode fiber carries FM signals to distances of 8km with a quality that meets or exceeds EIA RS-250B. Dual audio subcarriers are set at the factory for 6.2MHz, 6.4MHz or 6.8MHz. Video response is ±0.15dB, 10Hz-5MHz; audio response ranges 50Hz to 15kHz.

Circle (382) on Reply Card

Pro audio equipment

LightForce has announced its distributorship of the Citronic professional audio equipment, including the SPX5-41 crossover, SPX7-21 15-band equalizer, SM and MPX range of audio mixers and the VM340 video controller.

Circle (383) on Reply Card

Portable satellite remote link

Raytheon Marine Company has introduced the JUE-45T portable satellite communications system, manufactured by Japan Radio Company. The unit is designed to operate through the INMARSAT satellite network on L-band frequencies (1636.5-1645MHz transmit, 1535.0-1543.5MHz receive). Primarily offered for business and public service users, the system with 2.87-foot diameter antenna, fold-out stand and electronics unit requires approximately 10 minutes to set up for telephone, fax, computer or slow-scan TV applications.

Circle (384) on Reply Card

Multipair audio and plenum cable

Marshall Electronics has introduced three new products. From the Mogami division comes series 2930 snake cable offering a range of 2-48 pair of color-coded audio conductors, each with drain wire. The individual conductors are sheathed in cross-linked polyethylene. Also from Mogami, TCS5139 dual 75Ω coaxial cable for S-VHS comes in lengths from six feet to 50 feet with a 4-pin mini DIN plug termination. The 0.118-inch diameter cable uses a 25-strand center conductor. The SoundRunner division provides oxygen-free, plenum cable for high-definition speaker applications. Approved under NEC 725 CL2, the cable is available in 12ga and 16ga weights.

Circle (385) on Reply Card

Professional services

Classified

Professional services

UNUSED
CALL LETTERS
CALL
dataworld®
1-800—368-5754

NETCOM (201) 837-8424
NETWORK COMMUNICATIONS CONSULTANTS
931 TEANECK ROAD, TEANECK, N.J. 07666
STATE OF THE ART ENGINEERING FOR AUDIO & VIDEO
- **FACILITY PLANNING**
- **SYSTEM DESIGN**
- **CAD SERVICES**

HIGH PRIORITY CONSULTING
CAD Documentation
for the Audio/Video Industry
Facilities, Product and Equipment
Design, Schematics
212-246-3811 X510 SVC

IN OUR CONTINUING EFFORTS TO SERVE YOU...

From time to time, Intertec Publishing Corp. makes its subscriber lists available to carefully screened companies or organizations whose products, services, or information may be of interest to you. In every case, list users must submit their promotional material for approval. They may use the list only once.

No information other than name and address is ever divulged, although names may be selected by segments to which the particular offer might appeal.

We are confident that the majority of our readers appreciate this controlled use of our mailing lists. A few people may prefer their names not be used.

If you wish to have your name removed from any lists that we make available to others, please send your request, together with your mailing address label to:

Direct Mail Mgr.
Intertec Publishing Corp.
P.O. Box 12901,
Overland Park, KS 66212

Advertising rates in Classified Section are $1.50 per word, each insertion, and must be accompanied by payment to insure publication.

Each initial or abbreviation counts a full word. Minimum classified charge, $35.00.

For ads on which replies are sent to us for forwarding (blind ads), there is an additional charge of $40.00 per insertion, to cover department number, processing of replies, and mailing costs.

