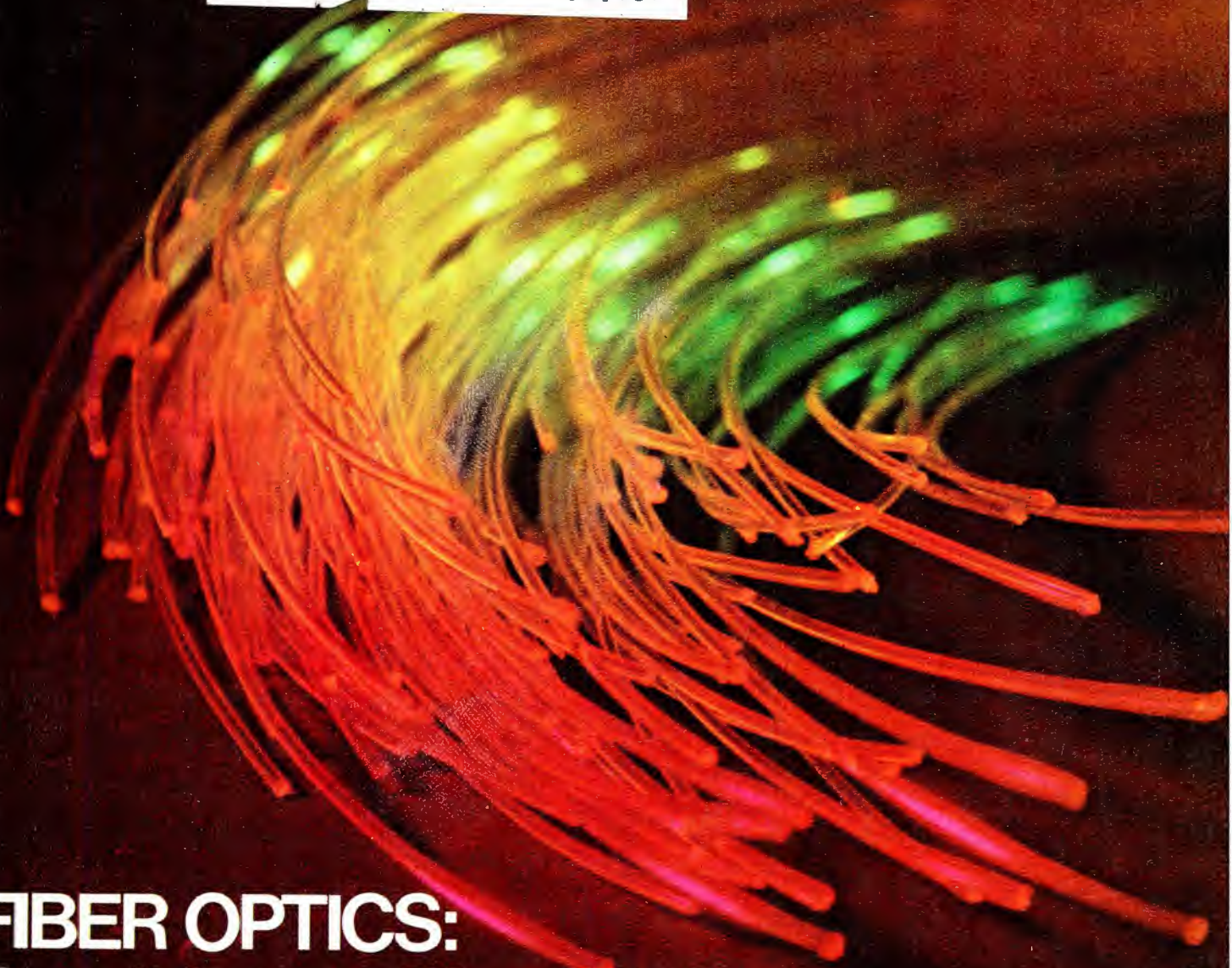


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- 22 Will Fiber Optics Start Another Revolution?** R & D on optical fibers continues. Already they are being used in cable TV. Considering their wide bandwidth, they probably will see extensive use in future communications. *Ron Whittaker.*
- 28 Broadcasters And The Future.** A look at many changes that are sure to come. The article warns, though, that we can lose today if we get caught waiting for tomorrow. *Ron Merrell.*
- 34 The Broadcaster And The Environment.** More and more we're going to be faced with locating and designing broadcast facilities so that they do not disturb the environment. *Harold Dorschug.*
- 38 Radio Workshop: Looking Ahead.** Our Workshop Editor peeks into the radio future and offers some sound advice. *Peter Burk.*
- 42 CP Antenna Update.** A second report on CP on-air tests. Includes comments from the manufacturers. *Robert E. Winn.*
- 48 You Can Take The Surprises Out Of Automation.** Part 3 of a 3-part series on TV automation. The author cites experiences encountered at WNEW-TV. *Bob Hueffed.*
- 54 Logic Illustrated.** Part 4 of a 4-part series illustrating digital basics. Watch the January issue for the beginning of new column based on digital troubleshooting. *Harold Ennes.*

## About The Cover

We're guessing that Optical Fibers will find their way into broadcasting, but it will be some time coming. Our what's ahead issue starts with Optical Fibers on page 22. *Photo is by Ron Whittaker.*

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Pat Finnegan, *Maintenance*  
Howard T. Head, *FCC Rules*  
Robert A. Jones, *Facilities*  
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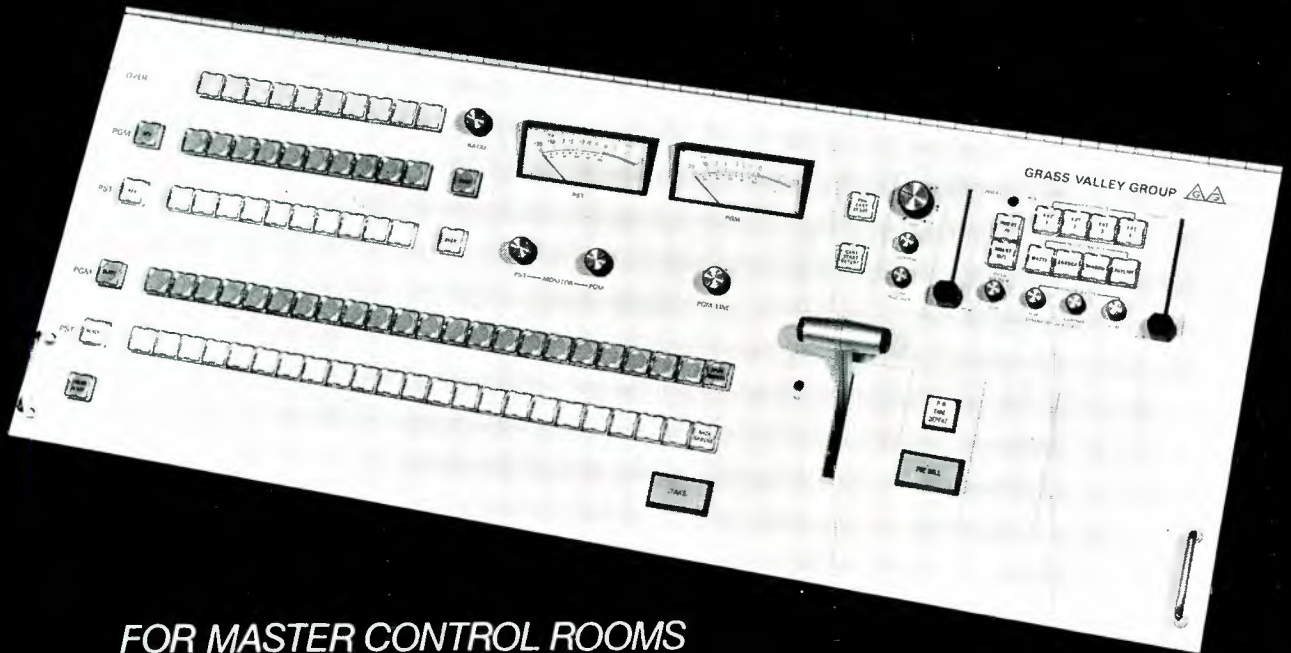
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# DIRECT CURRENT FROM D. C.



December, 1976/By Howard T. Head and Harold L. Kassens

## CB Expansion Takes Effect

Beginning January 1, 1977, the Class D Citizens Band at 27 MHz will be expanded from 23 to 40 channels. The expansion of the band is expected to extend the already severe harmonic interference problem now affecting TV Channels 2 and 5 to include TV Channel 6 as well.

At the same time, the requirements limiting CB harmonic radiation will be tightened from the present 49 dB below carrier to 60 dB. Broadcast and receiver interests have maintained that this limit falls far short of that necessary to provide adequate protection to TV reception insisting that suppressions on the order of 100 to 110 dB below carrier are needed.

The CB people maintain that much of the problem of CB interference arises from audio rectification, affecting not only TV receivers but other home entertainment instruments as well. Whether this is so may very well be determined by a series of in-depth investigations which the FCC's Field Operations Bureau (FOB) is undertaking in the field, as well as other testing under way. In the meantime, the Commission has insisted that much of the blame lies in the inadequate performance of TV receivers, although it is hard to see how a receiver can be designed to reject a radiated r.f. harmonic. Hopefully, the tests now under way will provide at least some answers to this question.

## FM Height/Power Reduction Formula Challenged

The FCC Rules established a maximum limit of 100 kW ERP for Class C FM broadcast stations. Exceptions are provided, however, in the case of stations operating prior to the existing classification scheme employing power in excess of this value. In a recent case in Florida, a Class C station requested authority to increase its antenna height from 205 to 598 feet and to change site while retaining its (above-maximum) power of 160 kW. The application was granted by the Commission's staff, but was taken back when opposition was filed. On reconsideration, the Commission granted the application for the new location and the new

*Continued on page 6*



“ This is probably a terrible conversation to have during the dead of winter (Eastern style, that is), but Broadcasters who have visited our California marketing headquarters on the beautiful Santa Barbara coastline tend to identify us as the “Sea-Tek” Broadcast Group.

Curiously, we actually pronounce our name “SEA-TEK” . . . with an S, and an E, and an A, for your S-E-A . . . with a T, and an E, and a K, for your T-E-K—SEA-TEK.

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Well, enough of this. There's a lot more from the good group at Cetec on the following page.

Read on . . .

”



# DIRECT CURRENT FROM D. C.

Continued from page 4

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height but reduced the power to the 100 kW maximum. The reason for the action was the rule that super-power stations cannot extend the distance to the 1 mV/m contour.

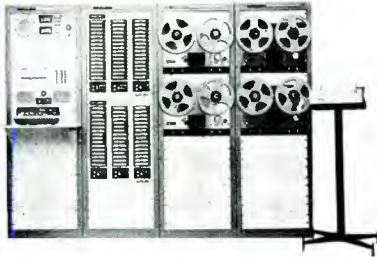
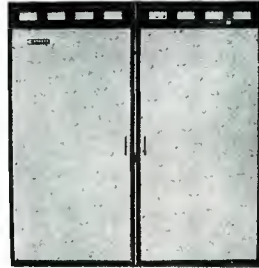
## Reinstatement of TV Translator Channels Urged

The Council for UHF Broadcasting (CUB) has requested the Commission to restore the use of UHF TV channels 70-83 for use by UHF TV translators. These channels were originally part of the UHF TV band, but were eliminated when this frequency space was vacated for land mobile use. Existing translators above Ch. 69 were permitted to continue operation on a secondary basis to land mobile, but no new authorizations are being issued.

CUB, noting that it is already difficult to find frequency space for translators in the preferred range of Channels 54-69, has urged the Commission to resume licensing of translators on the higher channels. One of the arguments advanced in favor of such an action is that the principal use of the band for land mobile operation is likely to be near large metropolitan areas while the greatest need for TV translators is in outlying areas where land mobile requirements can be satisfied at lower frequencies.

## Short Circuits

10-Watt non-commercial educational FM broadcast stations may now use Third Class Radio-telephone operators without broadcast endorsement or holders of restricted radio operator permits - under certain conditions...The Commission has reminded all stations that, in cooperation with the FAA, the painting requirements for antenna structures were changed in October, 1970 with the proviso that all towers must comply with the new requirements by November 1, 1977...From now on, when you file papers in rule-making proceedings, you only have to file an original and five copies instead of the 12 copies formerly required.



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## NAB Is Booked Solid For March Convention

All exhibit space for the 1977 annual convention of the National Association of Broadcasters in Washington, D.C. has been sold.

The convention will be held March 27-30 at the Washington Hilton, Shoreham Americana and Sheraton Park hotels.

NAB Exhibit Manager Edward L. Gayou said at the annual NAB exhibitors' meeting, that 188 associate members have signed up to exhibit broadcast equipment at the three hotels. At the 1976 convention at Chicago's McCormick Place, the total was 182.

Gayou said a total of 84,502 square feet has been assigned and a waiting list of firms will be established in the event of cancellations. He added that this is the first time all space has been sold by the time of the exhibitors' meeting.

Meanwhile, the National Associa-

tion of Educational Broadcasters held their annual convention in Chicago. Attendance reached a new low, and the exhibitors who did show up did little business. Once tabbed the "little NAB", the Association saw a near shutdown of the exhibit area on the second day of the meet.

The problem runs in several directions, not the least of which is the Association's emphasis on funding and other strictly educational television problems. From the exhibitor's standpoint, the conventions should have allowed more time for floor traffic in the exhibit area. The feeling toward the close of the convention was that exhibitors would not show next year. A second exhibitors' meeting was held on the last day of the convention. While it served to clear the air, it was already too late.

## SMPTE Winter Conference Will Focus On ENG's Future

Beyond ENG—the future of Electronic News Gathering, and Digital Television will be the subjects of the Eleventh Annual Winter Television Conference of the Society of Motion Picture and Television Engineers. The Conference will be held Friday and Saturday, January 28 and 29, at the St. Francis Hotel in San Francisco.

The ENG session will explore current production methods and take a look at this rapidly advancing technology. A panel discussion by ENG users should provide a lively exchange of ideas and experiences.

The session on digital television will cover a variety of subjects including digital disc recording, progress on digital video standardization, and digital and analog video

enhancement techniques.

Beyond ENG is the topic for Friday's sessions. Lee Marvin, Television Research International, and David Fibush, Ampex Corporation, are the session chairmen. The topic for Saturday's session is Digital Television. The chairmen for the session are William H. Orr, Orrox Corporation, and Louis Pourciau, International Video Corporation.

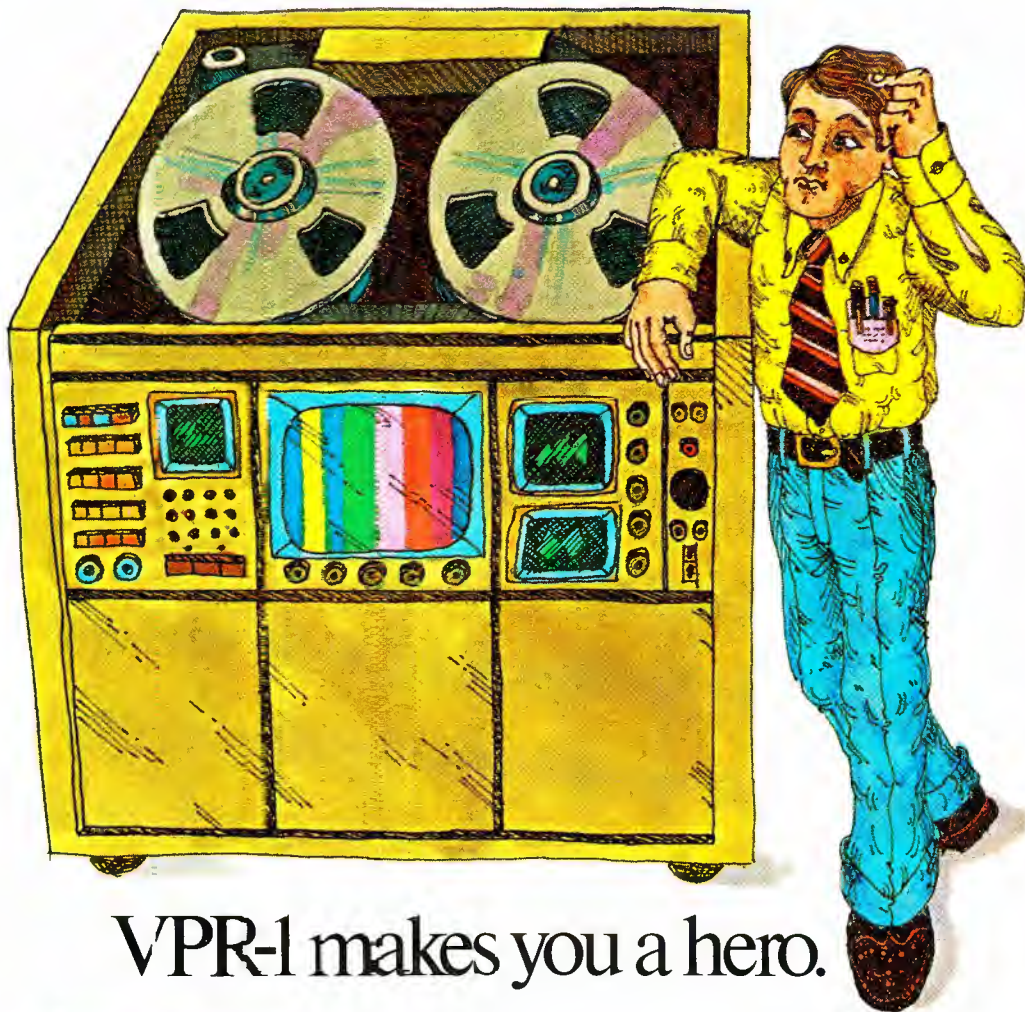
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**For Latest News  
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Direct Current page 4**

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VPR-1 is the one-inch helical recording system from Ampex, designed for users who can't take chances.

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# NCTA Hits Restrictive Rules

Burt I. Harris, Chairman of the National Cable Television Association, has urged the Federal Communications Commission to do away with its restrictive rules that have served as "copyright" substitutes.

He also outlined the industry's recommendations on several cable television issues scheduled for ac-

tion by the FCC this fall. Specifically, Harris focused on the 1977 re-franchise deadline, redefinition of cable, and subscriber rate regulation.

Appearing before an en banc meeting of the FCC, Harris told the Commissioners that with the recent passage of the Copyright Revision Bill, syndicated exclusivity and sig-

nal carriage restrictions based on cable's failure to "pay" for the programming it received could no longer be justified.

"The Commission's rationale for these rules was the alleged unfair competition provided by cable systems using products for which they didn't pay," he said. "Irrespective of the original merits of this position, it is now moot."

Harris said fears of cable's adverse economic impact on established broadcasters—the FCC's other major regulatory rationale—were virtually groundless.

"The difference which previously existed between parties who paid copyright and parties who did not, have been eradicated," Harris told the Commissioners. He urged the agency to eradicate the now obsolete regulatory differences between cable and broadcast television.

The 1976 Copyright Law, which becomes effective in January, 1978, grants CATV systems a compulsory license for the carriage of all radio and television broadcast stations whose carriage is authorized by the FCC. The new law also requires CATV systems to pay for the carriage of all distant non-network television programs.

Harris also focused on several cable issues now pending before the FCC, among them the 1977 re-franchise deadline, redefinition of cable, and subcarrier rate regulation.

In March 1977, Harris said, some 5,000 CATV systems will be required to file "amended franchises" with the Commission in order to meet the certification requirements.

Harris said that while NCTA was in accord with the Commission's proposal to conform to the rules, it has "grave concern about the Commission's requiring that these rules must be reflected in franchises prior to the normal date of the franchise."

Irrespective of what action the Commission takes on the 1977 re-franchising issue, Harris said, three important public interest concerns must be considered.

- No cable operator should have his ability to serve the public jeopardized as a result of the Commission's desire to obtain franchise uniformity.



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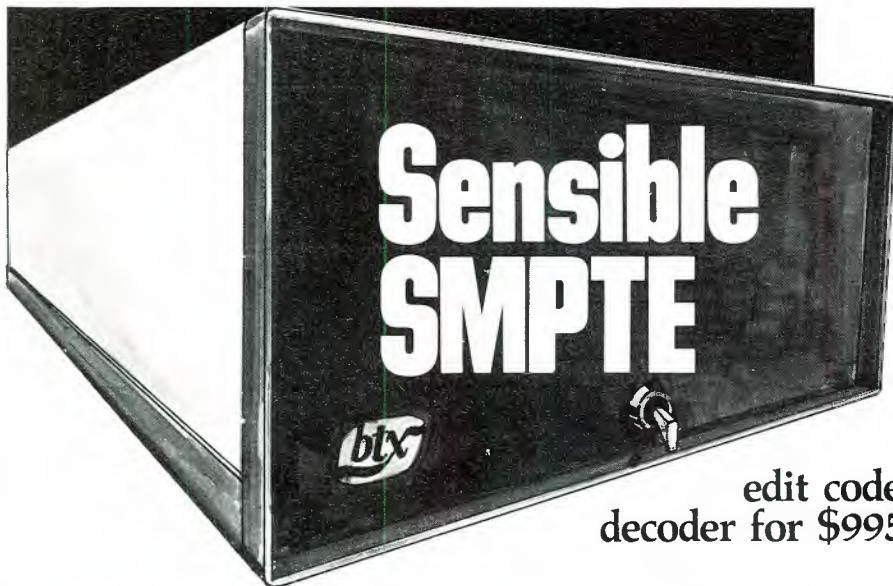
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For More Details Circle (11) on Reply Card

## Chicago Will Host CATV '77

Chicago's Conrad Hilton Hotel is the site and "CATV 77: The Choice of 11,000,000 Families" the theme for the National Cable Television Association's 26th annual convention, April 17-20, 1977.

More than 5,000 attendees are expected at the nation's largest CATV trade show, which will feature a full array of technical and management sessions, pre and post-convention activities, and well over 100 hardware and software exhibits.

"This year the Convention Committee is working hard to present a program which is topical and exciting, but which also offers plenty of practical experience and information," said Marc Nathanson, President of Falcon Communications and Chairman of the NCTA Convention Committee. "Also for the first time, the NCTA Convention will include a major session devoted to the international cable television scene, featuring cable representatives from around the world."

According to Nathanson, the 1977 Convention Program will be organized around five basic cable topics: System Operations, Finance, Regulation, Pay Cable, and Technical. Throughout the convention, eye-opener and major sessions will focus on different aspects of these basic topics.

Convention activities will actually begin on Saturday, April 16, 1977 with the NCTA Convention Tennis Tournament at Chicago's MidTown Tennis Club, and a Saturday evening reception. The convention will officially open with a keynote address on Sunday afternoon, April 17, by a prominent national official.

Beginning Monday, April 18, each day's program will include early morning eye-opener sessions followed by major management and technical sessions each morning and afternoon.

The new International Cable Session on April 19 is being planned by NCTA in cooperation with the International Broadcast Institute and its executive director, Jean D'Arcy.

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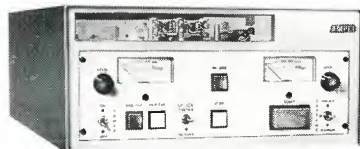
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# HITACHI SK-70

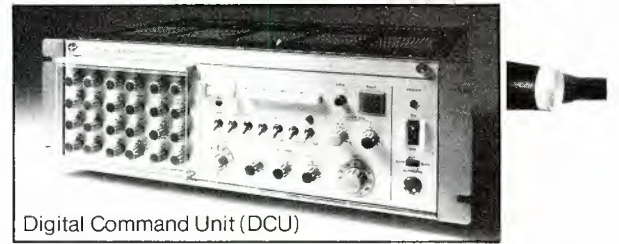
## The One Camera That Can Do The Work Of Four... Inside Or Outside The Studio!

The modular SK-70 converts easily from a fully equipped, self-contained color studio camera to a modified studio camera. In the field, the studio version of the SK-70 can be connected directly to a VTR with only a co-axial cable. And for hand-held portability, the camera head features a shoulder mount, an auto-iris portable zoom lens, and a 1.5" viewfinder, along with a DC and process pack. The Digital Command Unit (DCU) with up to 3000 feet of single co-axial cable strongly enhances the capability of the SK-70. Another striking option is a 22:1 zoom lens that can be used for the studio version of the SK-70 in the field.

No matter which configuration you choose from those shown in the photo and three diagrams, the Hitachi SK-70 offers the precision and reliability of three 2/3" Saticon tubes in the camera head to insure excellent picture quality, combined with all the latest advances in broadcast camera technology.