FOR SALE

FULLY REFURBISHED TP-66 Film Projector $4,500. Refurbed TP-7 slide projector system $1,250. SIMBER BROADCAST SERVICES (609) 435-1091. 05-89-1t

EXCELLENT CONDITION LIKE NEW: One Fujinon 7x7.5mm Sony mount lens (latest version, "Cyclops"): $5,000; one J-labs HL79A-D betadaptor: $650; one Sony BVP-50 CCD [Camera head only] with one Sony BVW-1A (with VA-1 adapter): $21,000, with CA-3A head adapter and RM-P3 paint box: $22,500; one Sony BVP-30 with CA-3A and Fujinon 14:1 lens (CCD rated Pegassus II model): $13,000; One BVW-20 with any of above $2,500. (415) 841-0601. 05-89-1t

MINT SONY BETACAM EQUIPMENT...2 BVW-40 Recorders, $14,500 ea.; 2 BVP-3A Cameras/BVV-1A Recorders, $15,000 ea.; 1 BVP-3 Camera/CA-3 Adaptor/VA 1V component adaptor, $14,500; 1 BVW-75 Betacam SP recorder, $29,500; 1 NEC Eflex Digital Efx., $10,000. Ask for Dave 202-546-8900. 5-89-1t

FOR SALE: New Tektronix VM-700 opt 1, $15,250.00; new Skotel TCG 80-N, $1,500.00; new Sony BVH-2K AU-27 cards, $150 ea.; new Tektronix 2430 A Digital Scope, $7,000.00. Contact Bob Blanks, 212-972-3400. 3-89-3t

SONY DXC3000 CAMERA with Fujinon 14x1 plus 2X; BVU110 Recorder with time code; VO6800 Recorder. 616-456-9010. 05-89-1t

GRASS VALLEY 1680-10V SWITCHER. Chroma keyer, analog borderline, single mix effects. Great condition. $11,000. Contact: David Walker (804) 355-8637. 05-89-1t

SERVICES

AUDIO AUTOMATION: Computer controlled, 8-CD changers, music and commercial program software, hard disc for commercials. Complete: $6900. BGM INTERNATIONAL, (904) 438-8054. 7-71-tfn

WE PLACE ENGINEERS
ALL CATEGORIES FOR TV, PRODUCTION, VIDEO, CATV (EXCLUDING OPERATORS)
America's Leading Source for a Decade
(TV STATIONS, PRODUCTION FACILITIES, CORP TV, MFG, CATV)
For information phone or write Mark Kornish
key systems
479 Northampton Street
Kingston, PA 18704
Employer Paid Fees
(717) 283-1041

TRANSMITTING AND CAMERA TUBES. One stop for all of your requirements. All foreign and domestic brands, rebuilts, and obsolete material available at low, low prices. Large inventory means fast delivery. Daily Electronics, P.O. Box 5029, Compton, CA 90224, (800) 346-6667, (213) 774-1255. 3-89-6t

TRANSMITTER TUBE REBUILDING SINCE 1941: 3CX2500, 4CX5000, 4CX15000 and many others. Write for details. FREELAND PRODUCTS INC., Rt. 7, Box 628, Covington, LA 70433. (504) 893-1243 or (800) 624-7626. 6-79-tfn

MILWAUKEE SCA CHANNEL FOR LEASE: Class B Milwaukee FM station. Excellent coverage of Milwaukee metro and beyond. Call Dave Edwards, WUWM Radio, 414-229-4664. 05-89-1t

HELP WANTED

BROADCAST EQUIPMENT SALES REP—Leading national distributor of broadcast audio equipment is expanding our sales rep organization. We seek aggressive professionals. We support your efforts and pay top commissions. Exclusive territories available in most regions of U.S. Send resume to Mr. Roy Laurence, RADIO RESOURCES, 7483 Candlewood Road, Hanover, MD 21076. 05-89-1t

DIRECTOR OF TECHNICAL OPERATIONS AND ENGINEERING. The Museum of Broadcasting, New York City, requires an individual with a minimum of 10 years broadcast experience in television systems and components. An engineering degree or the equivalent is required; good network and industry contacts a plus. Reply with resume and salary history to M. David Weidler, Treasurer, The Museum of Broadcasting, One East 53rd St., New York, N.Y. 10022 05-89-1t

TV BROADCAST MAINTENANCE ENGINEER: Must have FCC General License and at least two years experience in TV Studio equipment maintenance. Should be familiar with ¾ in. ENG equipment, cameras, and 1 inch videotape. Some transmitter and microwave experience a plus. Submit resume and salary requirements to: KIMT TV, Dale Byre Chief Engineer, 112 N. Penn., Mason City, Iowa 50401. Phone 515-423-2540. 05-89-1t

CNN

TELEVISION ENGINEERS

Turner Broadcasting System, the leading News, Sports and Entertainment system in satellite communications, has career opportunities for engineers with **broadcast maintenance** experience. These positions demand an extensive background in television engineering and at least two years of training in electronics technology. Turner Broadcasting System offers an excellent benefit and compensation program. Send resume to:

Mr. Jim Brown, Engineering
Turner Broadcasting System, Inc.
One CNN Center
P.O. Box 105366
Atlanta, Georgia 30348-5366
404-827-1638

TBS is an equal opportunity employer.

TELEVISION MAINTENANCE ENGINEER needed for top UHF Independent in San Diego, CA. Must be a hands-on, take charge engineer, with three or more years of UHF transmitter experience. Studio and microwave maintenance experience is helpful. Send resumes to: Richard Large, KUSI-TV, 7377 Convoy Court, San Diego, CA 92111 or call 619-571-5151. E.O.E. 05-89-1t

MAINTENANCE ENGINEER: Expanding, full-service post production facility in beautiful Pacific Northwest looking for versatile engineer. Responsibility for maintenance of D-2, Sony BetacamSP, CMX-3600, etc., plus audio sweetening room, field production equipment and duplication department. Send resumes, references and salary requirements to: Engineer, P.O. Box 1288, Lake Oswego, OR 97035 05-89-1t

KU SNG TRUCK ENGINEER Opening soon for KU Satellite SNG truck engineer at fast growing modern VHF television station in northeast. Will chiefly be responsible for operation and maintenance of truck, but may also be used for studio maintenance. An EOE. Respond Broadcast Engineering, P.O. Box 12901, Dept. 705, Overland Park, KS 66212. 05-89-1t

Classified

HELP WANTED (CONT.)

MAINTENANCE ENGINEER needed for national cable network based in Hollywood. Must be current and competent in the operation, trouble-shooting, repair and installation of broadcast video and audio equipment. Send resume and salary requirements to: Manager, Network Services, P.O. Box 38934, Hollywood, CA 90038-0934. 05-89-1t

CNN

SATELLITE UPLINK ENGINEERS

Cable News Network, the leading news system in satellite communications, has career opportunities for engineers with earth station maintenance experience. These positions demand an extensive background in television and satellite uplink engineering. There will be some travel involved. Turner Broadcasting System offers an excellent benefit and compensation program. Send resume to:

Jim Brown, Engineering
Turner Broadcasting System, Inc.
One CNN Center, Box 105366
Atlanta, Georgia 30348-5366

TBS is an equal opportunity employer

BROADCAST ENGINEER—WFNX-FM, Boston Phoenix Radio seeks and engineer for a Class A station located in the metro Boston area. Responsibilities include studio maintenance engineering, remote broadcasts and maintenance of high powered transmittiing equipment. Qualified candidates will have 3-5 years related work experience. Please call Max Tolkoff, Program Director at 617-595-6200 or send resume to: WFNX-FM, 25 Exchange St,, Lynn, MA 01901. 05-89-1t

MAINTENANCE ENGINEER: Central California network affiliate seeks maintenance engineer with minimum 3-years experience in the maintenance and component level repair of modern broadcast equipment. Resume to Personnel, KSEE, P.O. Box 24000, Fresno, CA 93779. EOE M/F/H 05-89-1t

MAINTENANCE TECHNICIAN Immediate opening for studio maintenance technician in fast growing modern VHF television station in northeast. Must have ¾ and ½ inch tape experience. Grass 300, ADO, Chyron, Utah Betacart, and satellite experience also helpful. An EOE. Respond Broadcast Engineering, P.O. Box 12901, Dept. 705, Overland Park, KS 66212 05-89-1t