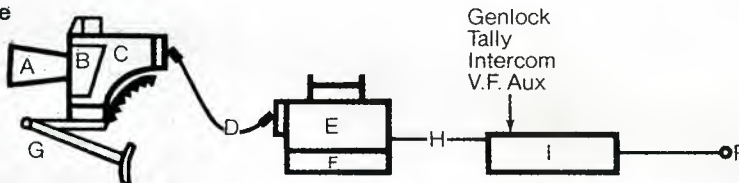
As you can see, our outstanding Hitachi SK-70 is a sound investment for broadcasters, production studios, and universities who need broadcast quality performance in a wide variety of assignments, all for the price of a single camera. We'd be pleased to arrange a demonstration of how the SK-70 can fit the following camera requirements inside or outside your TV studio, and more:

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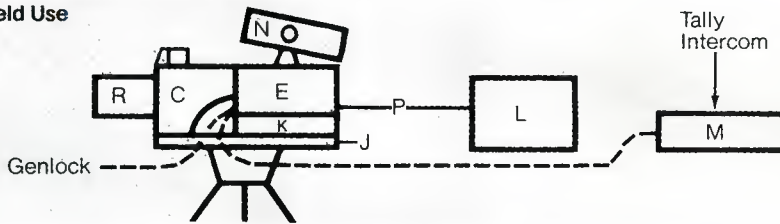


Digital Command Unit (DCU)

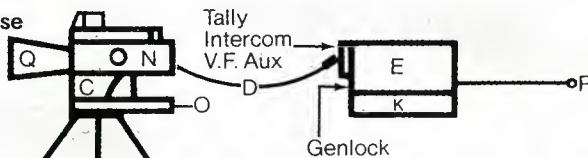
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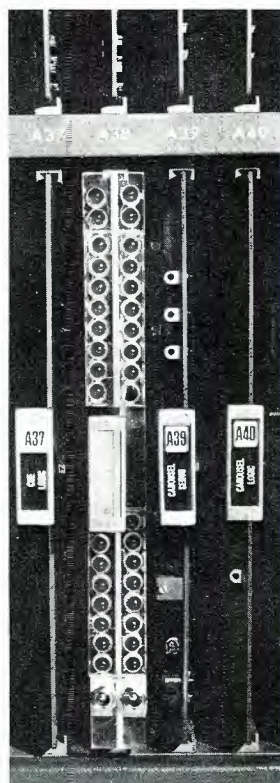
**SBE Position On ATS**

The SBE, in accord with its By-Laws, concurs with the general premise that the use of Automatic Transmission Systems (ATS) by AM, FM, and TV broadcast stations is a viable concept in the continuing evolution of operating technology. However, it agrees with others that a *completely* unattended automatic broadcast station has yet to be developed and shown to work, and it expresses serious doubt as to whether or not such an operation is even desirable. In any case, unlicensed persons should not be granted the authority to operate broadcast transmitters.

The SBE is concerned with what it sees as a lack of an overall definition of ATS. If the terms "automatic transmitters" and "automatic transmission systems" cannot be used interchangeably, then we insist that those elements comprising the "system" be spelled out. It is the SBE's opinion that these components should include not only the transmitter, transmission line, and antennas, but also the supervisory and control elements.

*Continued on page 18*

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Image Processor



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Image-Ex™ is a standalone signal processor that improves the quality of video pictures played back from U-matic and other helical VTR formats by providing the following features:

### Image Processing

Better than image enhancement, the Image-Ex image processing system eliminates the soft transitions and blurriness typical of U-matic and other helical format VTR's to increase the clarity and detail of the TV picture. Image-Ex's unique design permits crispening of even multiple generation tapes without adding visual noise to the picture.

### Video Noise Reduction (VNR)

The video noise reduction system of the Image-Ex device utilizes comb filtering and noise coring to improve the video signal to noise ratio. In addition, residual subcarrier and other interfering products

are eliminated from processed video to provide crisp clear pictures even from multi-generation tapes.

### Chrominance Luminance Delay Compensation

Chrominance to luminance delay, or the "comic strip effect" is a displacement of the color portion of the video picture relative to its luminance image. Such delay occurs with headwear of U-matic and other format VTR's and is particularly troublesome with the playback of tapes recorded on a different VTR. This characteristic creates soft edges in the video picture and smeared transitions between different colored objects. The Image-Ex device corrects this problem with a correction range of  $\pm 200$  nanoseconds. By putting the color back where it belongs, Image-Ex provides sharp clear pictures with improved color characteristics.

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## SBE Journal

We believe that those stations installing ATS control equipment should be required to submit a proof-of-performance to the FCC before permanent authority is granted for such operation. Further, the Commission should demand suitable inspection and documentation, on an annual basis, of the performance of the ATS in order to regularly confirm the integrity of the system.

The SBE concurs with the Commission's view that, during periods of temporary failure of portions of the system, an absolute go/no-go setup may not serve the public interest. Rather, "failsafe" circuitry, coupled with a reliable alarm system, should adequately insure against those situations which could cause interference to other stations, as long as the transmitter would shut off if either the circuitry or alarm system should fail.

The alert signal, indicating a condition, an alarm level, or a turnoff, should be mandatory, and the SBE proposes that it be located at the studio along with the control center. A responsible station employee should monitor and exercise control over the ATS, and the system should be equipped with the capability for high-quality, off-air monitoring, as well as the means for that person to turn the transmitter on and off in response to indications that any operating parameters are out of, or back within, tolerances. Upon an alarm indication, a qualified operator would be immediately sent to the transmitter location.

The test circuitry incorporated into the ATS controller should be such that when an operating parameter which had been out of tolerance returns within tolerance, the unit will instantly revert to its normal status. On the other hand, if that operating parameter had been so far out of tolerance as to cause a shutdown of the transmission system, then after the condition had been corrected, the system would have to be reset before the station could return to the air.

The SBE believes that ATS transmitters should continue to meet all existing requirements of design, installation, safety, and intruder protection. A high limit of output power must be established to prevent interference to other stations. The question of a low limit merely relates to the desirability of a low-powered

*Continued on page 81*

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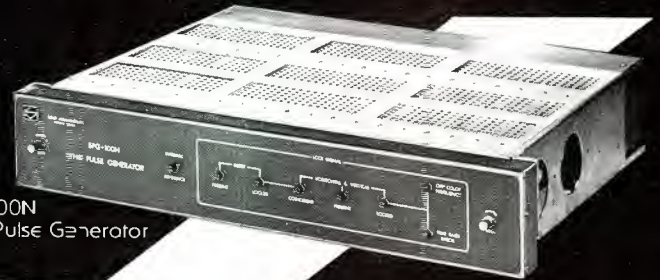


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and of course allows matching the BVP-100's colorimetry to that of other cameras.

**3. Built-in test generators.** On location, you can make many necessary balance and test monitoring adjustments without accessory equipment. And the less accessory equipment you need, the faster you can move.

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# Will Fiber Optics Start Another Revolution?

By Ron Whittaker

Now that many of us are convinced that fibers in our **diet** can improve our health, we are learning about some revolutionary advantages in another fiber for **video**—fiber optics.

The term “revolutionary” is a bit trite by now—so many things have gotten to be “revolutionary” these days—but with fiber optics we in television may just be facing a new technology which could fully qualify as being revolutionary. Some engineers, in fact, are viewing the new fiber optics technology as being as significant as the development of the transistor in the early 1950’s.

Consider the advantages given for an optical fiber (OF) “cable” when it is compared to a standard coaxial cable:

- Broadband; up to 1 GHz or more per 90 micron fiber
- Uniform attenuation over very wide frequency range (no equalization needed)
- As little as 4 dB loss per mile (2 dB per kilometer)
- Highly resistant to interference
- No problems with “leakage”
- Insensitivity to temperature variations

- Extremely small size
- Not nearly as fragile as coax
- Lower cost than coax
- High reliability

Optical, or light-conducting glass fibers have been around for quite some time. You probably first saw them used in the little fiber optic “fountain” lights with their 100 or so fibers “spraying” out of the top. Since they normally require dim lighting to be appreciated (which means that they are rather dim, themselves) many of these lights ended up sitting on the top of TV sets being used as “TV lights.”

But now it appears that these fibers will be going from the top of TV sets to inside TV systems, as optical fiber (OF) technology very rapidly takes hold. In fact, things are moving much faster in OF research (and application) than many “experts” predicted several years ago.

In a rather well-publicized application of OF, Teleprompter, in cooperation with Fiber Communication Co., has put into regular use an 800-foot (250 meters) link from their microwave receiver to the head end of a cable system. Six fibers were packaged in a single cable, which ended up being about

the size of a piece of standard RG-59 drop cord. The fibers, themselves, are only 90 microns in diameter each, or about the size of a human hair. Each of the fibers is **capable** of over 1 GHz bandwidth, which means that a six-fiber bundle would, theoretically, be able to carry about 1,000 TV channels.

In actual fact, however, the fibers are capable of a much broader bandwidth than present technology can handle. The Teleprompter system is now limited to 20 MHz bandwidth because of limitations in the light-emitting diode (LED) going into the fibers. However, new devices have been announced which could extend this 20 MHz limit to 200 MHz. In the next few years even newer technology could well extend this into the GHz range.

## How It Works

Before going further, it would probably be appropriate to take a look at how OF works, at least as it is now being applied in video cable. It must be kept in mind that this is only one of a number of potential TV-related applications of OF. Optical fibers will probably find their way into such things as picture tubes and camera tubes, to name just two applications now



## All-Plastic OF Cables

The Du Pont Company has developed two new all-plastic fiber optic cables for data transmission use.

They are PFX-P140R, a single plastic optical fiber reinforced with "Kevlar" 49 aramid fiber in a protective jacket of flame retarded "Hytrel" polyester elastomer, and PFX-P240R, a dual optical fiber cable designed for two-way communication. The two inner cables of PFX-P240R are color coded for easy identification and each is protected and reinforced by "Kevlar" and "Hytrel".

Both products feature attenuation of 470 decibels per kilometer at a wavelength of 656 nanometers. They transmit visible light over twice the distance of other currently available plastic optical fibers, according to Du Pont.

The cables are tough, flexible and crush resistant, Du Pont said, and the all-plastic make-up of the cables allows preparation of the ends with a simple razor cut for coupling to a light source and detector. The all-plastic construction also simplifies re-

pairs, which can be made in the field by a technician, usually on the first try.

Du Pont expects the two fiber optic materials to be used in military applications, in ships, submarines, helicopters, chemical plant or refinery control instrumentation, and in mining communications, as well as for optical links in computers and for the transmission of other data without electromagnetic interference. PFX-P240R, with its dual cables, allows two-way communication between computer and peripheral unit.

These two products join PFX-S, a plastic-clad, pure-silica-core cable announced earlier this summer. PFX-S features attenuation of 80 decibels per kilometer at a wavelength of 800 nanometers. Its attenuation is below 60 decibels per kilometer throughout the range 650-750 nanometers, assuring its compatibility with systems designed for red-transmitting PFX-P. It was developed to approach the mechanical toughness of plastic fiber optics with the run length capability of silica.

being experimented with.

Figure 1 shows how the OF principle is being used for video cable. The video and audio signals modulate the light from an LED (not unlike the LED's being used in a few hundred-thousand pocket calculators and digital watches right now). The light then passes through the optical fiber, which acts as a waveguide for the modulated light. At the terminal end of the fiber there is a P.I.N. diode sufficiently biased (50 volts or so) to be responsive to the high-speed fluctuations in modulation. After being amplified about 20 dB, the signal goes on its way as a normal 1-volt television signal. The concept is simplicity itself.

### How About Losses?

The optical fibers used for the transmission of video signals are made to far more exacting specifications than the fibers in the lamp that may sit on your TV set. The "drawing" of glass fibers to the rigid specifications needed for practical video applications has taken a number of years of intensive research and work—work that involved page-long formulas and references to such things as meridional rays, dielectric waveguide

energy flux and Fresnel losses.

Although the light attenuation in the Teleprompter installation is listed as 10 dB per kilometer (0.62 mile), losses in newer-type fiber is reportedly down to less than 2 dB per kilometer. Of course, in the short 250 meter (800 foot) "hop" from the rooftop antennas to the central processing center 34 floors below in the Teleprompter installation, the attenuation involved is negligible.

Using the 2 dB per kilometer figure, 20 dB amplifiers would make possible 15 km (9 miles) spacing between amplifiers. Depending upon the efficiency of the coax used in comparison, this would probably end up being somewhere near 10 times as efficient as ordinary coaxial cable. Equalization devices can be eliminated as well as automatic gain control (AGC) equipment, since OF is blind to both frequency and temperature variations.

The present 20 MHz bandwidth used in the Teleprompter installation represents only a fraction of what would be possible if the full potential of OF could be used. Current speculation is that with the adoption of digital processing of video, a bandwidth of a few

hundred or even thousand MHz would not be out of the question. What is needed at this point is small, inexpensive digital processors which could be mass-produced. If the video signal(s) could be digitized, you could conceivably move up to the potential afforded by a type of electromagnetic energy (visible light) which has a frequency of close to 1,000 terahertz (THz). (By the way, a THz is one step above a gigahertz and is equal to 1,000 GHz or 1,000,000,000,000 Hz.)

### Lasers and OF

Another important contribution to OF-video technology will be the perfection of small, inexpensive lasers, which will greatly improve the efficiency of the fiber optic light transmission process. The scattered light of the LED causes the light to "ping-pong" its way along the walls of the OF waveguide in a way that hardly represents an efficient and orderly transfer process.

The coherent light from a laser has already proven itself to be a much more efficient "light launching" device for OF. However, because of the imperfections in the best of today's fibers, there are still certain ping-pong effects, even when a laser is used. It is only





Fig. 1 The basic concept for an optical fiber (OF) system is illustrated here. Even with today's limited OF technology, it is estimated that it is possible to send video signals six to nine miles before re-amplification is necessary. No frequency equalization or AGC processing is necessary.

when this effect becomes great enough to result in a lack of resolution between discrete bits of information that the process breaks down. Fortunately, the extremely short wavelength of light ( $10^{-6}$  m.) coupled with the extremely high speed (about  $29^{10}$  cm./sec.) gives phenomenally high limits to work with. Some idea of the relative information capacity of OF compared with other electronic media is shown in Figure 2.

Numbers this big have very little meaning for most people until they are broken down into recognizable quantities. To give you some idea of just how removed these laser frequencies are from ratio frequency (RF) energy, consider the following.

### 20-Million TV Channels?

Laser emissions run from about 80 to 1,000 terahertz (THz). If we were to put 6 MHz-wide television channels throughout the region of possible laser emission we would have room for about 20-million separate TV channels!

The region on the electromagnetic spectrum which can be used by lasers starts considerably below the visible light region. In numbers, laser emissions run from a wavelength of about 5.3 to 0.4 microns, and visible light runs from about 0.7 to 0.4 microns. (In case you are having trouble with "microns" and don't have a dictionary handy, a micron is equal to one one-thousandth of a millimeter, or 10,000 angstroms.) When you get down to these wavelengths, missing some-

thing by a "hair" can put completely out of the ballpark, since the length of these waves is about 100 times the size of a hair!

To put it another way, the electromagnetic range theoretically possible with lasers would be capable of carrying about 300-billion telephone conversations simultaneously.

### Back To Earth

Although it's interesting to speculate, such astronomical channel capacity is completely beyond present television needs. So, returning to some numbers that are a little more down to earth and in line with current technology and needs, we find that with the best of LED-fiber-PIN combinations we can now transmit about 30 6 MHz signals through one of today's 90 micron "glass hairs" with plenty of room left over for guard bands. With a 1 volt video signal fed into the fiber optic link, you can expect a loss of about 2 dB per kilometer (0.62 mile) using the best of today's OF, which means that over a long distance you would need (20 dB) amplifiers about every 10-15 km (6-9 miles).

The receiving PIN diode and amplifier currently being used by Teleprompter is very lightweight and small—only about 10 cm (4 inches) square. The signal-to-noise ratio of the installation is reportedly 57 dB. The biggest current limitation appears to be the frequency response of the LED light launcher. The Teleprompter LED's are manufactured by Bell Northern and have

a response of 20 MHz, but the state-of-the-art appears to be the 200 MHz LED's recently announced by RCA.

### Other Current Applications

The Teleprompter installation isn't the only communication-related OF application. Rediffusion in England has installed an underground video link which they are currently testing. Japan is wiring a small community with OF, which will probably represent the first full-scale test anywhere. France is reportedly anxiously awaiting the outcome of such tests before launching an extensive OF project for Paris.

If rumors can be believed from France, that country plans to take a quantum leap into state-of-the-art communications by wiring the entire city of Paris with OF (instead of coaxial cable), thereby giving it the most modern broadband communications system found in any of the world's major cities.

### Future Possibilities

The adoption of digital signal processing will undoubtedly be a major step forward for OF technology. At the same time, however, this will vastly complicate the "cable"-to-home CATV interface. A digital-to-analogue-to-RF converter would undoubtedly necessitate a very sophisticated and costly "black box"—at least with today's technology.

The first approach, and the one that seems most practical right



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For More Details Circle (20) on Reply Card

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CAPACITIES OF ELECTRONIC MEDIA

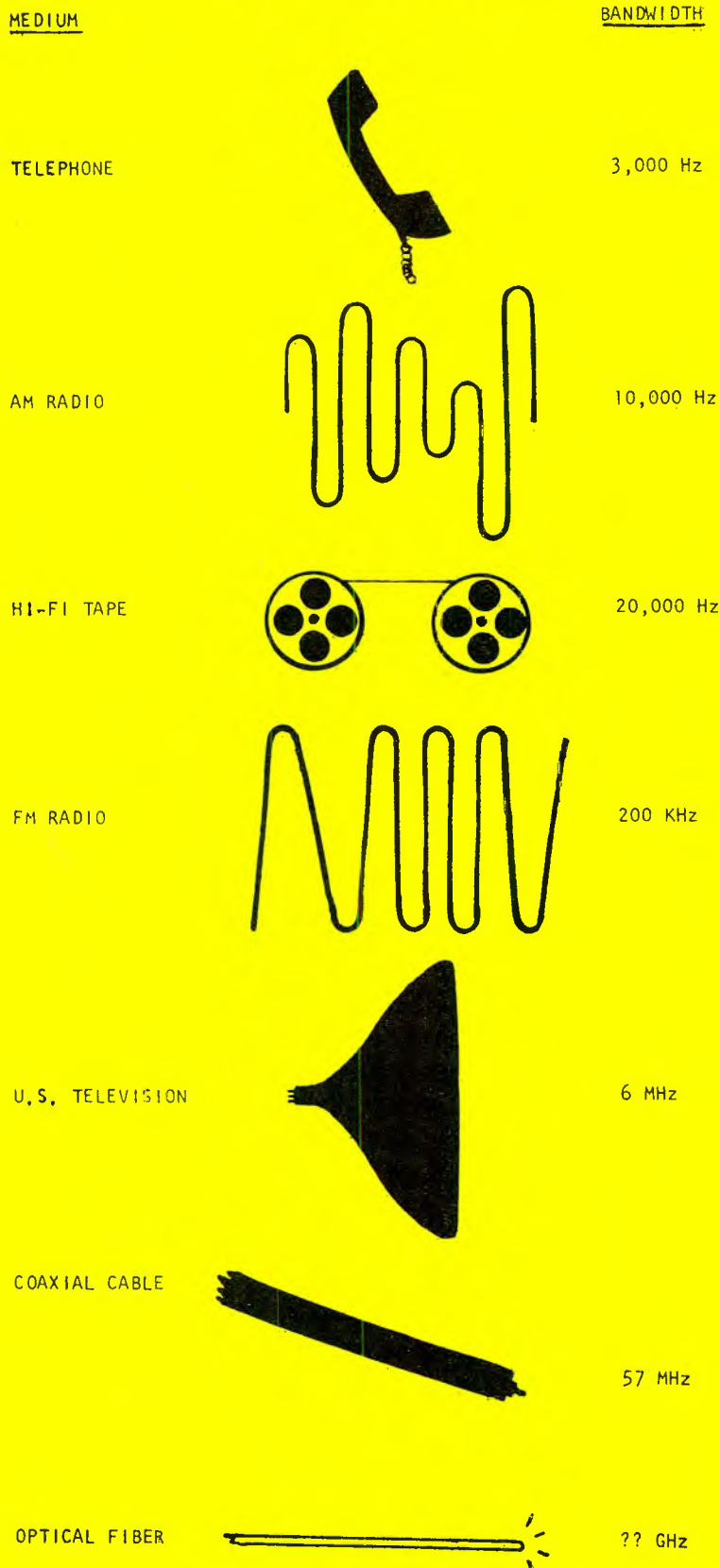


Fig. 2 The bandwidth and information-carrying capacity of electronic media continues to grow. From a bandwidth of 3 kHz (telephone), we now have developed a medium (OF) which, with the help of lasers, could (theoretically) have a bandwidth in the trillions of Hz. Right now the theoretical is a long way from the possible, since the maximum bandwidth attainable is reported to be 200 MHz. However, as the technology develops, we might someday see bandwidths of ten and hundreds of GHz.

now, would be to use OF transmission only for major long-distance links. From this point the digital, light-frequency signals could be converted into analogue RF and fed into branch lines for local distribution. In the case of CATV, existing coaxial hardware would not become obsolete. By making the long-distance hops by OF, certain quality and cost advantages should be possible.

Another possibility would be to take the OF cables directly into the home. Receivers would have to be manufactured which could accommodate the digital OF signal (along with standard RF).

For starters we could initiate channels which operate on double our current 525 line standard. With 1,050 or so lines we could achieve a video resolution which would equal the resolution the 35 mm motion picture film we see at theaters. Large-screen television projection systems would then become fully meaningful in terms of increased image detail. With "bandwidth to burn," we could even transmit three separate 12 MHz pictures, one for each of the primary colors. Why compromise anything? And, let's not forget audio. We would want two audio channels minimum (stereo) and would probably want to throw in the provision for a few more for other languages, different age levels of comprehension, etc.

In the beginning, even if only a few entertainment centers had such receiving equipment, it wouldn't matter, since such "narrowcast programming" could be inexpensively distributed, once the OF system was a reality. The programming would not crowd anything else out of the band.

As a final note, it should be kept in mind that at this early stage of OF technology there are many claims and counter claims about what it can and cannot do. Notwithstanding some confusion on present OF specifications and limitations, what we do know is that fiber optic technology is very definitely on the scene in broadcasting—both in this country and in Europe and Asia. The future for these little hair-sized fibers looks good, and they may even (as predicted) have the impact on electronics and broadcasting which will be equal to that of the transistor. □



# RCA

## ANTENNA AND TRANSMITTER USER REPORT

### WHN-AM, NEW YORK CITY, ADDS 50 kW AMPLIPHASE TRANSMITTER

"WHN-AM delivers great sound around the clock," reports Bob Walton, Chief Engineer of this Storer station.

"Our RCA 50 kW Ampliphase transmitter comes through with a standout signal in the tough New York market," Mr. Walton says. "It's a Type BTA-50J, located at the antenna site in East Rutherford, N.J., and remote-controlled from our Manhattan studio.



"We operate the Ampliphase and an older transmitter as an Alternate-Main system, with a weekly changeover. The common point reactance presented no matching problem for the Ampliphase transmitter, nor does our directional

**"50 kW Ampliphase transmitter delivers a standout signal"**

### WBEN, BUFFALO, UPGRADES WITH REMOTE-CONTROLLED TV AND FM TRANSMITTERS

"We used RCA on our TV-FM modernization program for good reason," says Frank Maser, Director of Engineering for WBEN, Inc.

"When you're investing nearly a million dollars in new plant facilities, more than equipment is involved. Technical expertise in system design and installation is important—and RCA was able to provide this



valuable support.

"The automated transmitters for

**"Technical expertise in system design...important"**

FM and TV completed our initial master updating program. Both systems are remote-controlled from the studio, with full redundancy in circuitry, STL, power, and transmitter functions.

"For TV, we installed a TT-30FL, 30 kW transmitting system with OPTO-Switcher and bi-level switching capability. This arrange-

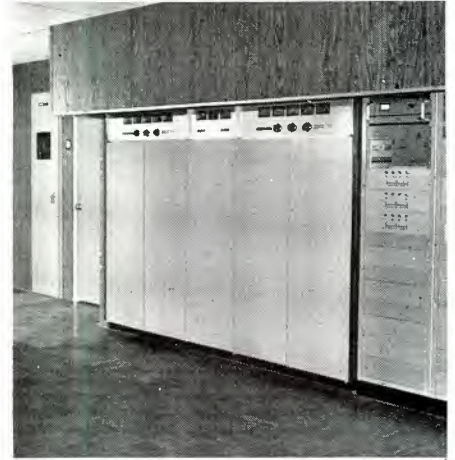
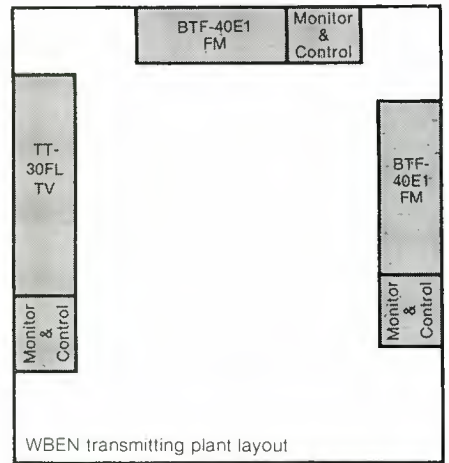
ment gives us full flexibility to

operate in parallel, or one side only, maintaining optimum VSWR without need for re-tuning.