R.F. MAINTENANCE ENGINEER—KCPQ-TV is seeking a television maintenance engineer with strong background in VHF-TV transmitters, broadcast microwave and satellite communication equipment. Five years full-time VHF transmitter maintenance experience required. Previous experience with RCA dual G-Line transmitters preferred. Valid drivers and FCC General Class licenses are required. KCPQ maintains a modern, well-equipped CP transmitting plant. Full benefit package and generous 401K plan are provided. KCPQ is an equal opportunity employer. Resumes: Larry Brandt, Chief Engineer, KCPQ-TV, POB 98828, Tacoma, WA 98499. No phone inquiries. 05-89-2t

CHIEF ENGINEER for Northern California. AM/FM. Great place to live and work. We're small, but we have great equipment. Experience in transmitter, antenna, automation, solid state, and computers. Send resume to KSYC/KYRE, 316 Lawrence Ln., Yreka, CA 96097. 05-89-1t

MAINTENANCE ENGINEER: Need five plus years experience in Post Production, with experience in maintaining one inch VTRs and Abekas, Quantel, Ampex effects devices. Please send resumes to One Pass Video, Attn: Chief Engineer, 185 Berry St., San Francisco, CA 94107. 5-89-1t

BRITISH BROADCASTING CORPORATION Senior Engineer, New York. In the USA, the BBC is well known for its high quality television programs, ranging from classic drama to Monty Python. In the corporation's New York bureau BBC staff assist in the production of a wide range of television and radio programs for the UK, including news, current affairs, sport, science and general entertainment. Could you lead a small team responsible for the operation and maintenance of broadcast equipment in the New York bureau? Could you give advice to production staff about the most effective way of transmitting live programs from any part of the USA to the UK? Apart from being able to demonstrate your potential for leadership, you must have relevant experience with broadcast quality video and audio equipment. Knowledge of facilities offered by common carriers within the USA is essential. Send resume as soon as possible to: Jonathan Crane, Head of BBC, New York, 630 Fifth Avenue #2153, New York, NY 10111. 05-89-1t

SITUATION WANTED

TECHNICAL EIC/VIDEO ENGINEER—15 years experience including major television network and nationwide mobile production facilities. FCC licensed/SBE Senior Television certified. For resume and information: (412) 264-4756. 5-89-1t

TRAINING

FCC GENERAL RADIOTELEPHONE operators license through cassette recorded lessons at home plus one week seminar in Boston, Washington, Detroit or Philadelphia. Our twentieth year teaching FCC license courses. Bob Johnson Radio License Preparation, 1201 Ninth, Manhattan Beach, Calif. 90266. Telephone (213) 379-4461. 8-81-tfn

NAPA VALLEY COLLEGE offers a 2-year telecommunications program with emphasis in 1-Inch "C" format, T.B.C.S., component and digital video. Call or write Gary Vann, (707) 253-3258 Napa Valley College, Napa, California 12-88-9t

Want more information on advertised products? Use the Reader Service Card.

Advertising sales offices

SANTA MONICA, CALIFORNIA
Herbert A. Schiff
Telephone: (213) 393-9285
Telefax: 213/393-2381
Jason Perlman
Telephone: (213) 458-9987
Telefax: 213/393-2381
Schiff & Associates
501 Santa Monica Blvd., Ste. 504
Santa Monica, CA 90401

OXFORD, ENGLAND
Nicholas McGeachin
Intertec Publishing Corp.
Roseleigh House
New Street
Deddington
Oxford OX5 4SP
England
Telephone: (0869) 38794
Telefax: (0869) 38040
Telex: 837469 BES G

TOKYO, JAPAN
Mashy Yoshikawa
Orient Echo, Inc.
1101 Grand Maison
Shimomiyabi-Cho, 2-18
Shinjuku-ku, Tokyo, 162, Japan
Telephone: (03) 235-5961
Telex: J-33376 MYORIENT

CHICAGO, ILLINOIS
Vytas Urbonas
Telephone: 435-2361
Telefax: (312) 922-1408
55 East Jackson
Ste. 1100
Chicago, IL 60604