"Rock 102, our 24-hour-a-day automated FM stereo station, operates twin BTF-40E1 40 kW transmitters as Alternate-Main systems. With this configuration and our custom logic systems, we're well protected against transmitter outages. The transmitters are fully automated, including automatic power level control. Our FM plant also includes a new BFG-8 circularly polarized antenna with de-icers.

"With the new transmitting systems behind us, we're moving on into the next phase of our master plan for improving technical operations."

"The RCA transmitter sounds great and gives no trouble."



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"With the new transmitting systems behind us, we're moving on into the next phase of our master plan for improving technical operations."

**"...transmitters are fully automated, including automatic power level control"**

# RCA

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At the Olympics, we saw coverage from a helicopter. Here you see Larry Scheer (left) of KNBC, Los Angeles, working as possibly the only U.S. newsman to pilot and report from what is, in effect, a mobile, remote color TV station mounted in a helicopter.



# What's Ahead For Broadcasters?

By Ron Merrell

*Don't get caught looking. It's nice to look down the pike, but if we dream too long of tomorrow, we'll lose today.*

If there is any one thing you can say with certainty about the broadcast industry, it's that changes will confront us just about the time we settle down to the task of digesting the last twist or turn in the technology.

In this issue of **Broadcast Engineering** we've put together some of the changes that are likely to affect the industry. Fiber optics, by far, is the most distant and mind boggling. But fiber optics is only one of the shadows on the horizon with new challenges we could be facing. Even if fiber optics is still years away from making inroads on the broadcast industry, it already is being introduced to cable television.

But not all changes are technical. OSHA appears on the scene, the environmentalists throw up roadblocks, the FCC gives and takes away, the FTC puts advertising under the microscope, and even the professional and trade associations

find themselves pressed to keep their rails straight.

On a day-to-day basis, the industry is on the edge of its chair. Which way will it go and will the trend last? And one of the greatest dangers is that the broadcaster can get caught waiting. ENG is a fine example.

Most of the early ENG equipment was not designed for broadcast applications. But innovators at the network and local station level opted for experimenting and doing it their own way. When improvements in equipment began to hit the market, they were the ones in the best position to make judgments on what features were relevant. Meanwhile, this doesn't mean that film is dead. There still are situations where film is more appropriate. What's more, the conversion costs may be inconsistent with profits vs. investments at some stations. Of this you can be sure, the industry will gain from the competition.

## At The IBC

At the recent International

Broadcasting Convention in London, ENG was one of the hottest topics. Even the planning committee had not anticipated such an interest, and several hundred people were turned away. The general European and U.K. feeling has been that image quality of ENG pictures is just too poor for serious consideration as a picture origination format in non-NTSC countries.

ABC's Julie Barnathan and Joseph Flaherty of CBS stood their ground, based on network news and special events coverage experience. Actually, Barnathan was not a member of the panel, but he made his opinions heard. Others on the panel were: moderator E. R. Rout of the BBC's design department; A. Protheroe, BBC News; M. Morizono, Sony; F. Van Poessel, Philips; and J. Fielek of Microwave Associates.

This meeting will be covered in detail in the January issue. But from a what's ahead standpoint, Barnathan stated that ENG equipment must be easy to operate and ultra reliable. He added that the cost had to be controlled because every \$1000 added to the ENG package cost would have to be multiplied 100 times at ABC because of the number of units they have in the field.

## A Shopping List To Remember

The networks usually lead the



way. CBS was into electronic news gathering at the network and station level in 1971. Today, more than 400 stations are equipped with some kind of ENG equipment. Away from the flagship stations, what is not commonly known is that network engineering, production and management can have a great effect on what the manufacturers will come up with next. It isn't the only way innovations are born, but even when the manufacturer develops something really new on his own initiative, his initial introduction often is made to the networks.

At the recent Society of Motion Picture and Television Engineers (SMPTE) annual conference, CBS/Broadcast Group president John A. Schneider made his technical desires known. The word was loud and clear.

"We at CBS are now in our third generation of ENG equipment. The first minicam weighed 51 pounds, designed for the 1968 convention. In 1973, we had the first camera designed expressly for ENG. That weighed 34 pounds.

"The latest newsgathering cameras are fantastic. They only weigh 13 pounds. And the development of the portable videotape cassette recorder has been a major contribution to the success of ENG. It is now possible for journalists, equipped with camera and recorder, to report the news electronically right on the spot—wherever and whenever it happens.

"But even the best 'portable' recorder weighs 32 pounds, a heavy burden after a while. Thus, the first item on our shopping list is a truly portable compact, reliable videotape recorder, weighing only about 10 pounds. This may require a change in standards that CBS may be willing to accept.

"Beyond ENG, the next item on the list involves the power source for this portable equipment. Present-day batteries are heavy, too heavy. They have also been known to leak and even to explode. Recharging is sometimes unreliable and too time-consuming. We need a power source with a capacity of 50 watt-hours per pound of weight, which can be re-charged reliably every night, and which is safe and will operate over a range of tem-

perature.

"Perhaps you can attack the problem from both ends, by reducing the power required to operate the portable equipment while reducing the weight of the battery.

"When a news event is covered abroad, we have to be able to edit and assemble the complete story on the spot. We must be able to transmit it by satellite, ready for broadcast. Thus, for the third item, we need smaller and lighter videotape editing machines and edit controllers which can literally be fitted into a couple of manageable suitcases. Once again, the editing equipment must be battery-operated. It must have all the facilities needed for editing and assembling a complete story to be transmitted, ready for broadcast.

"Equipment with these characteristics obviously lends itself to the production of documentaries. In fact, many local television stations are already using ENG equipment for documentaries. The cost savings are enormously impressive, where a shooting ratio of 30 to 1 is common. The freedom to keep the camera running has made all the difference for the producer in the field.

"However, the high shooting ratio obviously means a very large number of edits, and this in turn requires more sophisticated editing equipment than is now available.

"And because the camera crew should be as unobtrusive as possible in both news and documentary shooting, we need greater sensitivity for the cameras to operate effectively in natural indoor lighting. Perhaps you can achieve a two-stop improvement in sensitivity in two ways. The pickup tube in the camera may be made more sensitive or the zoom lens may be made faster.

"Speaking of optics, cameras are approaching the point in development where we have to plug a camera into the lens. It used to be the other way around. In the new Microcam the lens weighs two and a half pounds; the camera weighs eight pounds. However, the type of lens needed for typical sports shots weighs more like 57 pounds and is 10 times the bulk of the Microcam. Even on full-sized cameras, the

marvelous and expensive 30:1 f/3.5 lens looks enormous, like an all-seeing eye in a science-fiction show.

"Can't you pass some new laws of physics—or make the electronics so good that a big part of the zoom range can be handled by signal processing? Somehow, we just have to have a smaller optical front end. The optics problems, by the way, are equally serious whether on film or tape.

"Now let's turn to sports coverage. Have you ever seen our mobile units heading for a football game? On the road, they look like an armored division on the move.

"There are two semi-tractor trailers, each 40 feet long and 8 feet wide. One of these has expanding sides to increase work space when operating at the event. We may use 6 or 7 cameras at a regular football game, and up to 14 cameras for a special event like the Super Bowl. The gross weight of just one of these loaded units is 31 tons. The cameras must be monitored, switched for live broadcast, recording and slow-motion replay. There are microphones, audio switchers, and miles and miles of cable.

"There is no hiding the fact that it takes tons and tons of equipment to cover a major sports event, not to mention conventions, elections and the like.

"Even covering an event such as a golf tournament is a monumental undertaking. CBS doesn't own the golf course in Augusta, but I sometimes wonder. We have 16 miles of cable buried beneath the sacred fairways to provide the hole-by-hole coverage that viewers expect of the golf classic.

"Why is all this needed?

"One major advance in reducing the weight and size that you have given us in the past few years is changing from a cable the size of my fist to one the size of my little finger. We truly appreciate that, but we need more, much more.

"We need a color-stable, high quality, motion-insensitive transmission system.

"Perhaps digitally encoded signals along with automatic digital reprocessing can be used to achieve a "walk-around" wireless camera. Perhaps frequency bands and bandwidths not now allocated to the broadcaster may be the answer.



# Why Do We Have Over Customers In 20 Countries On





# 200 Orders From 5 Continents For BCN VTR's?

## **BCN VTR's are superior:**

They combine quality of Quad's with economy of 1 inch VTR technology and portability.

## **BCN VTR's are proven:**

Thousands of hours of operation at many customer sites, in studios and outside broadcasting.

## **BCN is really portable:**

The light-weight version BCN 20 operated successfully in boats, helicopters, cars and during the Olympic's in Innsbruck and Montreal.

BCN 20 – 69 min tape reel

BCN 20 – 80 min battery

BCN 20 – 23 kg light-weight

BCN 20 – auto-take assemble.

## **BCN is the advanced solution:**

3 high-quality audio tracks continuous recording – no gap, adaptable to digital recording, single frame display, cassette operation etc.

## **BCN is available:**

4 leading broadcast equipment manufacturers supply you with the BCN VTR's for NTSC, PAL, PAL-M and SECAM.

## **You don't have to wait ...**

For further information contact your local Bosch-Fernseh representative or Robert Bosch Fernseh-Division in Darmstadt/West-Germany, POB.



BCN 50  
stationary

BCN 40  
mobile

BCN 20  
portable

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**FERNSEH**



"Now if you do manage to create a lens-camera combination that is compatible in size and is as compact as we want, we come to another onerous problem on our shopping list.

"We have prompters which are in effect large 'portable' television receivers placed on the camera. The arrangement is in every respect a full-fledged Rube Goldberg contraption—and one must almost mount the camera to the prompter. It is an unbelievable rig. It adds an extra cable or two to be taped to the camera cable—or vice versa. It's time to do something about this.

"I understand a hologram produces an image right out there in space. That would be a good objective for a solution to this problem. I respect the problem; it's a tough one.

"That takes care of news and sports. But the largest part of our broadcasting operation is television entertainment. It is competitive, and we want to do it in the most effective and economic way.

"At present, we use both videotape and film—about two-thirds tape and one-third film. Film is more flexible, but it's twice as expensive to use. So, if we are successful in working out satisfactory labor agreements, we plan to start using tape at our Studio Center film stages in Hollywood, where many of our situation comedies are made before live audiences.

"However, film is still used in our nine weekly, hour-long prime-time drama series. We would like to convert to tape. But that means that we will need an electronic editing device—something to handle the 300 to 400 edits presently made in each hour-long program by a movieola. Perhaps that is something that you, here in this room, can develop.

"That's our shopping list. Not too long, although perhaps demanding.

"As you see, all things have not been invented, and all techniques have not been developed.

"We have been in this business for a long time, by current standards, but in some areas we still

use first generation equipment.

"This shopping list is not of the pie-in-the-sky variety. It's down to earth. It's something that the people in this room can fill."

Now the manufacturers are not always waiting with baited breath to hear what the nets want. Enough of them are leaders in their own right. But the fact remains that when the nets say they want something, it has a definite effect on what you're likely to see, sooner or later, exhibited at conventions.

### CP Antennas

Although still in the wings, circular polarization for television was the subject of a petition of Rule Making filed in February of 1975 by the American Broadcasting Companies, Incorporated. The reply comment date was September 6, 1976. There was substantial response from the networks, the Corporation for Public Broadcasting, the NAB, the Association of Maximum Service Telecasters (AMST), equipment manufacturers and broadcasters. Apparently, there wasn't a consensus. In another section of this issue, you can read a report updating that situation.

### There's Logic, Too

In recent issues, BE has been running a series on "Logic Illustrated". In recent times we've seen digital becoming a vital part of the broadcast equipment scene. A better understanding of how digital circuits work is a prime requisite for keeping up with what's coming down the pike. More importantly, since it will likely continue on its way to more widespread uses, a lack of at least basic digital logic theory will cause more problems than the equipment was designed to solve. The equipment manufacturers could be forced into increased costs, if they become too closely tied to equipment downtime. Troubleshooting digital circuits is a problem confronting both the broadcaster and the manufacturer. In 1977, **Broadcast Engineering** will start a monthly column called "Logic Lab". The first part will deal with where you can get more information on digital logic, and from there we'll be off into practical troubleshooting.

### Up and Down

Up in the sky, satellites are more and more a factor in everyday communications. Who knows how far we are from seeing the networks pumping programming down from the sky to the local TV station. You'll be seeing more on that in BE.

### What About AM And FM?

In another section of this issue, our Radio Workshop editor takes his look ahead. But looking ahead is not a private issue. Cox Broadcasting, among others, has been doing its share.

Cox's data show that:

- FM stations have been profitable since 1973.
- FM revenues have grown over 20 percent per year since 1963.
- In the Top 40 market, FM's share of radio listening will reach 42 percent this year.
- In the country as a whole, the FM audience should account for about 35 percent of all radio listening this year.
- FM revenues should grow at 22 percent annually over the next five years, while AM revenues will grow at 4 percent annually.

### Parting Shots

Automatic and unattended transmitters will be in great evidence in the future. TV stations will get their chance at circularly polarized antennas. And as you might suspect, live news will find its way into virtually every station.

Somewhere out there, we're going to see the solid state pickup devices replacing tubes, especially in ENG cameras. Automation will become an increasingly important factor in daily operations at TV stations. And you can expect to see more from the video disc and hear more about the digital VTR. Watch AM stereo. Of course there will be other innovations.

Before we pull the switch here, a word of caution is needed. You just can't afford to say, "Well, if that great stuff is coming, I'm going to hold off until it gets here." **There are station needs for today and tomorrow. The danger is that today can be lost because tomorrow didn't get here soon enough.** □



# The 1480 Waveform Monitor looks like your faithful 529 ... Until you examine the features

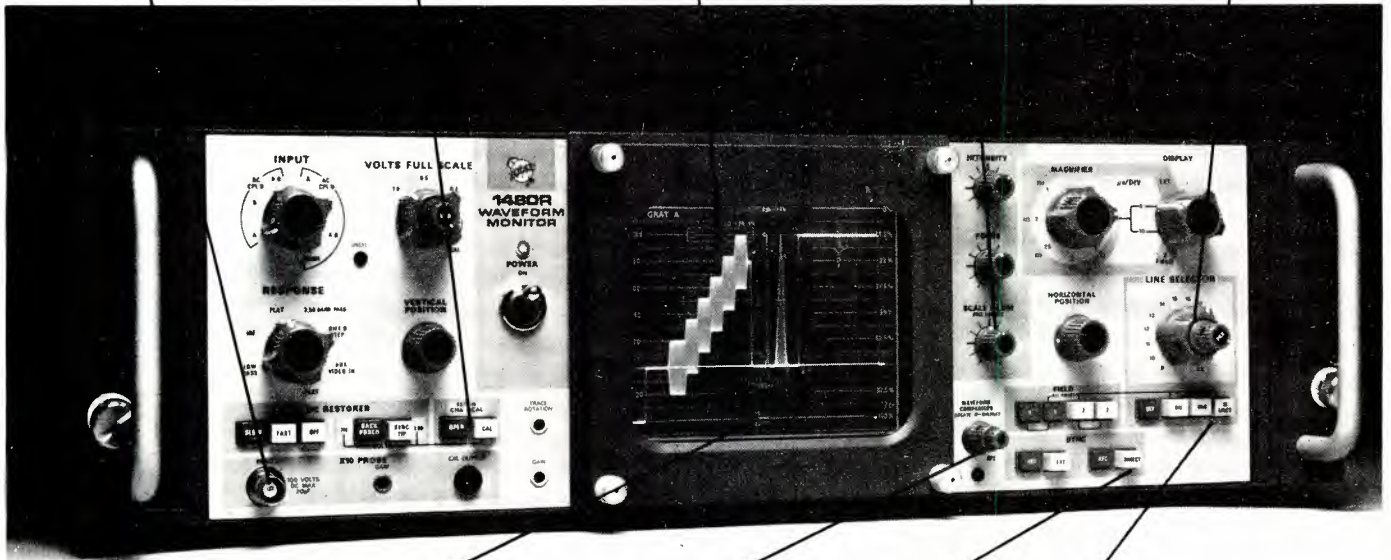
Probe Input option For high-impedance test points.

Display offset For level setting accuracy approaching 0.2%, offset the display of your signal with 1480's very accurate calibrator.

Bright CRT Bright enough to examine VITS without dimming the lights.

Two graticules Your choice of an internal or an external graticule is made with the scale illumination control.

Digital line and field selection For positive identification of signals displayed.



Automatic intensity change When you select a faster time base from the two-field mode, optimum intensity is maintained.

Comparison modes The 1480 will overlay portions of a signal for easier and more accurate comparison of levels.

Direct or AFC Sync Eliminates display jitter or displays jitter.

15 Line display This 1480 feature permits head-by-head VTR signal examination.

on rear panel

Auxiliary video input A special input/output circuit allows you to measure chroma/luminance gain and delay without disturbing your signal and for the use of special filters for unique measurements.

Line strobe In addition to having an auxiliary strobed video out for identification of individual lines on picture monitors the 1480 will strobe individual line vectorscope displays.

The TEKTRONIX 1480R Waveform Monitor does look like the TEKTRONIX R529; just as the half-rack width 1480C looks like the 529. But, there are differences. Some of them subtle, like the sharply focused trace on the bright CRT, others more conspicuous, like the optional input for use of a high-impedance probe. Some features won't be noticed until you examine the rear panel, like the line strobe output for strobing a vectorscope. This is a technique for intensifying individual line displays.

Yes, the 1480 Series Waveform Monitors are different, just as your measurement needs are different. Different from your needs in the sixties, when the 529 series was the high-performance monitor.

Write us, or you use the reader service number to get a series of application notes on the 1480. Better yet, contact your Tektronix Television Field Engineer.

He will be glad to show you the 1480 and its benefits.



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# Broadcasting And The Environment



By Harold Dorschug\*

One of the stories about the environment making the rounds recently purported to relate a conversation between the Lord and Moses.

According to the story, the Lord said to Moses, "There is both good news and bad news. The good news is that plagues small smite your Egyptian oppressors. The Nile shall be turned to blood, and frogs and locust shall cover the fields. Gnats and flies shall infest the Pharaoh's people, and their cattle shall die and rot in the pastures. And hail and darkness shall visit punishment upon the land of Egypt!

"Then will I lead the children of Israel forth, parting the waters of the Red Sea so that they may cross, and thereafter strewing the desert with manna so that they may eat."

And Moses said, "O Lord, that's wonderful. But tell me, what's the bad news?" And the Lord replied, "It will be up to you, Moses, to write the environmental-impact statement."

If you have filed recently to construct an AM directional array, or any towers or supporting structures over 300 feet, or any of four other FCC major actions, you may understand how Moses felt. Such construction requires submitting environmental information which may include an impact statement.

\*Chief Engineer, WTVI-TV, Hartford, Conn.

While this probably will be handled by your attorneys, there are certain aspects of the process which you, as an engineer, should understand in order to assist them. Your advice in pointing out areas in which broadcasting facilities are not as harmful to the environment as some other uses, and in offering suggestions for minimizing the impact of new construction, can be very helpful in persuading zoning and planning agencies to give approval.

The environmental issue is highly charged with emotion and often vague points of relatively minor importance are allowed to confuse a proceeding. Factual information, especially on some of the semi-myths that laymen hold about the effect of electromagnetic radiation on the environment, should be presented in an authoritative manner as often as necessary. Later, the engineer has a very important role to play in making certain that the plans proposed have minimum effect on the environment and that the work performed follows the original proposal.

As a result of a widespread movement to end practices which were destroying many valuable and irreplaceable aspects of man's natural heritage, Congress passed the National Environmental Policy Act of 1969. The FCC implemented the Act by incorporating its provisions applying to communications in Subpart I of Part I of the Rules

and Regulations containing Sections 1.1301 through 1.1319. Before planning any new work, start by reading this.

If your project comes within the provision, read everything you can get your hands on devoted to the subject, especially material covering the legal aspects, stories of cases involving power lines and pipe lines, and the effect of electromagnetic radiation on the environment. Such reading won't make you an expert in the field and don't try to pass yourself off as such. However, it will acquaint you with the language and processes encountered in opposing facilities intended for critical areas. Above all, don't deride your opponents (if you have any). The preservationists are usually sincere, intelligent, dedicated members of your community who want to keep your part of the earth in good condition for people yet to come.

## The Roadblocks

What are possible reasons for objecting to new construction? Here we are discussing how transmitters as studio plants located in downtown areas must satisfy other criteria. In this former case, the tower is generally the first target because of its visual impact. Admittedly, a tall tower can't be concealed and it is difficult to justify its presence in the desired location to laymen. This is fre-



# How a Panasonic VTR helps WISH-TV eliminate make-good headaches. FAST! FAST! FAST!



At WISH-TV, the CBS affiliate in Indianapolis, they're using a video tape system primarily designed to stop robbers... to stop another kind of loss—false claims for make-goods.

The system is the new Panasonic time lapse video tape recorder NV-8030. As Joe Missick, WISH-TV's director of engineering, explains it: "When an advertiser refuses payment because he says his commercial didn't run, or didn't go off right, we don't argue—we just show him a video tape.

"Now there is no question of what was run. There it is for our advertisers to look at, and there are no areas of contention. We have already saved the cost of the Panasonic time lapse video tape recorder in the first 30 days by eliminating false claims for advertisers' make-goods."

The Panasonic VTR not only verifies that the spots ran, but that the video reception was good.

In addition to high resolution, the Panasonic NV-8030 is versatile. WISH-TV also uses it for log verification, to check on commercial loudness and to pinpoint any transmitter interruption.

The NV-8030 can record pictures from an off-air monitor, continuously in different time sequences—9, 18, 72 and up to 108 hours (that's 4½ days) all on one reel of tape.

WISH-TV uses it in the 18-hour mode—so one tape monitors virtually an entire broadcast day.

Could the system work for you? The easiest way to find out is to call us. Or send us the coupon. That way, the next time one of your advertisers makes a false claim, instead of telling him he's wrong—you can show him.

Panasonic Company, Video Systems Division, Dept. 302  
One Panasonic Way, Secaucus, N.J. 07094.

- Send me technical information on the NV-8030.
- Have a Panasonic video specialist call to demonstrate how the NV-8030 can be used at my station.

Name \_\_\_\_\_ Title \_\_\_\_\_

Please Print

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City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

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quently one of the few choice open areas left. Engineering constraints often make it difficult to find a suitable alternative.

AM plants, by nature, require flat, level terrain, ideally of a moist character. Tower height is determined by frequency and efficiency. Painting and lighting must meet governmental regulations. There can only be one "best" answer to the problem. Even though during storms or other emergencies its critics may stay tuned to the station for up to date information, in good times it looks like a big piece of ugly steel standing right in the middle of a wetland ecosystem.

FM, TV and microwave towers are vulnerable to the same arguments. Here the best site seems always to be on a hill that creates the most objectionable silhouette on the skyline. However, some latitude does exist in meeting power-height combinations and your knowledge of this relationship may help in working out a compromise. In a number of hearings covering a broad field reported in the literature on the subject, it was shown that if there is no satisfactory alternative, a reasonable accommodation could be worked out if the problem is approached properly.

### **Positive Points For The Station**

What are some of the positive points to be emphasized on behalf of broadcasting?

Compared with other users of an equivalent amount of land, such as industry or housing, a broadcasting facility does not create any of the following problems:

- It causes no air pollution, creates no oil slicks, nor are any toxic gases used.
- There is no noise problem.
- Waste disposal demands are minimal.
- No valuable resources are removed from the earth such as minerals, gravel or timber.
- It has one of the lowest use densities, resulting in maintenance of the greatest amount of open space. For example, a two-tower array with full half-wave ground system at 1 MHz requires about 30 acres, yet less than one-half acre would actually be used for building, tower bases and guy anchors. The

balance remains open space. With a ground cover of grass it would be a natural habitat for wildlife.

● Because of this low density use, minimal demands are made on community supported services such as police, fire protection, schools and roads.

### **The Big Myth**

The matter of radiation sets broadcasting apart from other more common property uses and it must be considered because it is often confused in the layman's mind with nuclear radiation. With the current controversy over nuclear power stations, you should be in a position to adequately answer any questions about broadcast radiation.

Controlled laboratory tests on both plants and animals have demonstrated that electromagnetic fields produce observable effects. In the case of animals, "it is possible to observe agitation, excitement and increased motor activity sometimes going as far as turning tranquil animals into aggressive ones". In the case of plants, "at large field intensities, for example in the vicinity of relay transmitters and ultra-short-wave links, growth is inhibited".

The authors of this reference work concluded, "if we keep in mind the fact that the biological effects of radio waves depend on a number of factors (the most important being intensity of the field, its nature, and the exposure time), it becomes clear that not even the final results will be unambiguous and will vary more or less (or even be contradictory)". These tests used high intensity fields with carefully focused exposures not usually found in or around broadcast facilities. Also, pulsed radiation was found to be more biologically effective than CW.

An excellent survey of the broadcast situation in the IEEE SPECTRUM of August 1972<sup>2</sup> reaches the conclusion that "Radiation levels found in the vicinity of high-power broadcasting stations, in most practical instances, are considerably lower than those usually associated with biologically hazardous fields."

This statement assumes that itinerent personnel will be kept away from areas of extremely high fields, such as AM tower bases, by

fences or other protective enclosures, and that FM and TV radiation, because of the vertical patterns of the antennas used, will not be directed at people.

Very often transmitters located in suburban or rural areas support large populations of small wild animals such as skunks, squirrels, foxes and even deer, together with snakes and birds. It does not appear that the RF fields continually saturating their habitat damages their life cycle.

Unfortunately, while research and study continue, opinions of scientists often fail to agree. As a result, standards for safety set throughout the world are not uniform. The greatest attention has been given to effects of 3-30 GHz radiation, where tissue heating is the primary hazard. Lower frequency phenomena have been less thoroughly investigated because of the lack of evidence of damage.

### **Maximum Levels**

In the U.S., maximum recommended levels for human exposure have been established by the American National Standards Institute (ANSI) and adopted by OSHA. For a frequency range of 10 MHz-100 GHz, these are a power density of 10 mV/cm<sup>2</sup> for periods of 0.1-hour or more, or an energy density of 1 mWhr/cm<sup>2</sup> averaged over any 0.1-hour period. There is no limit established for radiation below 10 MHz, although there appears to be no reason why this same standard could not be used.

In the USSR a value of 20 V/m has been adopted as the limit over the frequency range of 0.1-1.5 MHz but the Czechoslovakian Socialist Republic limit is only 10 V/m for a range of 0.01-300 MHz for an 8 hr/day exposure.

### **How Can The Broadcaster Help?**

In summary, what steps should the broadcast engineer follow in protecting the environment? We suggest that he should use his specialized knowledge and ability, and here are some ideas.

First, he must attempt to locate any new construction in the least critical areas available and still be consistent with engineering requirements and statutory ordinances. He



must be sincere in his belief and attitude that the site he proposes is the best available. However, he should investigate acceptable alternatives, in case of controversial litigation. He must convince his architects and engineers to design the minimum facility required to achieve the objectives and have the resulting concept present a harmonious blend with the surroundings. The lowest land density use is the one most likely to be accepted.

Second, he should seek the advice of a qualified advisor such as a professor in the ecology department of a local college for recommendations on protecting the most sensitive flora and fauna, endangered species list items, etc., and how best to preserve them<sup>5</sup>. This action has solved at least one head-on confrontation<sup>3</sup>. Also, management must be persuaded to publicize the plans in order to avoid any possible criticism that something underhanded is being proposed<sup>4</sup>.

Finally, he must make absolutely

certain that during installation, everything is done which he agreed upon with the preservationists. He should keep approaches to the property as narrow as possible. He should keep heavy equipment and building material off delicate root systems. He should reduce dangers of erosion and siltation by disturbing ground cover and soil as little as possible, by reducing the time when raw soil lays open and by covering exposed soil with mulch whenever possible to prevent run off. He should keep in mind that what may look like a weed to him can be a very delicate and scarce part of the ecology.

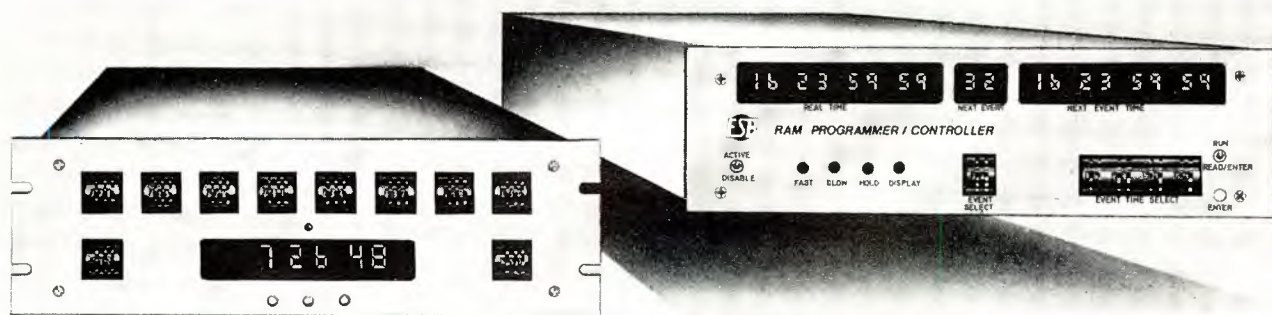
A concerted effort by everyone concerned can achieve your goal if you follow an approach which proves that you are not trying to use the earth's resources for a narrow or selfish interest. Show that you acknowledge the generations of the past who have preserved what we now use and that you are not forgetting the many generations yet to come. Only in

this manner can life centuries from now become more than bare survival.

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# PERFECT TIMING



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## What's Ahead For The Radio Broadcaster

By Peter Burk

Unless you've had your head buried in a transmitter for the better part of 1976, you're already aware that another technological revolution has descended on the broadcast industry.

Spin-offs from the computer and aerospace industries continue to spin into our domain, making it possible for us to deliver a better product more economically. In addition, the FCC is inching toward some changes that will enable us to take advantage of the new technology and offer our listeners exciting new aural delicacies. This month, as we tie the ribbons on 1976, we'll peek into the next three hundred sixty-five and beyond and see what effect these advancements will have on the back shop at your station.

### **No More Logs**

By the time this issue goes to press, the commissioners at the FCC will be voting on the long-awaited Automatic Transmitting System (ATS). If the men in the ivory tower put their blessing on the proposed system, many stations will be able to install a black box that will relieve the necessity of an operator on duty.

After approval by the commissioners, appropriate rules will have to be adopted and a magic date for going on the system established. It's hard to predict how long that may take, but if you have enough operating logs to last through the coming year, you probably won't have to get any more printed...ever.

### **AM Stereo**

Stereo has probably done more for FM than all of its other assets

put together. It's natural then that AM broadcasters would like to jump on the bandwagon. To date, two AM stereo systems have been proposed. The Commission isn't doing any testing on either system yet, but is interested in the results of outside studies now being conducted. Before any changes of this type can be approved, it must be demonstrated that the system is fully compatible with existing receiving equipment and that mono quality will not be degraded.

The receiver manufacturers are expressing a great deal of interest in AM stereo, and are providing some of the input to the broadcast industry. One of the interesting problems is the matter of lighting a 'stereo' light on the receivers. Most broadcasters agree with the manufacturers that it is almost imperative to inform the listener visually that both ears are being stimulated separately, but the limited bandwidth on AM makes the transmission of a pilot difficult.

It's not likely that any action on AM stereo will be taken in the near future, but it's something you might think about if you're planning a new AM studio. The transmitter conversion will be simple compared to the changes necessary at the studio.

### **Music For Four Ears**

If you think stereo proof of performance is a task, dream for a few minutes about discrete four channel for FM. Let's see...left front into right ear, left rear into right front...**twelve** separation measurements at each frequency, not to

mention cross-talk!

Progress on quad at the FCC is encouraging. Field tests on a discrete system have already been conducted and are being analyzed by the chief engineer at the commission's labs in Laurel, Maryland. Results should be out in three to six months, but don't hold your breath waiting for a notice of proposed rule-making. Pacific FM Inc. filed their discrete four channel application in 1971!

Several months ago, CBS filed for adoption of standards for FM stereo quadrasonic transmission and in all likelihood, Sansui will make a similar application. No tests have been filed yet on either matrix system, so it's going to be a while before any decisions are made.

The Commission isn't intentionally dragging its feet on these projects. The main concern is that any new system be the best possible, since we'll have to live with it for a long time. On the bright side, the people shortage that has hampered the Commission is being rectified. Many new departments that have been short of warm bodies are hiring right now.

Fortunately, not all of our technology requires commission approval before we can put it to work. Microprocessors are perhaps the hottest thing in radio automation for 1977. Digital has become a way of life, with applications blossoming in almost every corner of the station. 1977 should bring us a 'smart' audio processor, more sophisticated tape handling equipment, and a whole raft of improvements in almost every type of broadcast equipment. Ever increasing use of



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For More Details Circle (23) on Reply Card



large and medium scale integration is responsible for much of the progress.

Electronic news gathering, television's claim to fame last year, will receive more attention in radio as we find ways to preserve the immediacy of radio without sacrificing quality. **Radio Workshop** will devote the next several months to ENG for radio.

### Are You In The Picture?

Yes, the state of the art is advancing rapidly. Are you? 1977 technology requires 1977 engineering. The engineer who's still emptying grid leak pans had best keep an eye on the young fellow standing behind him. Sure, he's still a little wet behind the ears, and probably doesn't know a cat whisker from a SY3, but you can bet he won't get

lost on a Karnough map.

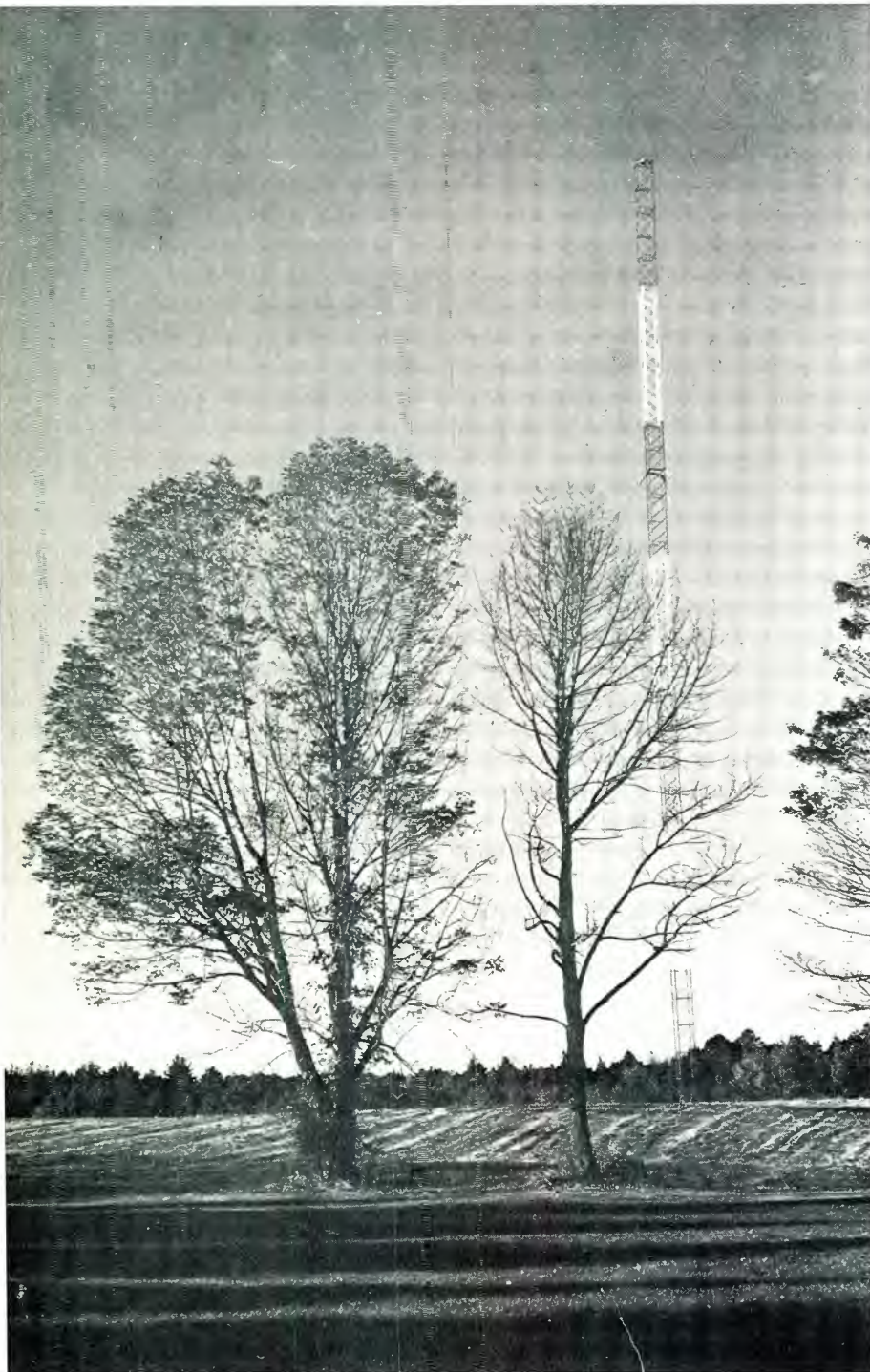
A comfortable working relationship with digital logic is no longer just something nice to have, it's essential for survival. If you don't already feel at home in the land of true or false, now's the time to get with the program. This month's **Broadcast Engineering** contains the last installment of "Logic Illustrated" by Harold Ennes. Next month, BE will begin another Ennes feature called "Logic Lab". These articles are written on a level that a newcomer to digital logic can understand and are an ideal way to tune into 1977.

Another way to improve your grip on those little black caterpillars is to establish a reference library at your station using data books supplied (usually free) by the IC manufacturers. They usually contain applications notes as well as device ratings and pinouts. None has made the best seller list yet, but they do make for good reading on cold winter nights. Even more important, when you do have a problem with a piece of equipment, you can find out a lot more about the device in question from the data sheet than you can from the equipment instruction book.

Many colleges and universities are now offering night courses on digital logic. If you're not at home with logic yet, consider taking a course or two. Build or buy some sort of breadboard for experimenting with TTL or CMOS packages. Learning by doing is tough to beat.

1977 is also the year to get your shop ready to handle a new breed of problems. A good triggered scope is absolutely essential with dual trace capability high on the nice-to-have list. A logic probe is a real time saver, too. Take a look at your hand tools, too. Removing an IC with a 250 watt soldering iron and a pair of vice grips just doesn't cut it!

If you're in a competitive market, don't forget the guy across the street has as much access to 1977 technology as you do. What worked for you last year might not be good enough this year. Change...like it or not...is the name of the game. If you have a need for informative articles in specific growth areas or if you have ideas to contribute, drop us a line in care of the Radio Workshop Editor.



There's more to this photo than meets the eye. Your station and the environment will be a subject you'll have to face the next time you change sites or plant towers. Note here that towers can blend with the surroundings. (Photo by Harold Dorschug, WTIC, Hartford, Conn.)



BE will be running hard to keep you up to date on what's happening, but it will be more important than ever to make it to the conventions. Next up is the annual NAB convention. Exhibition floor space is already sold out. And all indications are that it will set a new record for attendance. Here is your chance to touch and compare the items you need most.

No doubt about it, there will be several new pieces of equipment. And what the manufacturers like most is to have the broadcaster stop by the booth and ask questions or ask for a demonstration. All too often the broadcaster walks the aisles, finds what interests him most, and then stands back and looks and looks and looks...what we should all be doing is communicating.

Speaking of communicating, the Society of Broadcast Engineers (SBE) will hold their annual meeting during the convention. Here's a golden opportunity to meet and talk with engineers from all parts of the country. You'll learn more about the SBE's engineering certification program, and you'll have the chance to talk about the industry and the equipment in the exhibits with other engineers.

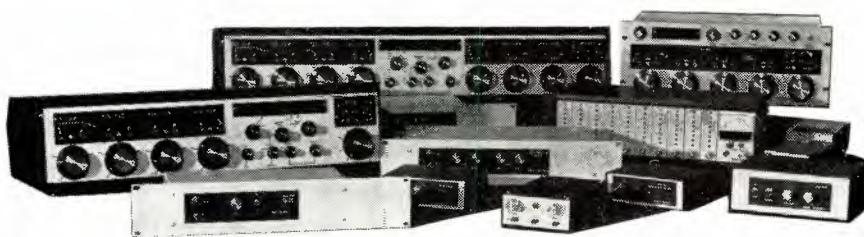
From the financial side, and based upon recently released FCC figures, FM had a great year in 1975. Of over 180 markets reporting, about 160 showed gains, while only 10 had losses. Eight markets, led by Jacksonville, Florida, reported revenue increases of more than 100 percent. AM growth was good, but not dramatic.

It has been reported (**Broadcasting**, November 8) that NBC is prepared to drop their all-news operation, News and Information Service (NIS). Originally, NBC had planned on signing 150 subscribing stations. They're down now to a reported 62, with an audience of about 200,000.

While all-news is down for the count at NBC, this format has met with success at local stations. As you might suspect, the key is getting into the local news and not relying solely on the national news.

Among the challenges to come for radio will be new and interesting ways of carrying the local news. After all, ENG did start in radio. □

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# An Update On CP

By Robert E. Winn\*

A subject of growing interest and importance to many broadcasters is that of circular polarization for television. This discussion does not argue the case one way or the other but tries to offer an objective overview on the subject. It briefly reviews the status of the proposed FCC Rule Making and the Circularly Polarized TV tests that have been conducted. It takes a look at the theoretical advantages of circularly polarized TV, discusses the WLS-TV experiment on the Sears Building in Chicago and concludes with a discussion of transmitting equipment requirements.

## FCC Status

The Federal Communications Commission adopted a notice of proposed Rule Making on May 11,

\*RCA Broadcast Systems.

1976 in Docket No. 20802 looking toward the amendment of Part 73 of the Commission's Rules and Regulations to permit television broadcast stations to employ circular or elliptical polarization.

This notice of proposed Rule Making resulted from a petition of Rule Making filed February 12, 1975 by American Broadcast Companies, Incorporated, that requested the Rules and Regulations be amended to permit the use, on a permission basis, of circular or elliptical polarization for TV broadcast transmissions.

The comment date for the Television Circular Polarization notice of proposed Rule Making was August 24, and the reply comment date was September 6, 1976. There was substantial industry response consisting of the National Association of Broadcasters, the Asso-

ciation of Maximum Service Telecasters, the three Commercial Television Networks, Corporation for Public Broadcasting and several equipment manufacturers. The responses ranged from strong support to opposition of the proposal for various reasons.

## Tests

Limited data on TV circular polarization had been attained by an experiment some years ago at Station WTAJ-TV, which was then WFBG-TV, Channel 10 in Altoona, Pennsylvania. A recent experiment was conducted during 1975 at Station KLOC-TV, Channel 19 in Modesto, California. A report on this test has been filed with the Commission.

The American Broadcasting Company obtained an experimental authorization to conduct television

## The Manufacturers Are Saying...

It was one year ago that **Broadcast Engineering** ran a feature article on circularly polarized antennas. In that article, the CP antenna used in the KLOC-TV FCC authorized experimental tests was described and test procedures were explained. That was the Jampro antenna. And there are others.

Of course **Broadcast Engineering** is not supporting any one make or model. What most people want to know is (1) what tests have been run, and (2) what do the results reveal? Meanwhile, it's obvious that different designers will find different configurations and techniques. While these differences will

affect the results, what **BE** is trying to nail down is the feasibility. And so far as we can determine, the evidence seems to support the theory that CP antennas can help eliminate ghosting and co-channel interference.

CP antenna manufacturers are putting their money where their mouth is. The antennas are available from Harris Corporation, Jampro, RCA, CCA (marketing the Bogner antenna), Micro Communications and Alford Manufacturing. So it shouldn't be held up because we are talking strictly theory.

Harris Corporation, Broadcast Products Division, feels that their CP techniques will produce excellent results. A company spokesman told **BE**, "Published reports by well known consultants have proven that fact to our satisfaction, and we now feel it is our responsibility to see that this new technology becomes established as the state-of-

the-art in TV transmissions."

The Harris Cavity Backed Radiator (CBR) CP TV antenna has a unique feature. A broadcaster can install one now and transmit in the horizontal mode with excellent results, and then, with a minor on-site modification, broadcast CP signals when authorized to do so by the FCC. Harris, according to Product Administration VP Jim Combs, has their antenna in supply now.

CCA is marketing the Bogner CP antenna, and they also have one which can be field modified after installation for CP transmissions. Their antenna uses the same basic slot-director technique as their standard horizontally polarized units. Their UHF and VHF high power CP antennas were announced and demonstrated at the '76 NAB convention.

Thomas J. Vaughan, president of Micro Communications, Inc., com-



# TV Antennas

circular polarization tests at WLS-TV, their owned and operated television outlet in Chicago. The WLS-TV transmitting plant was installed in the Sears Building in Chicago in 1974 and an interim antenna installation mounted on the west cylinder on the top of the building was employed. Field measurements and observations were made for ABC by Smith and Powstenko, Consulting Engineers. Three engineering reports have been submitted to the Commission. Additional details of this antenna system will be given later.

## ***Is Circular Polarization Coming?***

The question being asked by many broadcasters today is "Is circular polarization coming?" To help answer that question, it is important to look at some of the

theoretical advantages of circular polarization.

These advantages might best be seen by first investigating the horizontally polarized signal. As shown in Figure 1, the radiated field lies entirely within the horizontal plane and with time traces out a sine wave. The received signal will be maximum when the receiving dipole is in the horizontal plane, and will diminish to zero as the receiving dipole is rotated to the vertical position.

By taking two dipoles mounted at right angles, as in Figure 2, and feeding them in phase quadrature, we find that we can produce a radiated field that rotates around the axis of propagation with the magnitude of the field vector remaining constant. This radiated signal is circularly polarized and is defined to be either right hand or

left hand, depending upon the rotation of the "E" vector when looking in the direction of propagation. We can see from this diagram that if we place a dipole receiving antenna in this field, the received signal will be constant as the dipole is rotated through 360 degrees. Thus, theoretically, circular polarization makes it simpler to adjust rabbit ear and whip type antennas since the antenna orientation will be less critical.

## ***Ghost Reduction***

Probably the greatest advantage of circularly polarized transmission is the theoretical ghost reduction capability. This benefit is based on two factors. First, the reflection behavior of circular polarized fields and second, the polarization discrimination by circularly polarized receiving antennas.

menting on the need for CP TV antennas said, "Some of the additional services that are being planned will use TV for shopping, banking, instruction, and business. The BBC is presently transmitting coded signals to selected viewers who are able to ask a computer for all sorts of information..."

"All these new services have two things in common: (1) They will demand higher quality reception; and (2) It will cost additional funds." He goes on to say that ENG is involved as well. He goes on to conclude, "Our present method of transmitting linear horizontal polarization (for TV) is very restrictive and does not permit the use of any of the new Ghost Filtering Techniques. CP is not only desired by the broadcaster, but will be demanded by the viewer when the new applications are implemented, and he has to pay for the service."

Jampro Antenna Company be-

lieves very strongly in CP antennas for television. In reply comment filed with the FCC, in favor of CP for TV, Jampro's president, Peter Onnigian, stated that none of the opponents for CP really had any substantiating arguments. The Association of Maximum Service Telecasters proposed a "go slow" attitude and more study of the matter to the Commission. The Corporation for Public Broadcasting on the other hand is concerned about a further disparity between UHF and VHF telecasters. CPB believes that VHF stations will switch to CP antennas, while UHF stations may not be able to do so economically. CPB therefore suggests a delay, and more study. Neither MST or CPB have indicated a desire to put money into tests of the matters they question. Onnigian says ABC television and KLOC-TV, Modesto, where Jampro conducted its CP tests, invited all interested parties

to make tests using the two facilities.

Jampro believes that adequate testing of this new type of TV antenna and its resulting mode of propagation has been accomplished. Onnigian says the results are in and are positive. Jampro therefore has urged the Commission to promptly act upon its own proposed Rule Making, and adopt it as written.

In the Jampro tests, they found existing home antennas were completely compatible with CP transmission. As a matter of fact the Jampro field tests indicated 66 percent of the homes tested, showed better pictures with CP, compared to normal horizontal polarization, using the same ERP. Indoor antennas, for UHF reception, which consist of rings, vees, bow ties or other electrically small pickup devices, perform much better with CP transmission than they do with the present mode.