NEW YORK, NEW YORK
Diane Gottlieb-Klusner
Telephone: (212) 702-3404
Telefax: (212) 702-7802
Mike Trerotoli
Telephone: (212) 702-3405
Telefax: (212) 702-7802
866 Third Ave.
New York, NY 10022

FREWVILLE, AUSTRALIA
John Williamson
Hastwell, Williamson, Rep. Pty. Ltd.
109 Conyngham Street
Frewville 5063
South Australia
Phone: 799-522
FAX: 08 79 9522
Telex: AA87113 HANDM

CLASSIFIED ADVERTISING
OVERLAND PARK, KANSAS
Renée Hambleton
P.O. Box 12901
Overland Park, KS 66212
913-888-4664

Ad index


6129
A GENERATION AHEAD OF ITS TIME
SIX LEVELS OF VIDEO
IN TWO MIX EFFECTS SYSTEMS
FOR FEWER TAPE GENERATIONS
IN EDITING
SURPASSES EVERYTHING
IN ITS CLASS AND BEYOND
NOTHING ELSE EVEN COMES CLOSE
from
$10,995
financing available
CROSSPOINT LATCH CORP.
UNMATCHED ELECTRICAL SPECIFICATIONS
STANDARD FEATURES
TWO MIX EFFECTS SYSTEMS
FOUR LEVELS OF KEYS OVER BACKGROUND
800 EVENT MEMORY
32 PATTERN GENERATOR
TWO PROGRAMMABLE FADER ARMS
RGB CHROMA KEYER
THREE COLORIZERS
FIVE FRAME ACCURATE TRANSITIONS
LINEAR KEYERS
THREE COLORIZERS
SECOND CHROMA KEYER
SECOND DSK WITH OUTLINE AND DROP SHADOW
16 INPUTS WITH SHIFT KEY.
SECOND 32 PATTERN GENERATO
SERIAL OR PARALLEL EDITOR INTER
NEXT EVENT PREVIEW
ACCESSORIES
STEREO AUDIO FOLLOW MIXER
Circle (125) on Reply Card
CROSSPOINT LATCH CORP.

ressive Concepts in Television Technology

The new SPG-1300N

proves our commitment to setting standards ...Again!

In 1971 Jim Leitch, our founder, designed the original NTSC Sync Generator with consistent SCH! This SPG-100N was so new and exemplary that it became the forerunner to RS-170A.

We're doing it again with the all new SPG-1300N, proving our commitment to leadership with progressive concepts in television technology.

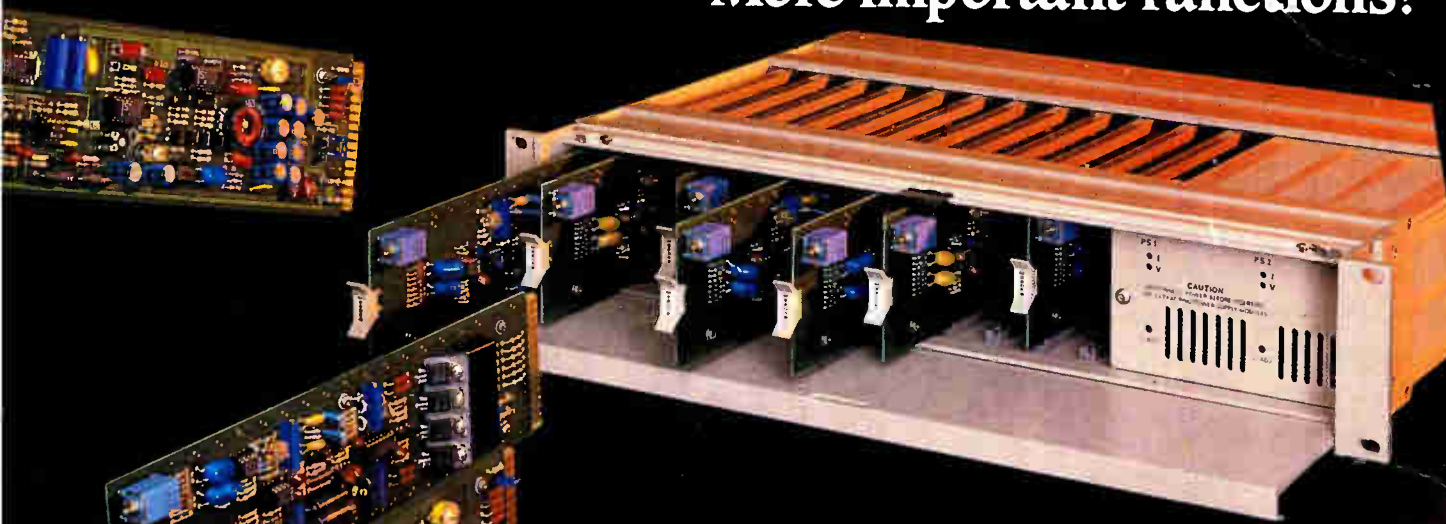
- Low cost, modular 1RU design.
- No warm-up, high stability TCXO (<1 Hz).
- RS-170A zero SCH Sync Subcarrier, Black and Test Signal outputs.
- Independent timing for pulses, black and test signals.
- Adjustable blanking widths and burst flag position.
- NTSC Digital Genlock.
- Accurate, 12-bit digital test signals (option).
- Color frame-locked stereo tone output.