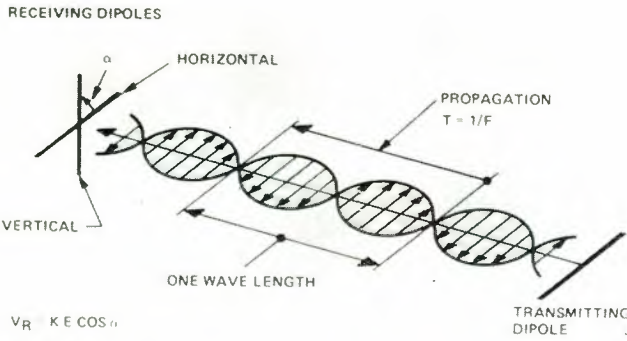


Figure 1

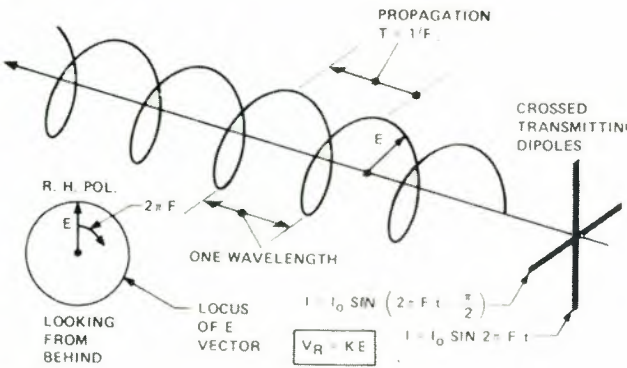


Figure 2

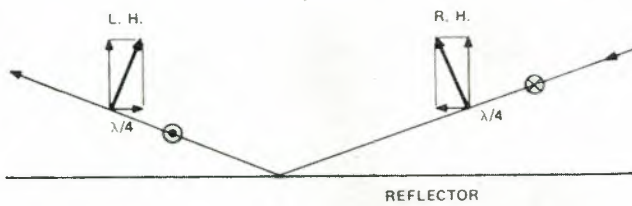


Figure 3

Figure 3 illustrates the reflection phenomenon of electric fields. The right hand circularly polarized signal shown on the right is vectorially represented with the instantaneous horizontal and vertical components. Note that the vertical component is pointed upwards and the horizontal component is directed inward. When the signal is reflected from a horizontal reflector, the horizontal component will be reversed in polarity as shown in the left hand vector representation. Note that the horizontal component is now directed outwardly, and that the vertical component remained unchanged and directed upwardly. The result is that the sense of rotation is reversed, and the reflected signal is now left hand circularly polarized.

The second factor contributing to

ghost reduction is that of polarization discrimination by the receiving antenna. To rephrase this slightly, a right hand circularly polarized receiving antenna responds only to right hand circularly polarized radiation. Figure 4 illustrates why.

Shown are two receiving and one transmitting antennas. All three use identical cross-dipoles connected in phase quadrature. The transmitting antenna radiates a right hand circularly polarized signal as a result of the connections to the feed lines. The receiving antenna on the left is identical to the transmitting antenna in the drawing, and it is also right hand circularly polarized. Since it is used as a receiving antenna, it faces the transmitting antenna.

Note from the diagram that if either of the receiving antennas are

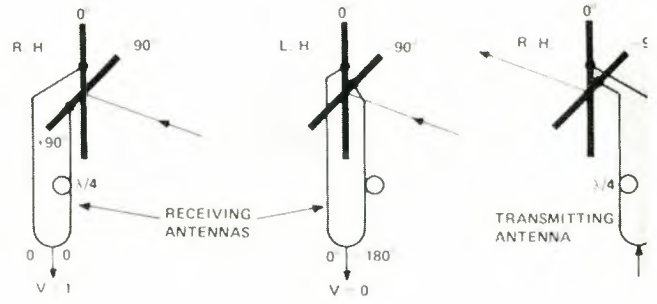


Figure 4

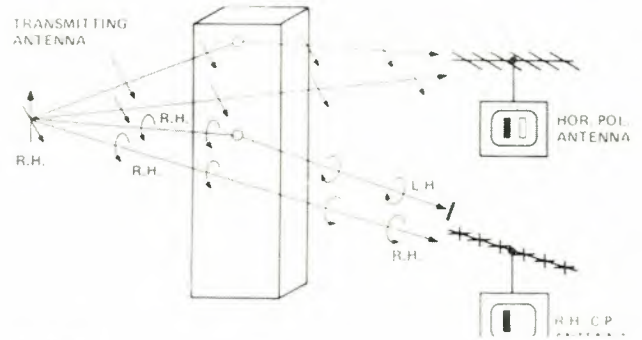


Figure 5

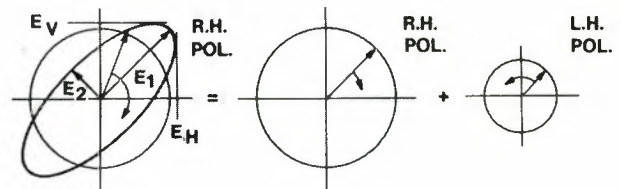


Figure 6

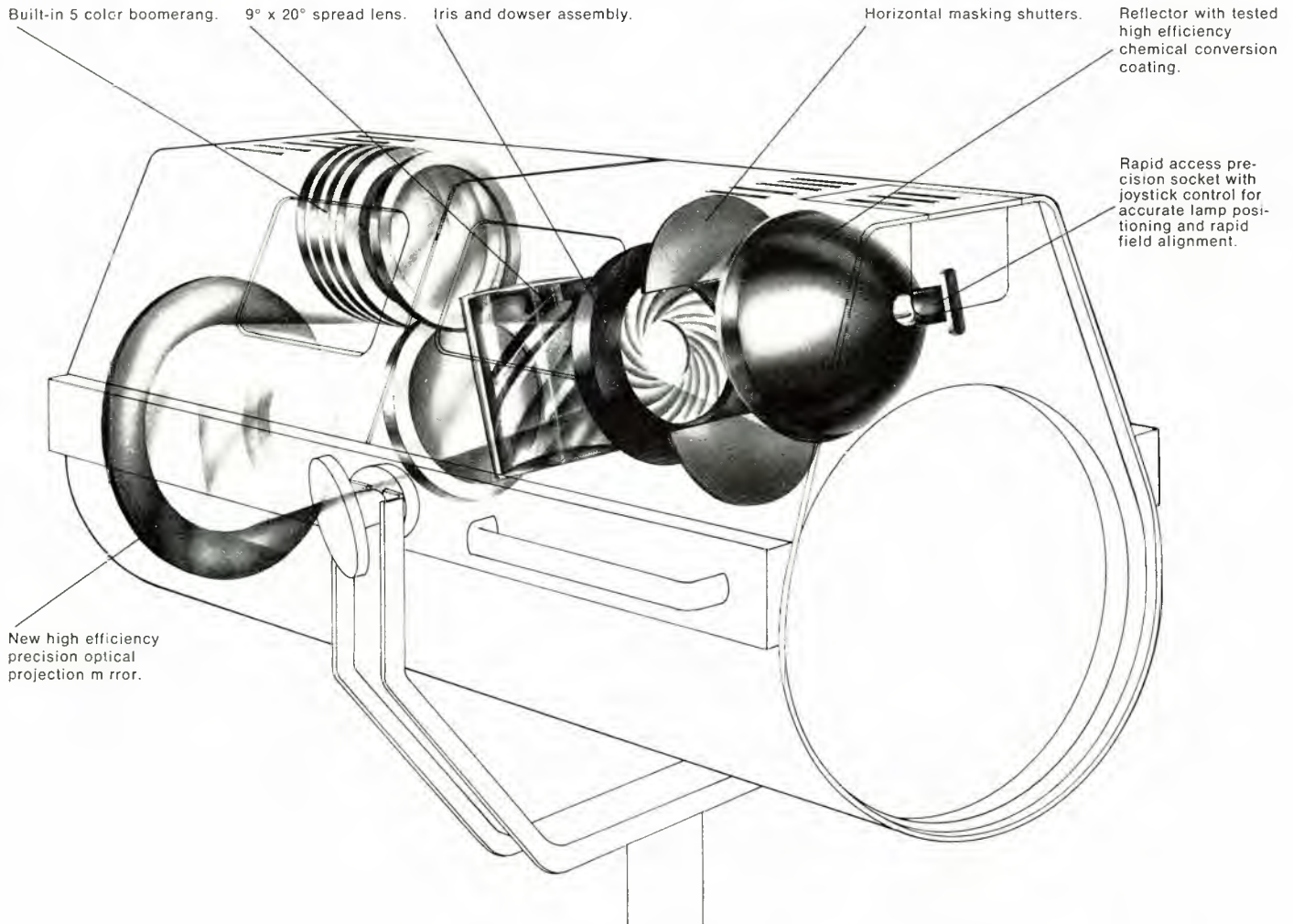
rotated 180 degrees to face away from the transmitting antenna, their direction of rotation is reversed. This fact is similar to realizing that the hands on a clock turn counter-clockwise when viewed from behind the clock. This reversal in front to back rotation gives rise to the potential advantage of circular polarization to reduce adjacent and co-channel interference.

The antenna in the center is wired for a left hand circularly polarized signal, but it is otherwise identical to the transmitting antenna. If we supply a signal to the input of the transmitting antenna we see it is first split between the horizontal and vertical radiators and that the horizontal feed contains a quarter wave, or a minus 90 degrees, phasing section. This

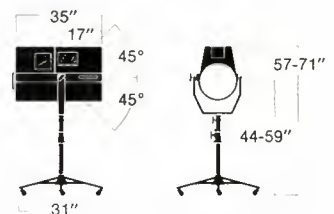


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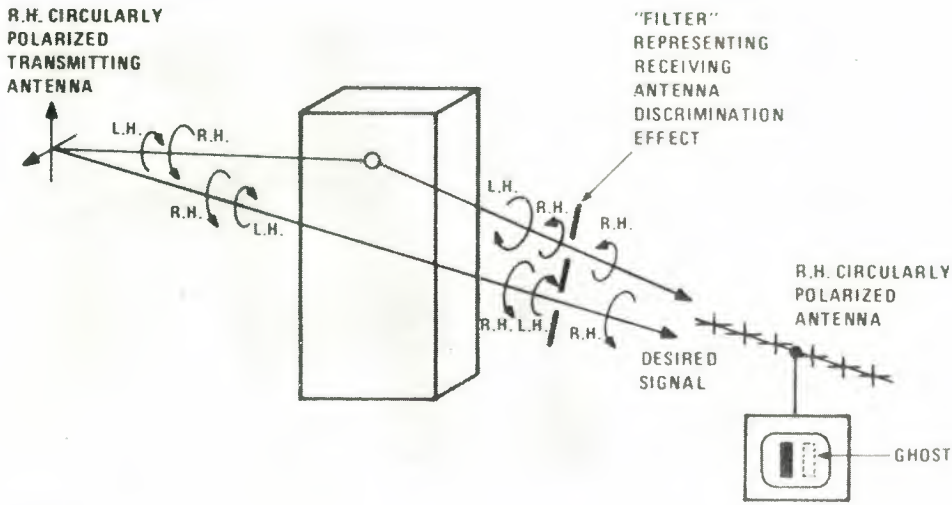


Figure 8

Figure 7

phasing section provides the required quadrature feed to the crossed-dipoles to transmit a right hand circularly polarized signal.

Looking at the center receiving antenna, it will have zero output since the signal arriving from the crossed-dipoles at the combiner junction will be 180 degrees out of phase.

Looking at the right hand polarized receiving antenna we see that the signals received by the two crossed-dipoles add in-phase at the combiner and produce an output.

To see how these factors provide ghost reduction, let's examine a simplified illustration of a typical transmission system.

**Typical Transmission System**

Figure 5 illustrates a transmitting

antenna on the left and two receiving antennas on the right, the top right being a horizontally polarized antenna and the lower right being a right hand circularly polarized receiving antenna.

Looking at the upper signal, and assuming the transmitted signal to be horizontally polarized only, we see that the horizontally polarized receiving antenna receives two signals—one a direct path signal and the other a reflected path signal. Provided that the path length of the reflected signal is sufficient, and that its reflection amplitude is high enough, a ghost will be seen on a TV set connected to this antenna.

Looking now at the lower signal path and assuming that both the transmitting and receiving antennas are right hand circularly polarized,

we see that again two signals are present at the receiving antenna. The direct path and the reflected path. However, this time the reflected path changed polarity upon reflection and is now left hand polarized. Due to the polarization discrimination of the receiving antenna, only the direct path will be received, and the ghost signal will be eliminated.

**Circular Polarization**

In practice, rarely is anything perfect, and the same holds true for the term **circular polarization**. Let's examine the quality of the circuitry polarized signal.

The term **Polarization Ratio** is typically used to describe the

*Continued on page 72*

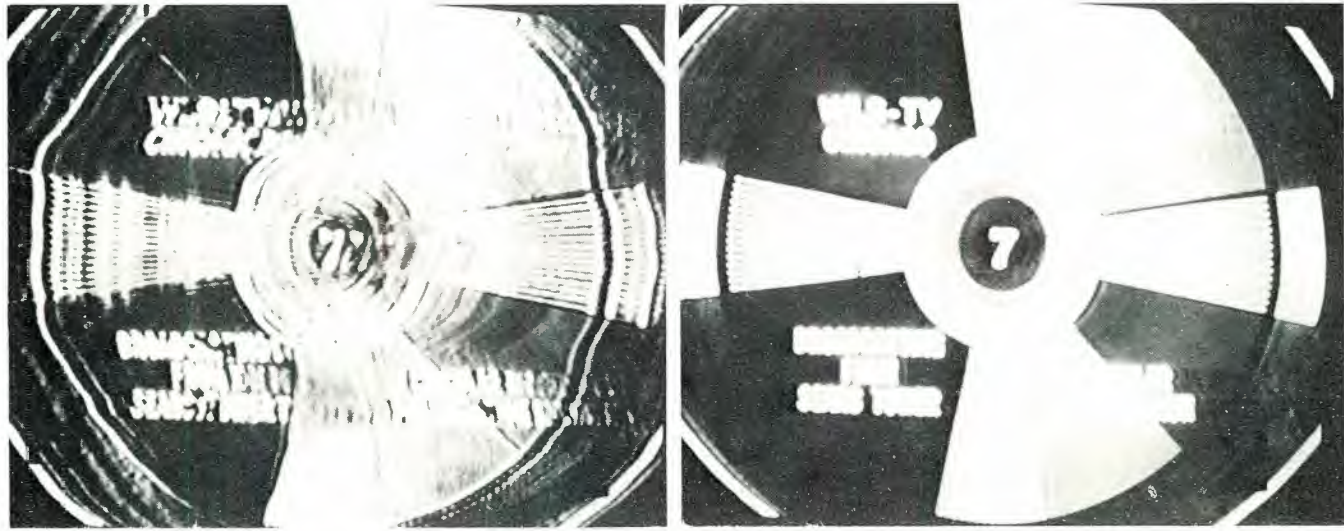


Figure 9 These are off-air pictures taken during the Chicago test. On the left, a signal under the worst conditions without CP. The right side picture shows CP improvement.



# RCA power tubes of the future have a remarkable past: actual lifespans up to 30,000 hours.

Tube Operating Hours Reported by 20 TV Stations*		
<b>Up to 5 kW</b>	24,142 hrs.	21,329 hrs.
Types 8890 & 8806	12,263 hrs.	19,200 hrs.
Aural service	16,200 hrs.	14,000 hrs.
<b>Up to 12.5 kW</b>	10,096 hrs.	10,525 hrs.
Type 8891	9,402 hrs.	
Visual service		
<b>Up to 17.5 kW</b>	16,600 hrs.	18,300 hrs.
Type 8807	29,800 hrs.	21,200 hrs.
Visual service	30,100 hrs.	20,400 hrs.
<b>Up to 27.5 kW</b>	9,778 hrs.	9,776 hrs.
Type 8916	7,875 hrs.	13,183 hrs.
Visual service	10,799 hrs.	

\* Serial numbers and tube type data available on request

RCA power tubes are at work now in new-generation color transmitters. Proving their value with an excellent combination of high gain, high linearity, plus long operating life.

*Documented* long life. In the table, you can see actual operat-

ing hours reported by 20 TV stations. That reliability comes from RCA's sturdy, coaxial CERMALOX® construction and thoriated-tungsten mesh filament, which minimize inductances and feed-thru capacitances. So you can use simple, economical broadband circuitry.

In fact, RCA can supply you with the right circuit and cavity to go with the tube you select.

For high performance and proven long life in a wide range of power tubes, there's one thing to do. Contact your RCA Representative. Or, RCA Power Tube Marketing, Lancaster, PA 17604. Telephone 717/397-7661.

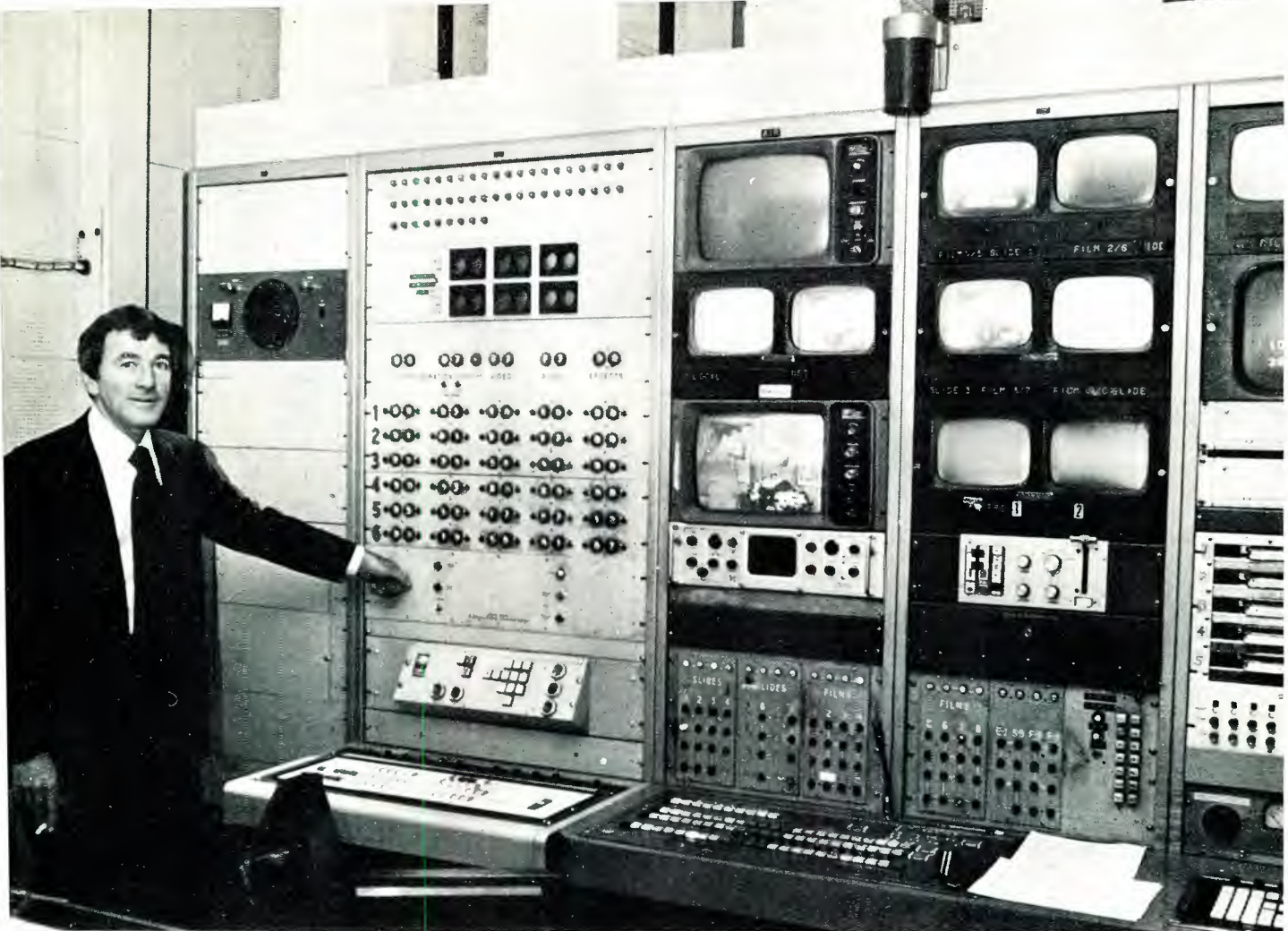


# RCA

For More Details Circle (27) on Reply Card

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Larry Fraiberg, Vice President & General Manager WNEW, powering-down and phasing out "yesterdays" automation system in preparation for the BCS/CDL Total Automation System. 1975.

If You Get People Involved...

# You Can Take The Surprises Out Of TV Automation

Part 3 of a 3-part series/By Bob Hueffed

In the November issue of **BE** we traced the history of automation at Metromedia from 1961 to 1974. The November article started in the era of tubes and transistors and ended with the introduction of a digital computer, in 1969, at Metromedia's Los Angeles station, KTTV.

## Incubation Period

From 1969 to 1974, the industry went through an incubation period, and some tough times, and then came on stronger than ever. "Things" had changed, and at a revolutionary pace. To compete and

maximize profits, a station's communication system had to operate in "real" time. To illustrate, in January, 1970, WNEW-TV averaged 1200 commercials per week of which 550 were "60's". In January, 1976, they averaged about 3000 commercials per week of which 200 (approximately) were "60's". In December, 1976, WNEW is estimating 3500 commercials per week. Adding more people to a manual system could not handle this load effectively. In fact, just adding people could be self-defeating. Fortunately, the broadcaster and

hardware suppliers were getting prepared for the "better-days-to-come". The minicomputer grew to a giant in its industry, and manufacturers and computer programmers were learning more (in some cases for the first time) about avails, orbits, rotations, aged receivables, logs, makegoods, demographics, etc., etc., etc.

In the middle of this industry incubation and development period, 1973, WNEW's Bill Kelly was ready for a giant step forward in "Total" automation. After Kelly made his preliminary investigations, Dick



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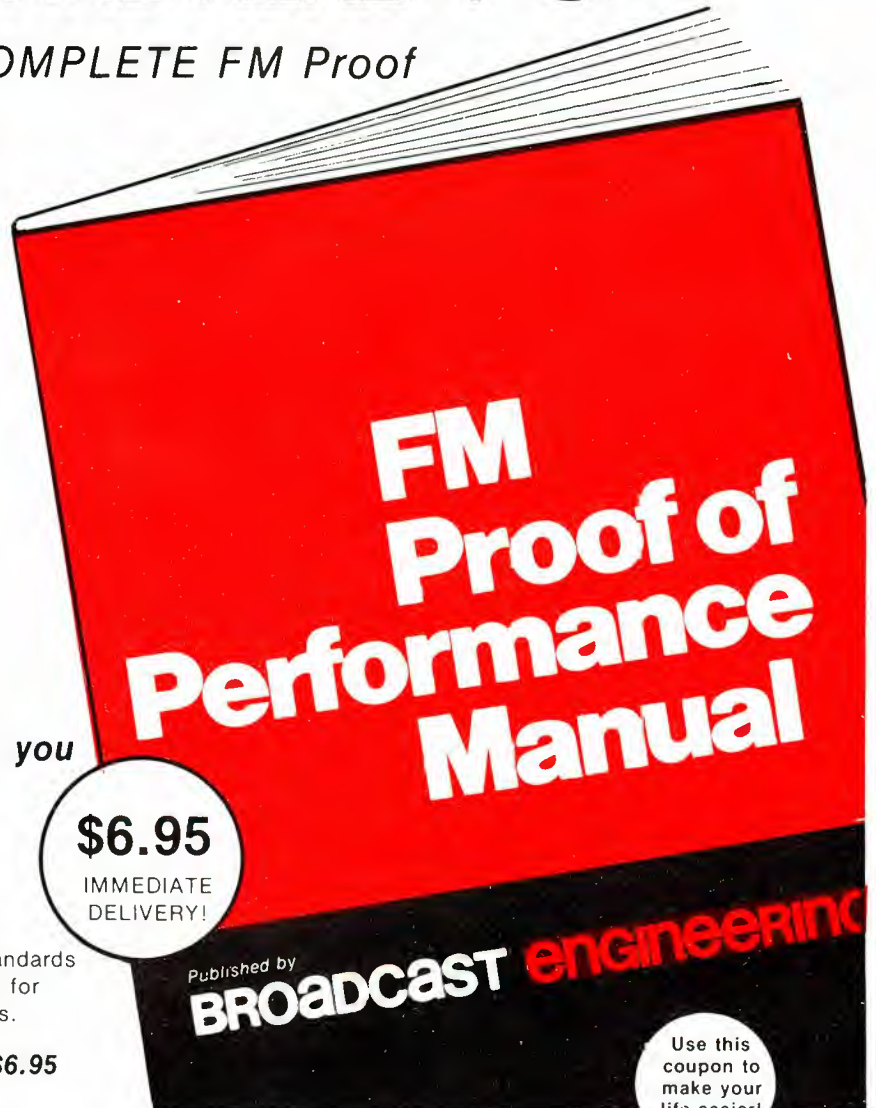
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Anderson formed an engineering team to define a Technical Operations automation system that could be hard wired to a Business Computer system, and the Metro-media master plan was modified. The "plan" now required that "Total" automation systems be installed at WNEW-TV, WTCN-TV and WTTG within a period of two years. And at the same time WTCN-TV, a newly acquired property in Minneapolis, had to design, build and move into a new building with all new equipment.

Early in 1974 Hal Christiansen formed a team to define and select a Business Computer system for five of the Metromedia stations... WNEW-TV, WTTG, WTCN-TV, KMBC-TV in Kansas City and WXIX-TV in Cincinnati. (Metromedia acquired the WXIX-TV property a few months after they purchased WTCN-TV.) All five installations were to be complete within two years.

In 1973 Metromedia selected the CDL System 200 Technical Operations Automation system for WNEW, WTCN and WTTG. Concurrently, they purchased Ampex ACR-25's. The ACR-25's were to become another link in the "Total" automation chain. Metromedia, Westinghouse, Ampex and CDL jointly defined an intelligent interface to permit CDL's System 200 to automatically program and control the Ampex ACR-25. These two interfaces are better known as the Ampex ADA (Automation Data Accessory) and the CDL ARCH

(Automatic Remote Cassette Handler).

In 1974 the Kaman Sciences BCS-1100 Business Computer system was selected. Although it was a relatively new system, it was backed up with experience, and more adaptable to communicate directly with CDL's System 200. Both systems used the DEC PDP-11/05 minicomputer and random access mass storage discs for data.

It is next to impossible to describe in detail the operational features and advantages of these two systems in less than 100 pages and a two day seminar. More important is to describe **why** and **how**.

Metromedia recognized that "real" time and accurate communications were essential for operating a TV station now and in the future, particularly independent stations in major markets. They were following their master plan and in 1974 they saw that they could **approach** a "real" time data and communications system for a TV station. The BCS-1100 could effectively handle the Sales/Service Department's work load and problems. They could communicate directly with Traffic because both departments use CRT terminals and a common data base that are controlled by the same computer.

The BCS computer can "talk" directly to the CDL computer; therefore, the Program Log can be transferred directly to Technical Operations. The CDL system can automatically schedule and control

ACR-25's, verify material, make machine assignments and control the machines, perform complicated audio/video sequences with a variety of effects, print the FCC "As-Aired" Log, and then transmit this back to the BCS system for automatic invoicing.

Over-simplified, but adequate to illustrate the full circle of the communications paths that you can now control with computer systems, and why Metromedia selected these systems.

### **Why Automate?**

Predictably, the Sales Service Department asked the question... "Why automate?" "Change" is always present in their operation, and their clients are becoming more unpredictable. They are well aware of computer horror stories, and there probably is not a sales department anywhere, in any industry, that is anxious to convert to a computer operation. But as Budd Meehan, Vice President and General Sales Manager for WNEW, said... "We had one of the best and most copied manual systems in the business...had to because we are an independent station in the Number 1 market with a National Sales Manager, two Local Sales Managers, 11 salesmen and two retail store specialists...but we could not continue to use a manual system forever...we have to learn to walk before we can run, and we'll be ready to run when we have to...and that day is rapidly approaching." Meehan added... "Ratings are measured electronically in New York, and when 0.1 of a rating point changes the price of your inventory, you have to know exactly what you have in inventory."

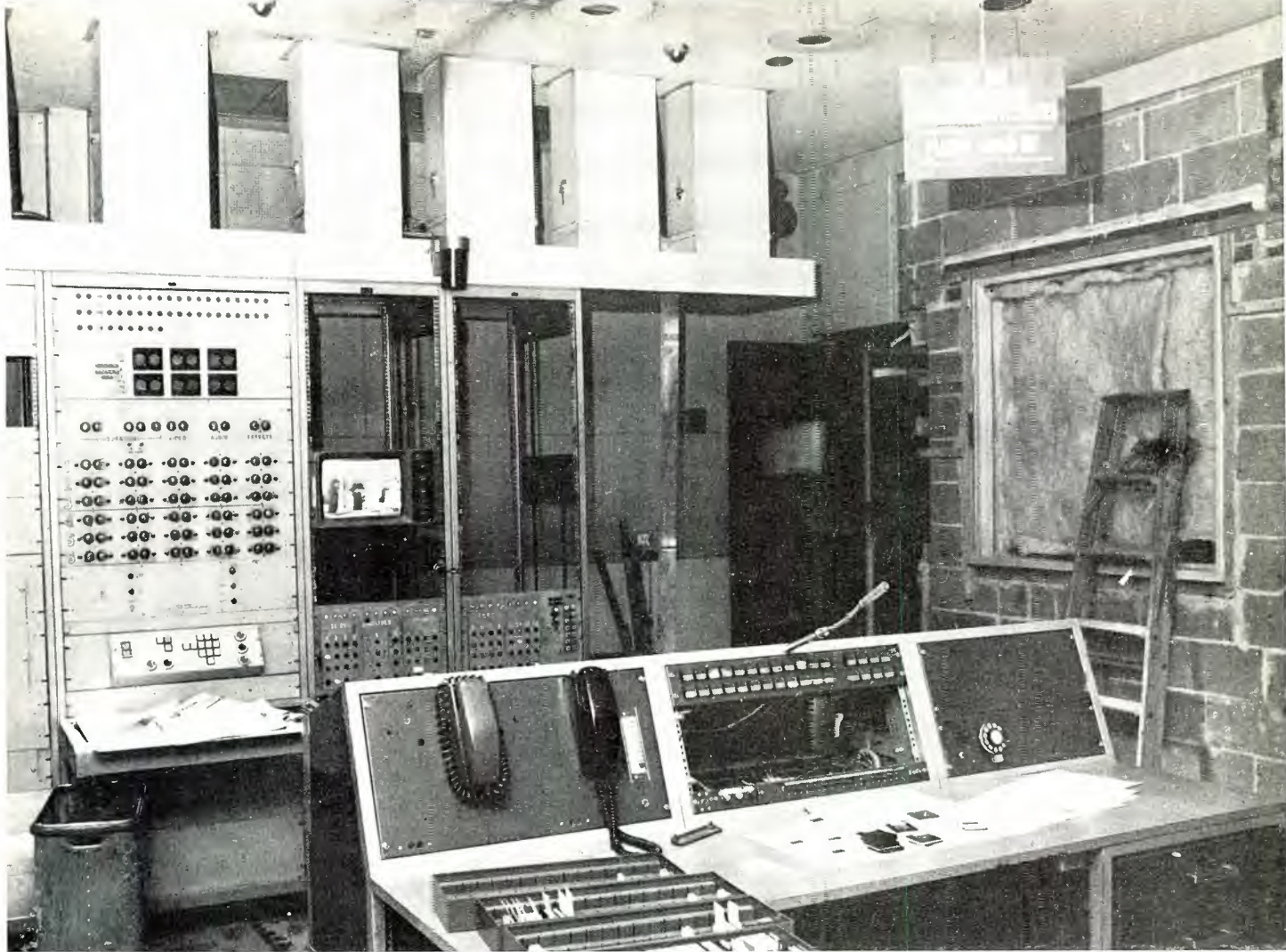
Ed Petrosky, Traffic Manager for WNEW, was anxiously looking forward to the day the system would be installed. With a staff of eight people since 1967, he had to cope with an increase in the average number of commercials per week from 700 in 1967 to 3500 in 1976, and during this period the number of 60's decreased from 650 per week to about 200 per week. Besides that workload there are:  
●35 to 60 new tapes and 10 to 20 new films delivered to his department each day that have to be screened, timed, and classified.

### **About The Author**

Bob Hueffed is a management and advertising consultant with offices in Rye, New York. He was formerly with Central Dynamics Corporation as Vice President and General Manager. Bob is not new to automation—in 1969 he pioneered and conducted broadcast automation seminars for Central Dynamics in major cities throughout the U.S. and was personally involved with the CDL automation systems at the Metromedia and Westinghouse TV stations. In fact, he is credited with coining the name "Total" Automation.

Bob has been an active member of many organizations in our industry including: a Trustee and Founding Director of the Broadcast Engineers Educational Advisory Committee, SMPTE ad hoc committee for standardizing and establishing the SMPTE Edit Time Code, IRTS computer and automation standards, co-chairman of the original NAB ad hoc Exhibitors' Committee, and has authored and contributed to many trade journal articles. He graduated with awards from Case Institute of Technology, and prior to joining CDL, he spent 15 years in the aerospace industry in sales and management positions.





**Making preparations** at WNEW master control room for installing the new CDL Technical Operations system. Note sign...  
 "We are experiencing operating difficulties—please stand by."

- An average of 35 to 40 letters and phone calls per day that usually make changes to the original instructions. That is the average for five days a week, but the majority of these requests arrive on Friday and affect the weekend and Monday's log.

- Many of the spots require additional production work at the station, such as adding an audio cart or slides.

You may question how eight traffic people could handle such an increase in workload...500 percent increase! When Petrosky was on the original "System Analysis" team in 1964, he learned the importance of thoroughly understanding all other department operations. The Traffic Department has to accept and distribute data and interact with more departments, more often than any other department. As Petrosky said... "We are the traffic cops of the station, and if we didn't understand the other guy's job and problems,

communications would halt...you cannot second-guess anyone, and if you don't have the answer, you have to know where to find it...and quickly...you have to have awareness to anticipate and execute accurately and timely". This attitude and training permitted a smooth and rapid transition to the computer systems. The WNEW traffic people are specialists that understand and operate the BCS and CDL systems (both systems have terminals in the Traffic Department), and they have firm control.

Traffic can now comfortably prepare the Log over a period of two days vs. five days with the punch card system. Machine assignments and film, tape, and slide rundown lists are produced by the CDL System 200 in a fraction of the time. A commercial material inventory crosscheck routine can be called up on a CDL CRT terminal to check if a commercial is on a

reel or an ACR-25 video cassette—important for scheduling people and machines.

The BCS-1100 and CDL System 200 computer systems became operational between May, 1974 and July, 1976.

### ***The First Total Automation System***

WTCN installed the CDL system first and it was operational in May, 1974. In January of 1975 the first ACR-25 was interfaced to the CDL system using the ADA/ARCH interfaces. That was a "first". In May, 1975 the BCS-1100 Business Computer system was hard-wired to the CDL System 200 Technical Operations Automation System, and with that connection the first "Total" Automation system became operational.

WNEW was operating their CDL System 200 in June, 1975, and the BCS-1100 was installed and con-



nected to the CDL system in August, 1976.

KMBC and WXIX had their BCS-1100 systems operating by September, 1975.

WTTG installed the BCS-1100 in December, 1975 and completed their "Total" Automation system when the CDL System 200 was installed in 1976.

The installations produced a few tears and some frustrations, but that was anticipated. WNEW and WTTG had the advantage of learning from WTCN's experiences, and the WTTG system was installed "easier than expected and according to plan". This learning curve also applied CDL and BCS, and their training programs were modified and intensified during this two-year period. Engineering departments visited CDL during the final stages of in-plant system assembly and test, and after the system was installed, maintenance and system operating courses were conducted at the station.

All agreed that training programs were essential to reduce the on-the-job learning curve cycle. Good training coupled with an understanding of your data and communications system will go a long way to eliminate frustrations, surprises and compromise.

WNEW installed their BCS system one month before the Fall season and the operator training programs had to be conducted on location during the hectic business hours. (BCS usually trains at their facility and provides additional in-

struction and "hand holding" on location.) Richie Witkin, Sales Service Manager at WNEW, had some rough days and long hours trying to convert from an established manual system to a computer system, but by October 1... "everything started to fall into place...we now feel comfortable with the system, understand how to manipulate it, and are looking forward to some of the new BCS operating programs".

Witkin's "wish list" will probably continue to grow, but many items are being developed now by BCS and will probably be available within the next six to nine months.

#### **Wish List**

According to Jack Finlayson, BCS Marketing Manager, BCS is developing some new powerful software for the Sales Service department.

1) The Avail format will be changed to allow for average cost per spot for a program or daypart and for each rate section or level. Specials can be reported separately. Customers can call for overlapping dayparts on the same run; i.e., 9:00 AM to noon and 10:30 AM to 11:00 AM. The customer can select the number of weeks wanted for each daypart. (This first phase has actually been completed and tested at the time of this writing.)

2) The Phase 1 data will be stored in the station's resident computer system to permit on-line manipulation that can be displayed on the CRT terminals or printed.

3) Allow a station to play management computer games to experi-

ment with raising or lowering certain rates or dayparts, and have the system recalculate values, etc., using the information of what is sold, available, preemptible, etc.

4) Add rating booking information to the station's resident computer and merge it with availabilities to prepare sales proposals, analyze orbits, compute cost per rating points, etc. These proposals could be printed for presentation to the client.

It is probably safe to say that these computer programs are on everyone's "wish list".

And there are more. The industry is changing every day as is technology. Digital techniques, micro-processors, Super LSI will force us to change, but if you do your homework now, you will recognize the opportunities.

To repeat Hal Christiansen's opening comment in this article... "the journey is not complete because 'Total' Automation is a moving target...to cope with it, you have to have a master plan for somewhere down the road". And he added... "get good hardware controlled by good software that works in **your** business environment...it is the only way to maintain control of your business".

The author is taking the liberty to append to these quotes excerpts from the October 15, 1976 issue of **Forbes Magazine**.

"New York-based Metromedia, Inc. owns six TV stations, all but one of them unaffiliated. Says its chief executive, John Kluge: 'Revenues from our five independent stations are running at an average 50 percent higher than last year, some of them up to 80 percent higher.' Reflecting this, Metromedia's earnings more than doubled in the first half of 1976; its stock zoomed from five in 1975 to as high as 30 this year. [the article continues]...Metromedia bought independent WXIX in Cincinnati for \$3 million four years ago; today it is worth at least \$9 million."

These are probably some of the reasons why Hal Christiansen is looking for the P&L's on Monday rather than Wednesday...and is probably being nudged just a little by John Kluge.

(Editor's note: What a way to "go to black") □



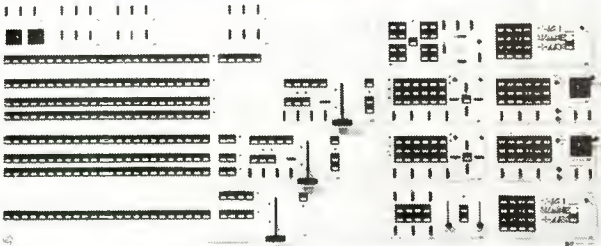
Lottie Bryan, Assistant Traffic Manager WNEW, and Skip Aldrich, system specialist WTCN-TV, training on the CDL System 200 traffic terminals at WNEW.





# Central Dynamics. International pacesetter in television broadcast equipment.

## Video switchers.



### New, Super Powerful CD 480 The Smart Switcher

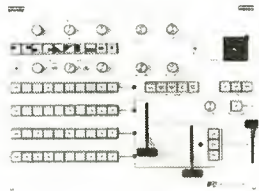
Revolutionary modular switchers with unprecedented production power. They outperform the largest conventional switchers, yet are extremely simple to operate. Their power and ease of operation are due to CDL's new Sequential Effects (SFX) Amplifier, which can cut, mix or wipe between two Background Sources and two separate Key Sources either individually or in any combination. Models with one or two SFX Amplifiers provide all the standard and optional features you need, including Rotary & Random wipes, RGB Shadow keys, Hard and Soft Color Border wipes, Color Border keys, Quad with Color Borders, Encoded Chroma keying, Key Mask generator, and 16, 24 or 32 inputs. A variety of modular accessories will continue to keep your switcher smarter than the rest as new technology develops.

Ask about the AFM-10 Audio Mixer/Switcher—an ideal companion to the CDL VS-10 and VS-14 video production switchers.



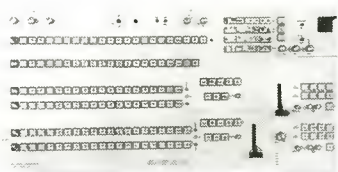
### VS-10

An inexpensive broadcast quality 8-input switcher that features flexibility and ease of operation. Self-contained electronics for rapid installation in ENG and other small mobiles.



### VS-14

Sophisticated enough for large studio production, yet compact and inexpensive enough for small mobiles. Soft wipes and keys—even a Downstream keyer—are standard. Self-contained and remote versions available.

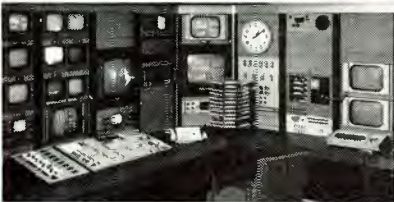


### VSP-1260S

#### An amazing value

Now the smallest station can afford a conventional 20-input mix/effects switcher of the highest quality and reliability and get it in under 30 days! All features, including an Encoded Chroma keyer and Bordered keys, are standard (not optional, as is often the case). And the price is astonishingly affordable.

## Automation.



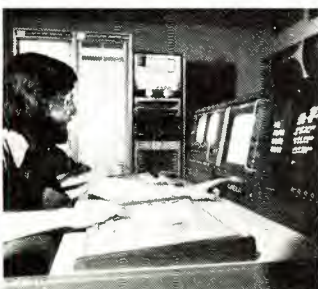
### System 100

Computer controlled automation system for Technical Operations that communicates directly with a Business Computer System. Stores and retrieves the schedule with entry error checking, makes automatic time corrections, performs complicated audio/video switching sequences (including dissolves, fades, wipes and keys), assigns machines, verifies material, and prints the "As-Aired" log.

### Master Control Switchers

Ranging from CDL's new CD 480 MC to a 2 Bus MCS-829 or a 3 Bus MCS-770. All 3 can be interfaced to System 100 Technical Automation System.

## Tape editing systems.



### PEC-120 Video Tape Editor

A computer editing System with easily operated control panel and CRT display for rapid and precise control of VTR's & Switcher CDL's unique Self Learning Cueing Software Program is a new feature.



### EDS-200 Video Tape Editor

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# Logic Illustrated

Part 4 of a 4-part series/By Harold Ennes

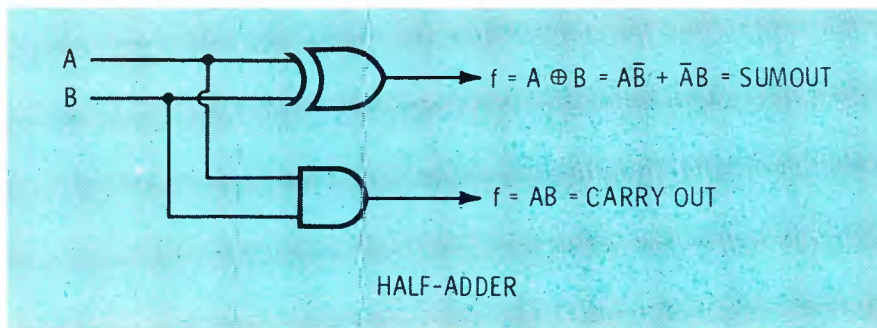
Logic networks are used for binary addition and subtraction. Multiplication can be accomplished by over-and-over addition; division by over-and-over subtraction. Any arithmetic function can be accomplished digitally by logic networks. Such functions are basic to all decision-making logic systems.

BASIC BINARY ADDITION TABLE

A	PLUS B	= SUM OUT	CARRY OUT
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

4-1. This is the basic binary addition table. (To review binary addition, see "Digital Math Part 1," BE June '74.)

Two outputs are required: 1. Sum out; 2. Carry out.



4-2. This circuit satisfies the binary addition table of 4-1. This is termed a **half-adder** because there is no provision for a **carry input**. Only a **carry output** is provided. This becomes a **previous carry** to any following stage.

The boolean relationship for a half-adder:

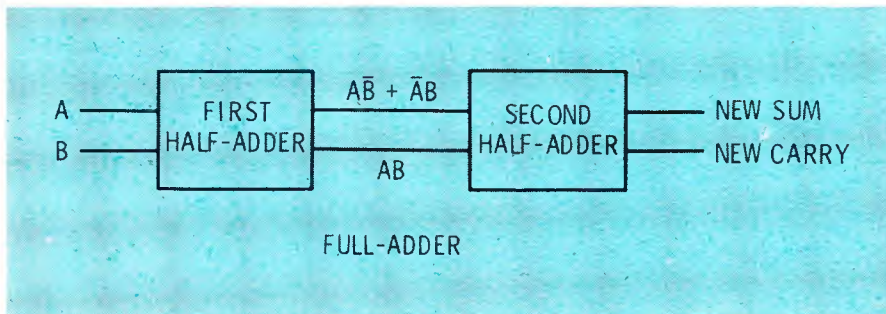
$$\begin{aligned} \text{Sum} &= A\bar{B} + \bar{A}B \\ \text{Carry} &= AB \end{aligned}$$

FULL BINARY ADDITION TABLE

A	PLUS B	PLUS CARRY IN ( $C_n$ )	= SUM	NEW CARRY ( $C_n$ )
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

4-3. Expands the binary addition table for a **carry input** (previous carry). Where:

$$\begin{aligned} C &= \text{previous carry.} \\ C_n &= \text{new carry.} \end{aligned}$$

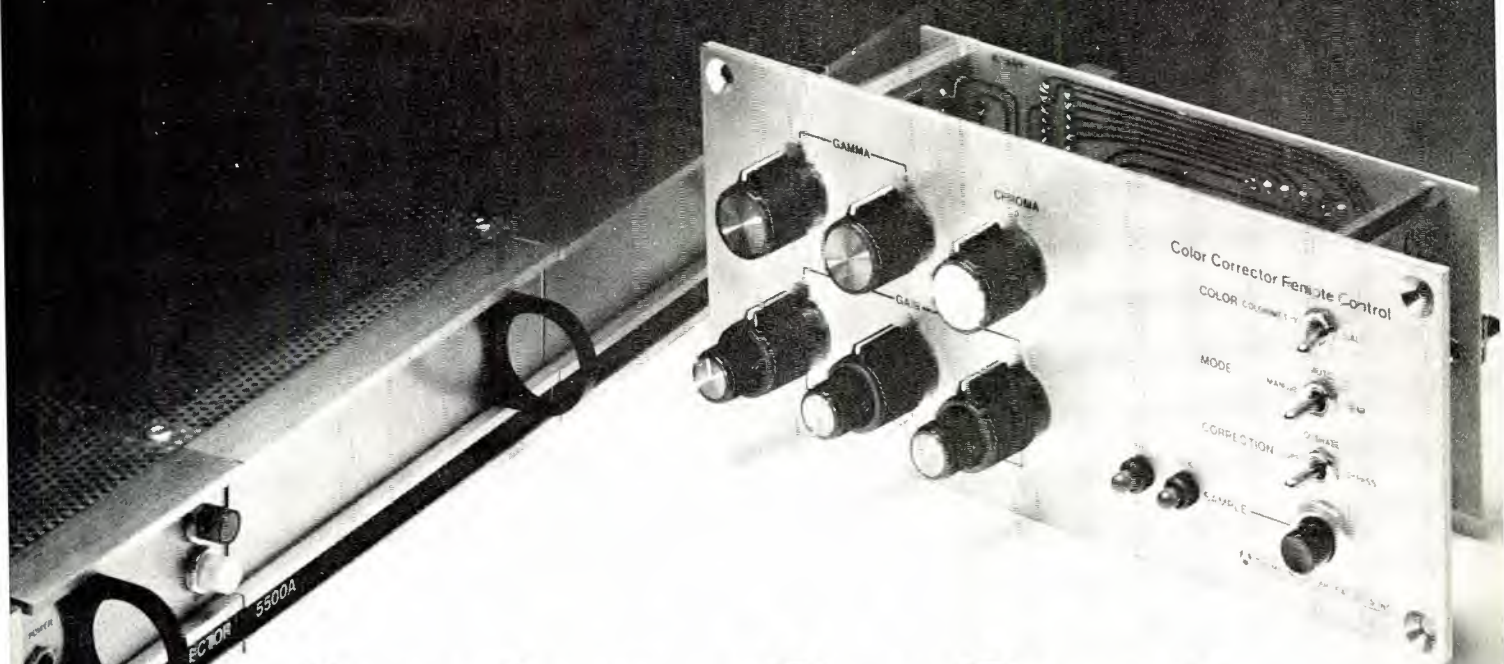


4-4. The circuit for a half-adder (4-2) simply represents the function required. In real life, 2-input or 4-input adders are constructed in a single **chip** (IC), usually with provisions for true or inverted inputs, and true or inverted outputs.