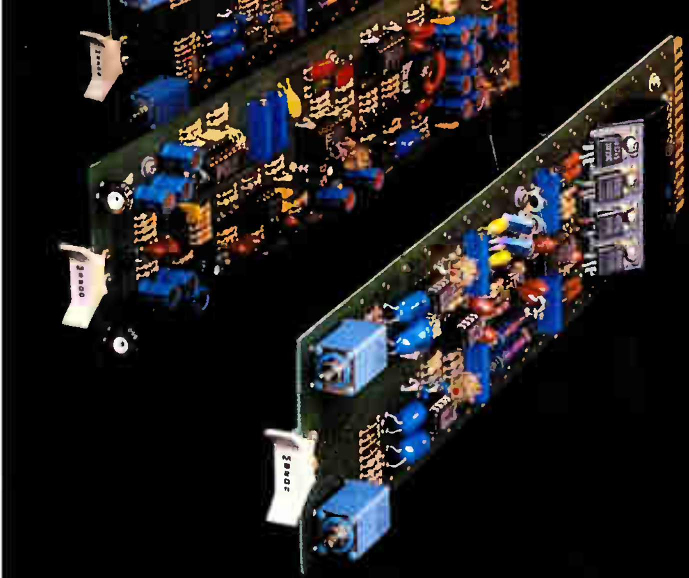
LEITCH

Leitch Video International Inc., 10 Dyas Rd., Don Mills, Ont., Canada M3B 1V5 • Tel: (800) 387-0233 Fax: (416) 445-0595 Telex: 06 986 241
Leitch Video of America, Inc., 825K Greenbrier Circle, Chesapeake VA 23320 • Tel: (800) 231-9673 or (804) 424-7920 Fax: (804) 424-0639

Circle (2) on Reply Card

More versatility!
More important functions!





The D8212 Distribution Amplifier System just keeps on growing!

All of Ward-Beck's substantial investment in R&D is directed towards one single objective ... to bring you the very best professional audio systems.

That's why other manufacturers, who try to satisfy a wider range of audio and video applications, simply cannot match the performance and quality of Ward-Beck audio products such as the proven D8212 DA System.

Now Ward-Beck is proud to announce the addition of new modules for the D8212 System. These include the M8200 transformerless, remote sensitivity microphone pre-amplifier, a stereo DA and a test oscillator.

We invite you to ask for details on these and other high-performance products in the expanding D8212 family.

WBS

WARD-BECK SYSTEMS

Ward-Beck Systems Ltd.
841 Progress Avenue, Scarborough, Ontario, Canada M1H 2X4.
Tel: (416) 438-6550. Fax: (416) 438-3865.