A **full adder** is, in effect, two

half-adders in cascade as shown by 4-4. Note that for the final sum output to satisfy the binary addition table 4-3, the previous carry function ( $C=AB$ ) must be incorporated in the logic. The following sections show the boolean development.





## Introducing a Color Corrector for Electronic News Gathering.

Electronic News Gathering makes tough demands upon the broadcaster. Color imbalance and colorimetry problems are frequently encountered. Matching remote camera shots to indoor studio programs or assembling tapes from different locations or cameras is "chancy" at best. Often that fast-breaking story doesn't allow for camera rebalancing!

Thomson-CSF Laboratories now provides a solution to such difficult encoded signal color problems. With the Model 5500A Color Corrector, you'll be able to rebalance and match video signals *after* encoding. It can be used either after the play-back tape machine or following the microwave receiver during live coverage. In most cases, a noticeably improved color picture will result. For ease of operation, a Remote Control unit is included as standard equipment.

As an added feature, an optional automatic Sensor unit is also available to control the Color Corrector for telecine use.

Whether for Electronic News Gathering, tape production or telecine use, the Thomson-CSF Laboratories Color Corrector System should be working for you. Interested? Give us a call.



**THOMSON-CSF LABORATORIES, INC.**

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FULL ADDER IN BOOLEAN FORM

A	B	C	BOOLEAN SUM (f=1)	BOOLEAN NEW CARRY (C <sub>n</sub> )
0	0	0	0	0
0	0	1	$\bar{A}\bar{B}C$	0
0	1	0	$\bar{A}B\bar{C}$	0
0	1	1	0	$\bar{A}BC$
1	0	0	$A\bar{B}\bar{C}$	0
1	0	1	0	$A\bar{B}C$
1	1	0	0	$AB\bar{C}$
1	1	1	$ABC$	$ABC$

C = PREVIOUS CARRY  
C<sub>n</sub> = NEW CARRY

4-5. To understand the full binary adder, re-write the binary addition table (4-3) in boolean form (4-5), showing f = 1 for sum and f = 1 for carry.

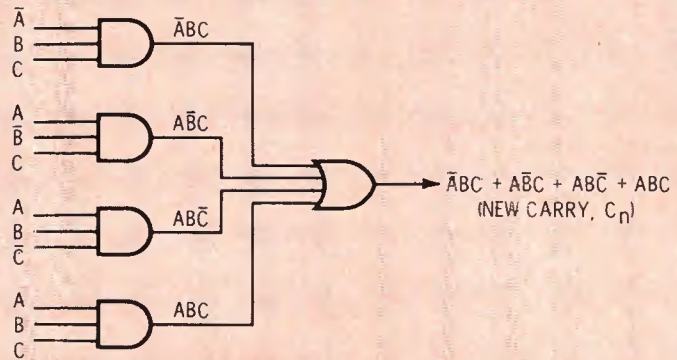
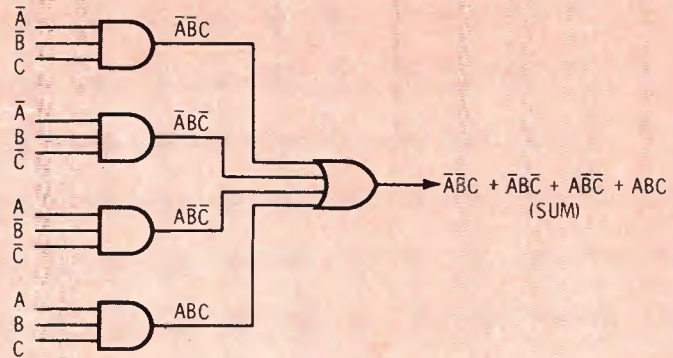
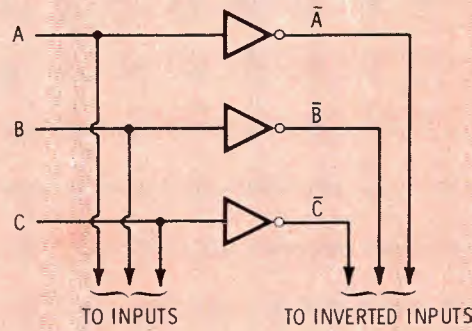
Where C = previous carry.

C<sub>n</sub> = new carry.

Then from the table (4-5) note that:

$$\begin{aligned} \text{SUM} &= \bar{A}\bar{B}C + \bar{A}B\bar{C} + A\bar{B}\bar{C} \\ &\quad + ABC \\ C_n &= \bar{A}BC + A\bar{B}C + AB\bar{C} \\ &\quad + ABC \end{aligned}$$

4-6. This constructs a full binary adder from the relationships of 4-5. Note that three inverter gates, eight AND gates, and two OR gates are required, for a total of 13 symbols.



BINARY ADDER FROM 4-5 RELATIONSHIPS

TRUTH TABLE PROVING: SUM = C(AB + A-barB) + C-bar(A-barB + AB) CARRY = AB + C(A-barB + AB)

A	B	C	A-bar	B-bar	C-bar	AB	A-barB	AB	A-barB	SUM		ORED SUM	CARRY
										C(AB + A-barB)	C-bar(A-barB + AB)		
0	0	0	1	1	1	0	1	0	0	0	0	0	0
0	0	1	1	1	0	0	1	0	0	1	0	1	0
0	1	0	1	0	1	0	0	0	1	0	1	1	0
0	1	1	1	0	0	0	0	0	1	0	0	0	1
1	0	0	0	1	1	0	0	1	0	0	1	1	0
1	0	1	0	1	0	0	0	1	0	0	0	0	1
1	1	0	0	0	1	1	0	0	0	0	0	0	1
1	1	1	0	0	0	1	0	0	0	1	0	1	1

WHERE C = PREVIOUS CARRY

4-7. Simplify the sum and carry expressions of 4-6, and prove by a Truth Table:

$$\begin{aligned} \text{SUM} &= \bar{A}\bar{B}C + \bar{A}B\bar{C} + A\bar{B}\bar{C} + ABC \\ &= C(\bar{A}\bar{B}) + \bar{C}(\bar{A}B) + \bar{C}(A\bar{B}) + C(AB) \text{ rule 20} \\ &= C(AB + \bar{A}\bar{B}) + \bar{C}(\bar{A}B + AB) \text{ grouping C and } \bar{C} \text{ terms.} \end{aligned}$$

$$\begin{aligned} C_n &= \bar{A}BC + A\bar{B}C + AB\bar{C} + ABC \\ &= C(\bar{A}B) + C(A\bar{B}) + \bar{C}(AB) + C(AB) \text{ rule 20} \\ &= C(\bar{A}B + A\bar{B}) + AB \text{ grouping and solving C and } \bar{C} \text{ terms} \\ &= AB + C(\bar{A}B + A\bar{B}) \text{ rearranged} \end{aligned}$$

Thus the simplified relationships are as follows:

$$\begin{aligned} \text{SUM} &= C(AB + \bar{A}\bar{B}) + \bar{C}(\bar{A}B + AB) \\ C_n &= AB + C(\bar{A}B + A\bar{B}) \end{aligned}$$

The Truth Table of 4-7 is derived from the procedure outlined in section 3-5.

THUS:

SUM = 1 when single 1 occurs.  
CARRY = 0.

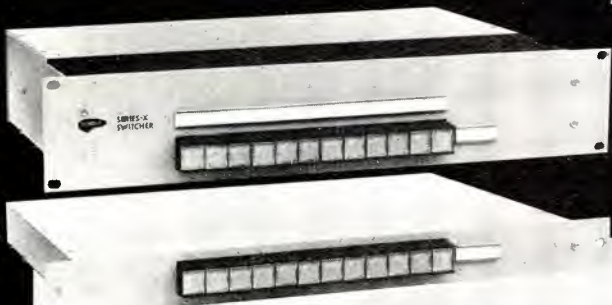
SUM = 0 when 2 ones occur.  
CARRY = 1.

SUM = 1 when 3 ones occur.  
CARRY = 1.

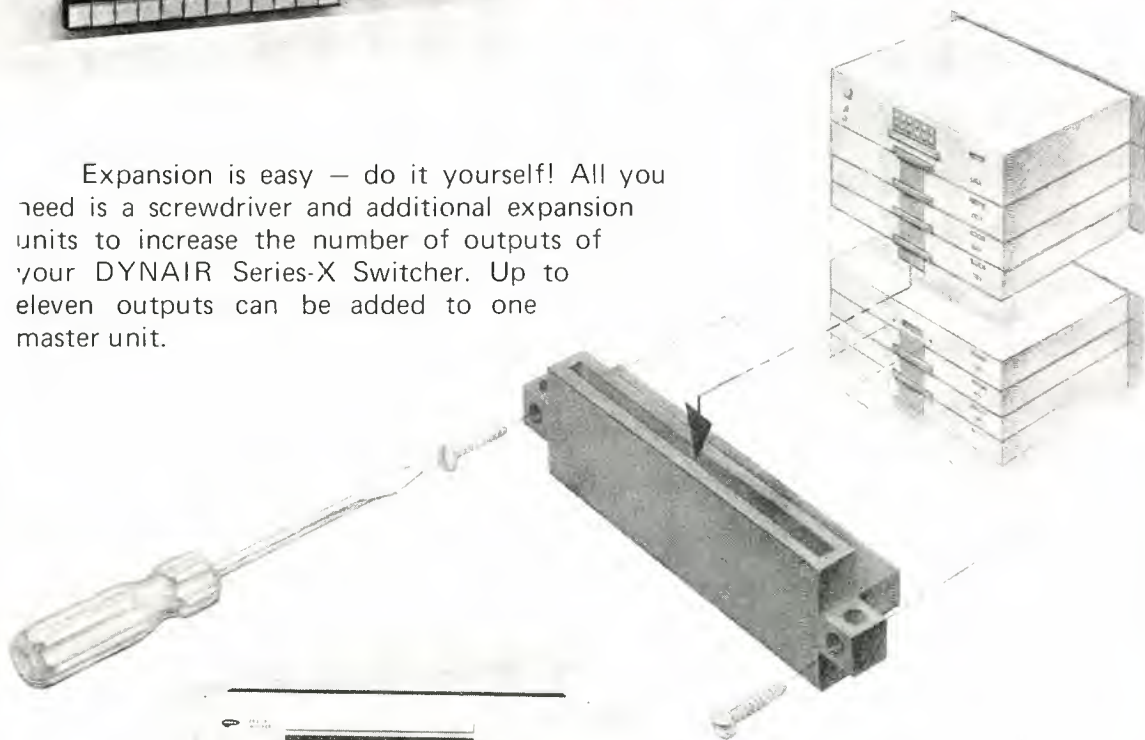


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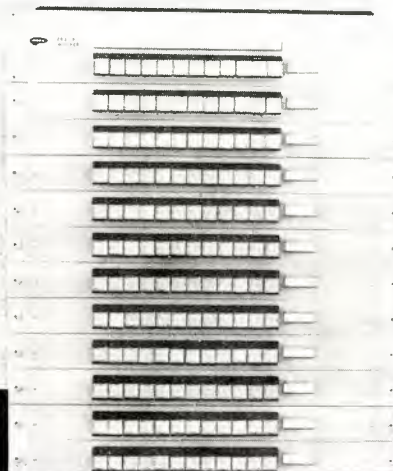


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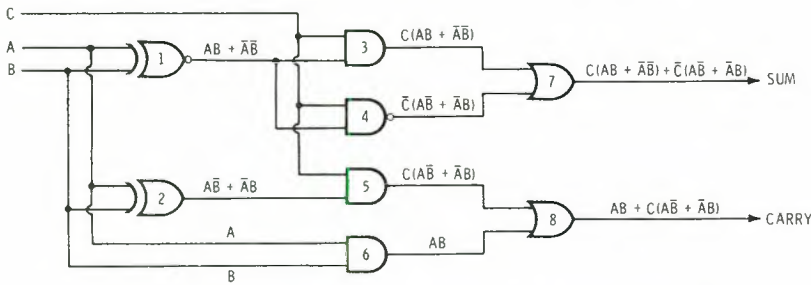


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DYNAIR





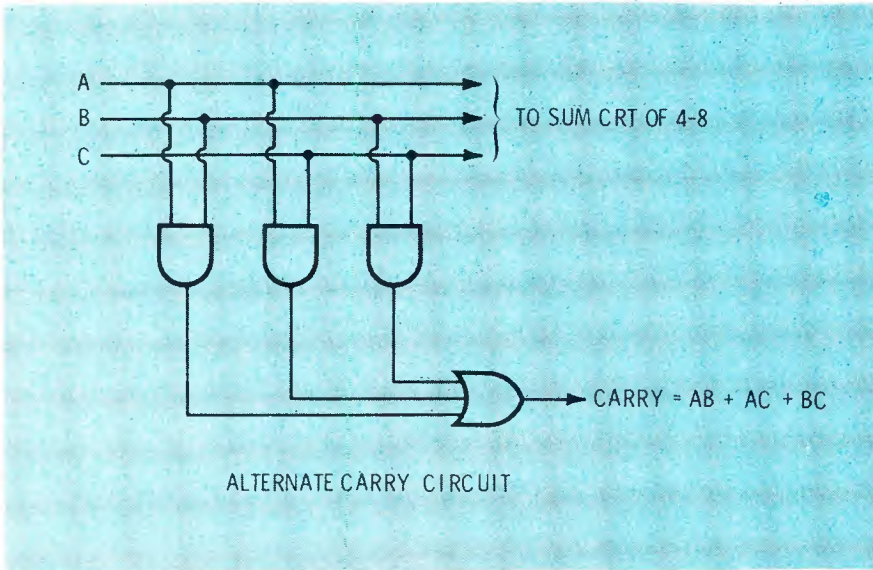
FULL ADDER FROM SIMPLIFIED BOOLEAN RELATIONSHIPS OF 4-7

- Gate 1 ..... Exclusive NOR
- Gate 2 ..... Exclusive OR
- Gates 3-5-6 ..... AND
- Gate 4 ..... NAND
- Gates 7-8 ..... OR

4-8. Constructs a full-adder from the simplified relationships of 4-7. Where:

$C = \text{previous carry.}$   
 $C_n = \text{new carry.}$   
 $SUM = C(AB + \bar{A}\bar{B}) + \bar{C}(A\bar{B} + \bar{A}B)$   
 $C_n = AB + C(\bar{A}\bar{B} + AB)$

This requires only eight symbols in contrast to 13 symbols for 4-6. This is only one of many possible combinations.



ALTERNATE CARRY CIRCUIT

4-9. There may be more than one correct solution to a simplification of relationships. Example:

CARRY of 4-7:  
 $\bar{A}BC + A\bar{B}C + AB\bar{C} + ABC$   
 $= \bar{A}BC + A\bar{B}C + AB(\bar{C} + C)$   
 $= \bar{A}BC + A\bar{B}C + AB(1)$   
 $= \bar{A}BC + A\bar{B}C + AB$   
 $= AB + AC + BC$  Final simplification

For the carry logic, this would require the circuit of 4-9, replacing gates 2-5-6-8 of 4-8. Note that this does not necessarily simplify 4-8; it illustrates only that more than one simplification procedure exists for a given set of terms, hence circuits can vary for identical functions.

4-10. Proves 4-9 by a Truth Table. Thus sections 4-6, 4-7, 4-8, 4-9 and 4-10 are all equivalent functions (f). Drawings 4-8 and 4-9 are equally valid in design. The unsimplified version (4-6) **would not be valid.**

TRUTH TABLE PROVING VALIDITY OF  $AB + AC + BC$  FOR CARRY

BINARY			BOOLEAN	BINARY SUM (TABLE 4-7)	BINARY CARRY ( $AB + AC + BC$ )
A	B	C			
0	0	0	$\bar{A}\bar{B}\bar{C}$	0	0
0	0	1	$\bar{A}\bar{B}C$	1	0
0	1	0	$\bar{A}B\bar{C}$	1	0
0	1	1	$\bar{A}BC$	0	1
1	0	0	$A\bar{B}\bar{C}$	1	0
1	0	1	$A\bar{B}C$	0	1
1	1	0	$AB\bar{C}$	0	1
1	1	1	$ABC$	1	1

WHERE C = PREVIOUS CARRY



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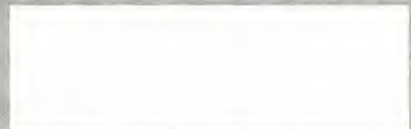
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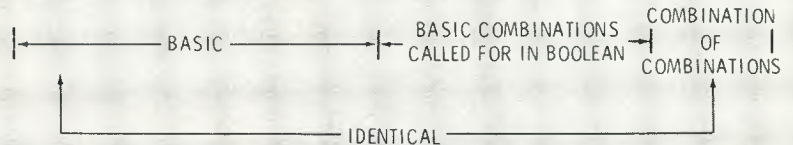
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TRUTH TABLE METHOD OF SIMPLIFYING  $AC + ABC + \bar{A}\bar{C}$

A	B	C	$\bar{C}$	AC	$\bar{A}\bar{C}$	ABC	$AC + ABC + \bar{A}\bar{C}$
0	0	0	1	0	0	0	0
0	0	1	0	0	0	0	0
0	1	0	1	0	0	0	0
0	1	1	0	0	0	0	0
1	0	0	1	0	1	0	1
1	0	1	0	1	0	0	1
1	1	0	1	0	1	0	1
1	1	1	0	1	0	1	1



4-11. To show the importance of simplification, suppose you have evolved the following boolean relationship for a given problem:

$$AC + ABC + \bar{A}\bar{C}$$

$$\begin{aligned} f &= AC + ABC + \bar{A}\bar{C} \\ &= A(C + \bar{C}) + ABC \text{ (factoring and} \\ &\quad \text{rearranging)} \\ &= A(1) + ABC \quad \text{rule 12} \\ &= A + ABC \quad \text{rule 16} \\ &= A \quad \text{rule 22} \end{aligned}$$

Figure 4-11 is the Truth Table form of simplification for this relationship. Note that the first and last columns are identical. To solve algebraically:

This says that the relationship  $AC + ABC + \bar{A}\bar{C}$  can be replaced by a straight wire from A.

FULL SUBTRACTOR TRUTH TABLE

A	B	C	D	$B_n$	$f = 1$ D	$f = 1$ $B_n$
0	0	0	0	0	0	0
0	0	1	1	1	$\bar{A}\bar{B}C$	$\bar{A}\bar{B}C$
0	1	0	1	1	$\bar{A}B\bar{C}$	$\bar{A}B\bar{C}$
0	1	1	0	1	0	$\bar{A}BC$
1	0	0	1	0	$A\bar{B}\bar{C}$	0
1	0	1	0	0	0	0
1	1	0	0	0	0	0
1	1	1	1	1	ABC	ABC

WHERE  $B_n$  = NEW BORROW  
C = PREVIOUS BORROW  
D = DIFFERENCE

4-12. Shows the Truth Table for full binary subtraction, including boolean expressions for  $f=1$ . (To review binary subtraction, see "Digital Math" Part 1, BE June '74.)

$$\begin{aligned} D &= \bar{A}\bar{B}C + \bar{A}B\bar{C} + \bar{A}BC + ABC \\ B_n &= \bar{A}\bar{B}C + \bar{A}B\bar{C} + \bar{A}BC + ABC \end{aligned}$$

Thus:  
where  $B_n$  = new borrow  
C = previous borrow  
D = difference

Note carefully that the Truth Table for the **difference** (D) column is identical to the **sum** column in 4-3, and 4-5.

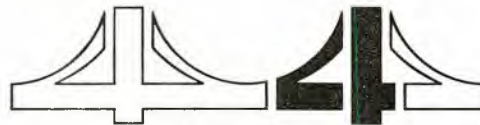


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"We used our new Compositor system during the election and were very happy with it. It seemed to me that the character edging made our display easier to read than the competitions'. We moved ahead of the other stations soon after the election results started coming in."—Terry Harrison, KTVK-TV Engineer



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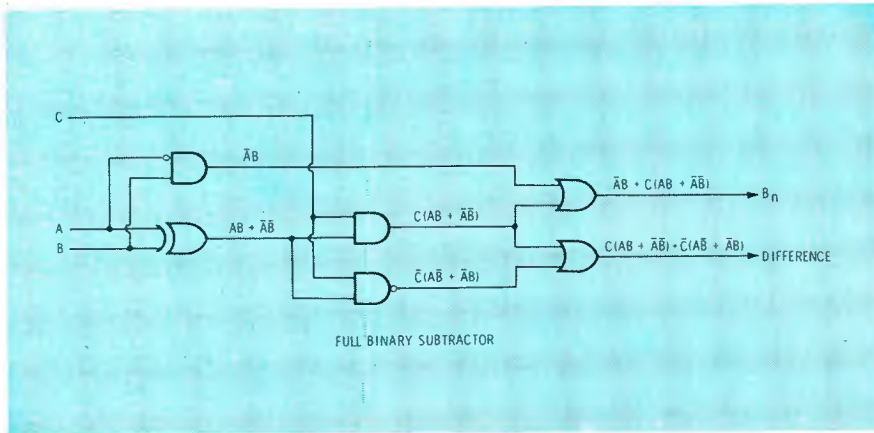
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4-13. Simplify the boolean expressions of 4-12, and construct a full binary subtractor from simplified relationships.

Let  $B_n$  = new borrow

$C$  = previous borrow

$D$  = difference

$$D = \bar{A}\bar{B}C + \bar{A}B\bar{C} + A\bar{B}\bar{C} + ABC$$

$$= C(AB + \bar{A}\bar{B}) + \bar{C}(AB + \bar{A}\bar{B})$$

rules 20 and 21

$$B_n = \bar{A}\bar{B}C + \bar{A}B\bar{C} + \bar{A}BC + ABC$$

$$= \bar{A}B + C(AB + \bar{A}\bar{B})$$

rules 20 and 21

The difference ( $D$ ) output is identical to that of the **sum** of 4-7, 4-8. This function is based on the fact that  $A-B$  is identical to  $A+(-B)$ .

Figure 4-13 is one possible logic network to function as full binary

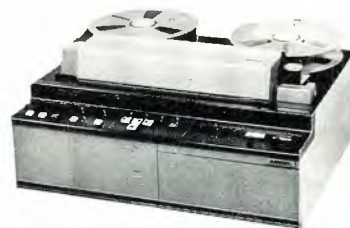
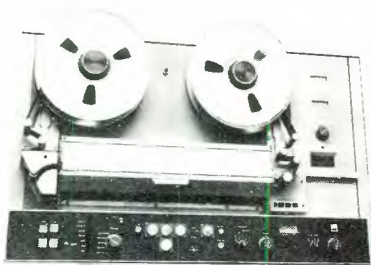
subtractor. The functions  $A+B$  and  $A-B$  are identical for two bits. The resultant functional difference between add and subtract is the action of the previous carry (for add) and the previous borrow for subtract. Carefully compare 4-13 with 4-8. Note how the following relationship is used:

$A+B$  = Sum (reads A plus B = sum).

$A+(-B)$  = Difference (reads A plus a minus B = difference).

This 4-part series has hopefully guided some readers into a better understanding of logic circuitry and basic design. If sufficient interest is expressed, we will continue at some future date with codes and code conversions, and design of more complex broadcast logic systems. □

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### Take 1...Electronic Journalism

This column, from time to time, will publish items written by ASTVC members. The opinion is that of the contributor and does not necessarily reflect the opinions of this column or **Broadcast Engineering**.

Submitted by Stuart M. Rudnick, "graduate" of NBC's VTR opns:

"At long last, the death knell of film is being sounded across the land. Unions representing film and videotape crews are scrambling for positions. Management people are giddy from the prospects of saving 'all that money'.

"Electronic Journalism has solidly established itself in all networks as well as many of the independent stations across the country. Smaller and lighter equipment arrives at our shores from Japan and Germany every day, adding to that produced in the USA.

"In Hollywood, budget people have been eyeing prime-time series, already shot multi-camera TV style, hoping one day soon we, or one of our Japanese friends, will give them a 'black box' enabling them to play their videotape in the various world standards.

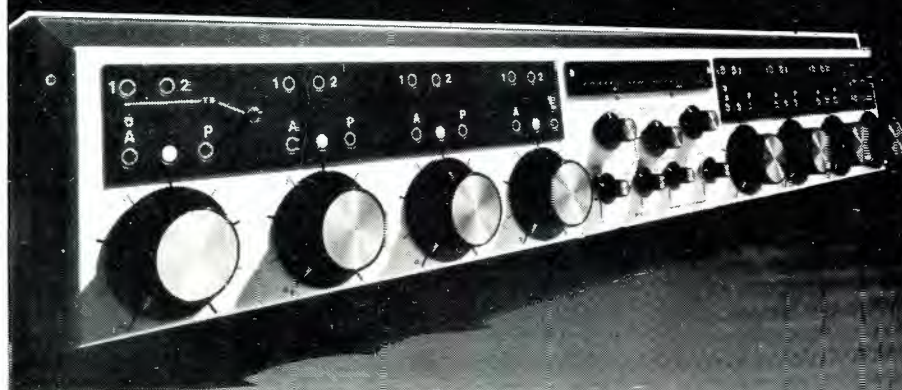
"All of this has brought a twitch to the eyes of the ASC members, while raising a twinkle in ours. ASC members have been seen in such out of the way places as Hollywood Video Center, E.U.E. and Teletronics learning a new trade. They no longer spend all their waking hours knocking videotape."

In future issues and in seminars, the ASTVC will try to keep you abreast of new developments during this terrific proliferation of new techniques and equipment. Conversely, let us know what you're involved in so that our ASTVC members might share your experiences.

### Take 2...The SMPTE invites the ASTVC

The ASTVC owes a debt of gratitude to the Society of Motion

*Continued on page 66*



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6076	180.00	395.00	215.00
6166A/7007	550.00	1225.00	675.00
4CX15,000A	400.00	825.00	425.00

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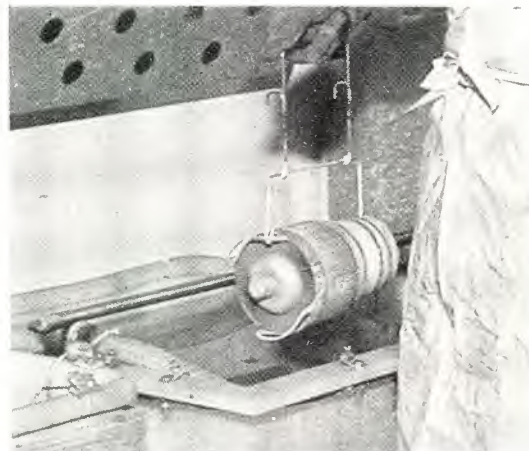
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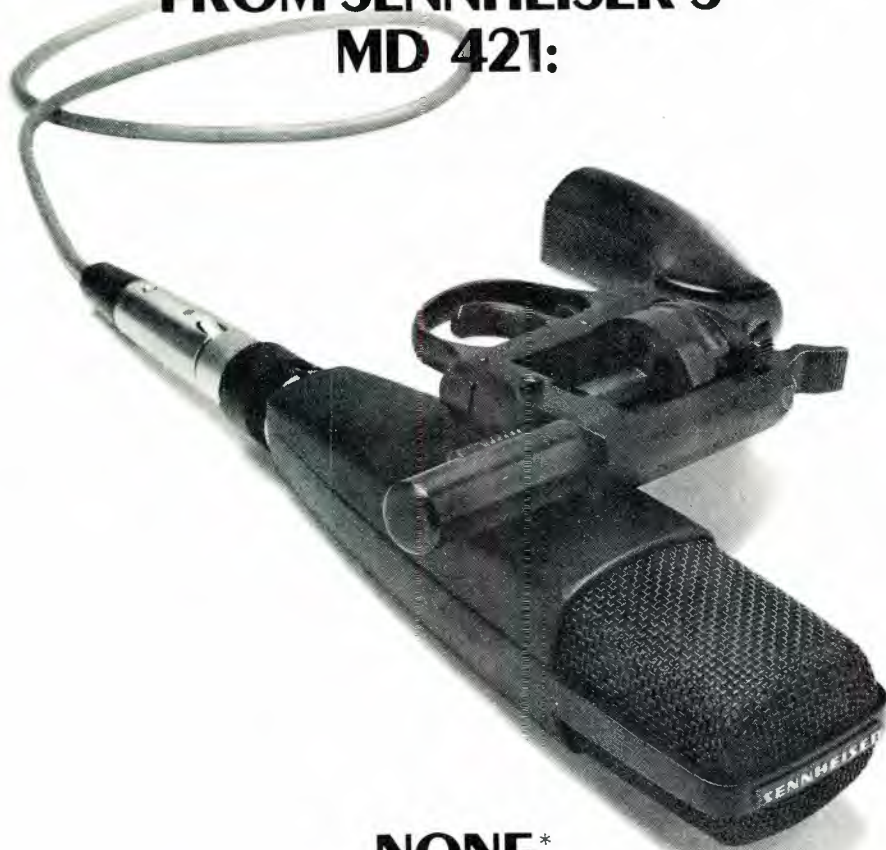


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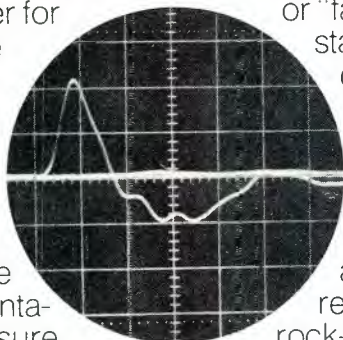
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Whether you need a microphone to capture transient sound like this pistol shot, or "face the music" on stage at 130+ dB in a disco or recording session, consider our MD 421. You'll discover its precise cardioid directionality, rugged design and wide, smooth response are ideal for rock-concert, recording and broadcast applications.

The price won't overload you either.



## Zoom In!

*Continued from page 64*

Picture & Television Engineers. Thanks to the generosity of Ken Mason, President of the SMPTE and Dennis Courtney, its Executive Director, the ASTVC was able to "set up shop" at their convention at the Hotel Americana in New York City.

At various times during the week of October 17th through the 22nd, members of the ASTVC staff could be found at our designated location enthusiastically "distributing" our latest information brochures.

We would be remiss in our duties if, at this time, we did not also give thanks to those of our staff that manned the ASTVC desk. They are: Stuart Goodman (ABC), Gerry Gander (CMI-Albany), Lois Filippi (ABC), Joe Martini (Vizmo Productions), and Gregg Suhm (Assoc. Dir. of Member Services). The above-mentioned would also like to publicly thank the members of the Ikegami exhibit who very kindly allowed ASTVC to "deposit" our crate of material with them each evening at closing time.

To those of you who were fortunate enough to attend the SMPTE convention, we don't have to tell you a thing about all those delightful booths crammed with all the latest new gear...and to all of you who did not have a chance to be there, we say you had better get to that next one! Jeff Friedman, of the SMPTE staff, must be complimented on the superb manner in which he setup and ran the exhibit area...

And lastly...for those who were given the ASTVC brochure at the convention, and for those of our members who will receive their copies in the mail, we wish to point out that the brochure was conceived and produced by Gerry Gander with the able assistance of the University Press at SUNY, Albany, NY...

### Take 3...Bits & Pieces

Malcolm Wall of the Office of Programming, Mississippi Authority for Public Educational TV is to be commended for his foresight and generosity. Through his instigation, the Authority has sponsored and

\*Outdoor test with Tektronix scope, set for 10V/division vertical, 01.  $\mu$ sec/div. horizontal: .22 cal. starter's pistol mounted 15 cm from MD 421 measured pressure of 111,000 dynes/cm<sup>2</sup> (175 dB SPL). Smooth, rounded scope trace indicates total lack of distortion.

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paid the initiation fee for five of their staff cameramen.

Wall said that he believes that his cameramen should be able to take advantage of every professional/educational opportunity available to them. He believes that the ASTVC offers that opportunity to aid them in their professional development. We certainly concur... Thank you, Mr. Wall!

At a recent meeting in NYC, Bob Henson, Regional Manager, and Dave Dever, Sales Engineer, both of IVC, have assured Bob Zweck that their corporation looks forward to participating in a program of training seminars with the ASTVC ...As you may know, International Video Corporation is one of the latest in the industry to join us as a Corporate Sponsor...

ASTVC staff members at the SMPTE convention met with members of the 3M staff relative to "firming up" our planned seminar generously offered by the 3M Co.... Ditto AMPEX and their kind offer of an upcoming demo/seminar...

Latest correspondence from the (British) Guild of TV Cameramen indicates that the time may be here for an International federation of TV cameramen! Representatives from the ASTVC were extended invitations to attend the Guild's annual meeting in London, possibly to discuss just that...We are excited about the prospects of just such a MERGER.

The ASTVC wishes all of you a very Merry Holiday and a Joyous Healthful New Year!!!

*SLO-Fade to black...*

## Religious Broadcasters Like New Law

President Gerald R. Ford has signed a comprehensive bill updating the nation's copyright laws. The new law, which goes into effect January 1, 1978, contains a section which protects the interests of religious broadcasters.

Section 112 (c) exempts religious programs produced by non-profit organizations from paying mechanical reproduction fees for the use of copyrighted music on tapes or discs

which they distribute to broadcast stations.

National Religious Broadcasters (NRB) initiated Section 112 (c) and supported it in hearings before the House and Senate. NRB is an association of 700 member organizations which produce and broadcast more than 70 per cent of the nation's religious radio and TV programs.

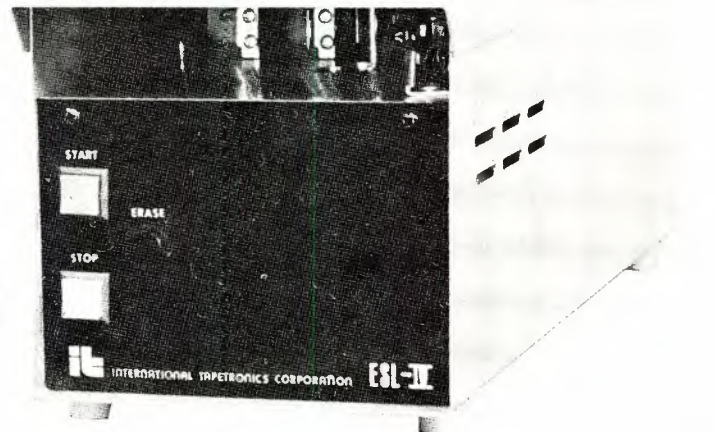
NRB executive secretary Ben Armstrong commented, "Section

112 (c) benefits the creators of religious music as well as religious program producers. On-air performance greatly enhances consumer sales of records, cassettes, sheet music, and concert tickets. Christian artists particularly need the kind of widespread exposure they receive on religious programs. Under the new law, as before, copyright holders will continue to receive performance fees from stations."

### ITC's ESL-IV

# AUTOMATIC, ONE-STEP TAPE ERASER AND SPLICE LOCATER

**\$495**



Now you can erase cartridge tape and locate the splice in the same operation automatically — without chance for human error. Simply insert your cartridge and press the start button. There's nothing else to actuate or hold down. When the splice is located, the machine automatically releases the cartridge — fully erased!

The ITC ESL-IV Series machine is super-fast (25-29 IPS), but gentle with tapes in NAB size A cartridges. It is super-quiet, super-rugged and ITC engineered to outlast and out perform any other eraser or splice locator made. Pays for itself in time saved and consistent results. All this and our famous 2-year warranty plus a 30 day money-back guarantee of satisfaction.

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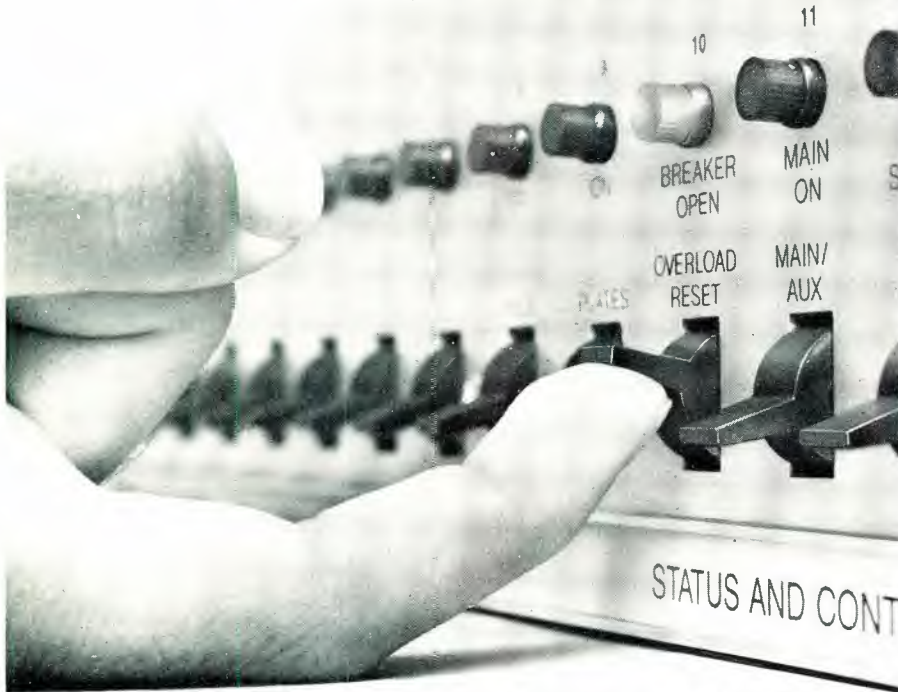
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# Now! Remote transmitter control



## is this simple.

Now there's an all digital system that gives you direct, positive on/off control and status monitoring of remote AM, FM and TV transmitters. We call it the X-14, and there's nothing else like it.

Fourteen toggle switches give you direct on/off control of up to 14 different functions like: filament voltage, plate voltage, main power, overload reset, tower lights and program source selection. No longer do you have to dial them in one-at-a-time.

In addition, fourteen status channels, each with its own, independent LED indicator, monitor such go/no-go functions and/or alarms as: power, voltages, temperatures, intrusion, VSWR and tower lights. You see a complete display of status and alarms, at-a-glance.

Besides all this, the X-14 is an economical way to add capability to an existing analog remote control system. It meets the FCC control failsafe requirements, and gives you a fully digital command system as

backup to your analog operation. So, the direct control switches on the X-14 can be used for critical "key" functions while, at the same time, you're using the analog system to read other transmitter parameters. With our optional Line Multiplex Filter, both the X-14 and your analog system will operate on the same phone line.

Exceptional data integrity is another advantage of the X-14. Both control and status information are updated every 400 MS, and a unique "double check" logic system virtually eliminates data errors. There are also fewer operator errors because there's no dialing and knob twisting. Each switch is labeled for a specific function. The X-14 is also ATS-compatible.

The X-14 is just one of the many new ways TFT is applying digital techniques to simplify and improve broadcasting remote control. For a demonstration, call or write. In Canada: Orange County Associates, Winnipeg, Manitoba.

## From BLUE BANANAS to SAG TAILS

### The Original Blue Banana!

Color television was in its infancy. The stillbirth of the CBS whirling filter wheel was superseded by a lively youngster called the all electronic NTSC<sup>1</sup> standard that was confirmed by the FCC in 1951. Transistors and ICs were still a decade away and TV equipment was full of vacuumized glass cylinders with metal innards that glowed brightly and were called "tubes".

A color camera of that era had three image orthicons, took four strong men to lift onto its pedestal, and was controlled by a CCU that was connected to three or four overheated, seven-foot racks crammed with electronic chassis. Several dozen appropriately colored knobs and a larger number of screwdriver slotted pots, ferrite cores and brass slugs, most with some interactive effect, completed the adjustment picture. It was a formidable task to properly set up a color camera, usually taking three to four hours of meticulous tweaking at both ends of the system by a pair of patient and persistent engineers.

Inspired by the goal of an opera-

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[www.americanradiohistory.com](http://www.americanradiohistory.com)

1. National Television Systems Committee or  
Never Twice the Same Color



tion based on electronic precision, one major network installed a color TV studio without visual contact between the camera operators and the knob twiddlers in the back room. The high light levels needed for the cameras of that period precluded the use of a live model for such long set-up periods and the technicians had to resort to still life images such as children's toys or bowls of fruit that didn't ripen too much at 3200°K.

Fruit bowls were ideal on several counts—they didn't get union scale, they came in a wide variety of hues and saturation, even idiots knew what color they should be (or did they?), and you could eat them when you got through.

It was the early afternoon of a big color spectacular and the crew were in lining up the cameras for that evening's production. After an hour of prime adjustments of such basics as I and Q quadrature, sub-carrier balance, gamma and aperture correction, video and pedestal levels, the real fun started. Registration, gray scale tracking, corner focus and so on, were interspersed with remarks on the intercom such as "give me a little more blue skew; no, you idiot, I said blue SKEW, not blue Q! Now we will have to realign all over again".

Apparently the color camera design engineers who figured out the adjustment nomenclature were related to the fiends in Detroit who make spark plugs so inaccessible as to require an expensive special tool and the digital dexterity of Harry Houdini to remove them.

At last we're ready for color operation, color bars look almost right, a little phase adjustment brings the magenta on target, and we switch to camera position and its bowl of luscious, mouth watering fruit in front of it; red apples, green grapes, orange oranges and blue bananas. Blue bananas? It can't be! A quick turn of the hue knob on the monitor renders yellow bananas, but now the apples are brown, the grapes are orange, and the oranges look sick! There is a long huddle in the control room, weighty scientific opinions on chroma shift due to cathode/heater leakage or screen grid saturation result in a new attempt to recheck and reset all controls with more

rigorous waveform scope monitoring. This takes another precious hour of frantic effort and time is getting short as a report comes in that the talent is beginning to filter into the dressing rooms.

Everything is realigned with the utmost care, the switch goes from bars to camera position again, and the bananas are still an unappetizing shade of blue. In desperation, the camera control engineer

throws down his headset and stomps out into the studio to apply the last adjustment tactic he knows—a good swift kick to the side of the camera—when suddenly his problem is solved in one fell swoop. For what his eyes can scarcely believe is that nature's benevolent gift to the monkeys on top of this fruit bowl are the product of a prankster who had painted them bright blue!

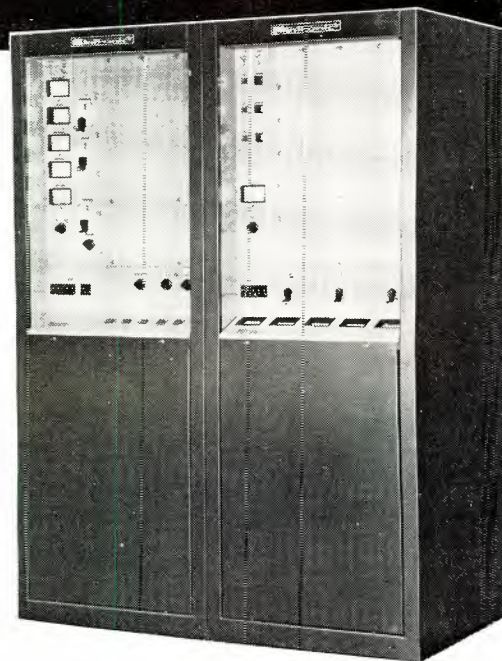
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**25Kw FM TRANSMITTER**

- Grounded Grid Driver
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- No Neutralization
- Front Panel Power Control From 2Kw to 30Kw
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- VSWR Protection



The SINTRONIC DFM-25K-B FM Transmitter offers the simplicity of "grounded grid on grounded grid" — grounded grid driver and power amplifier — resulting in a considerable reduction of components and a greater increase in stability and reliability. The driver section of the DFM-25K-B is the SINTRONIC DFM-3K-A 3500 watt FM transmitter. This driver operates at 1200 watts for full 25Kw output power but can be used as a 3500 watt emergency transmitter. The DFM-25K-B is FCC type accepted and field proven. The unit is self-contained in two cabinets normally located side-by-side. However, they can be separated according to individual spacing requirements.

SINTRONIC manufactures a complete line of AM and FM Transmitters to satisfy every broadcast requirement. Highest quality components are used throughout. All our transmitters contain design features that increase efficiency, provide greater reliability, and reduce maintenance time and costs.

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# Station to Station

## KOMU-TV: A Commercial Success

I enjoyed the article in the October issue about WUFT in Gainesville, Florida. Particularly since our operation is somewhat similar. I must disagree, however, with the statement that the University of Florida offers "a unique experience in television news."

I'd like to point out some comparisons between the WUFT operation as described in the article, and our operation at KOMU-TV, which is owned by the curators of the University of Missouri.

While WUFT is a public non-commercial station with a **potential** audience of 460,000 **viewers**, KOMU-TV is a commercial NBC affiliate with a **measured** audience (ARB, Nielsen) of approximately 35,000 **homes** on major newscasts. KOMU-TV newscasts maintain a solid number one metro position in

this 3-station market, and are tied for number one in ADI, despite the inherent disadvantage of frequently changing student anchor persons.

The newscasts on both WUFT and KOMU-TV are produced entirely by students under faculty supervision. KOMU-TV uses students (this semester about 55) from the university's journalism school for all filming, editing, reporting, writing, production and air work. Directors, engineers and studio cameramen are for the most part full or part-time station employees, but students are also involved—to a lesser extent than in the news—with these and all other departments of the station.

While WUFT replaces commercial announcements with public service announcements, the student-



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MMI Replacement Heads are professional heads — designed for the machines they will be used with — direct retro-fits, both mechanically and electrically — not modified or adapted heads originally intended for "home" or "semi-pro" recorders. But there is more to MMI Heads than their professional performance: An all-metal face that virtually eliminates oxide loading ... More than twice the gap depth-of-metal of some original equipment heads, thus permitting relapping (under normal head wear) for greatly extended head life ... Individual testing and calibrating of each head to insure meeting or exceeding original equipment specifications ... MMI has ¼-inch tape heads for Ampex, ITC, Magnecord, Revox A-77, and

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- HEAD RELAPPING AND REFINISHING (No-Charge head evaluation)

**NEW! MMI HAS HEADS FOR CART MACHINES!**



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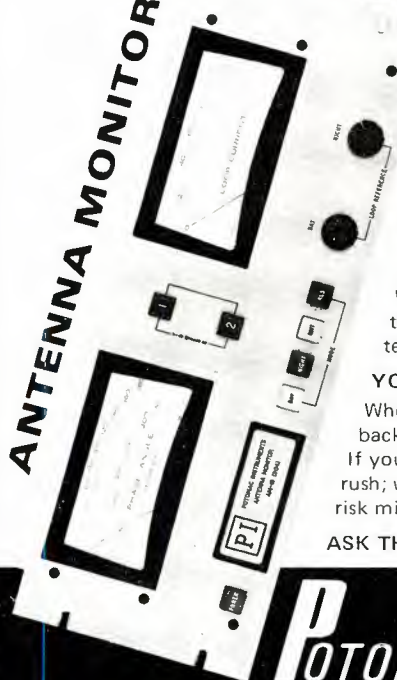
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# Just A Friendly Reminder

ANTENNA MONITORS



In case it happened to slip your mind and you are one of the few remaining directional stations yet to comply with paragraph 73.69 of the FCC Rules... you have until June 1, 1977 to have in operation a "Type Approved" antenna monitor.

### WE CAN HELP YOU

We have supplied over 90% of all "Type Approved" antenna monitors (both meter and digital readout) now in service.

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### YOU CAN HELP US

When the last deadline rolled around our order backlog resulted in an eight month delivery cycle. If you order now, you can avoid the last minute rush; we can deliver as required; and you will not risk missing the June deadline.

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and one or two single-system sound-on-film news stories," KOMU-TV's one-hour 6 o'clock newscast tonight will contain 10 to 12 local stories, at least eight of which will contain sound on film, generally in a package with "silent" film (which actually, in most cases, is natural sound).

**Dick Nelson**  
Managing Editor, KOMU-TV  
Assistant Professor

Station-To-Station is a column designed to keep people in touch... station to station and station to magazine. We encourage all stations to take part in a column designed for them. Got questions to ask of other engineers? Ideas for other stations? Comments to make about the industry? Well here's where you can lay it on the line. Just address your correspondence to: Station-To-Station, **Broadcast Engineering** magazine, 9221 Quivira Road, Overland Park, Kansas 66212.

produced newscasts at KOMU-TV typically contain seven to eight minutes of national and local spot announcements paid for at commercially competitive rates. Since KOMU-TV is supported entirely from these commercial revenues, the pressure to compete economically with other commercial stations in our market is identical to that in any commercial television station.

While "Everyone (at WUFT) agrees that it is better to make the goofs here in the somewhat forgiving atmosphere of a basically academic experience..." at KOMU-TV we take quite the opposite view: that it is better to work in an unforgiving commercial environment closely approaching the so-called "real world" (which, incidentally, we feel very much a part of). Our atmosphere is basically non-academic, and we wouldn't want it any other way. We, of course, agree that "supportive and constructive criticism" is essential to students' development and we try to provide that too.

While WUFT's 30-minute newscast contains "several silent films

## NEW FM AND TV FIELD STRENGTH METER FIM-71

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- Front Panel Speaker
- Recorder Output
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- Measures FM Harmonics to -80 dB
- Price — \$2,500 complete with dipole antenna.



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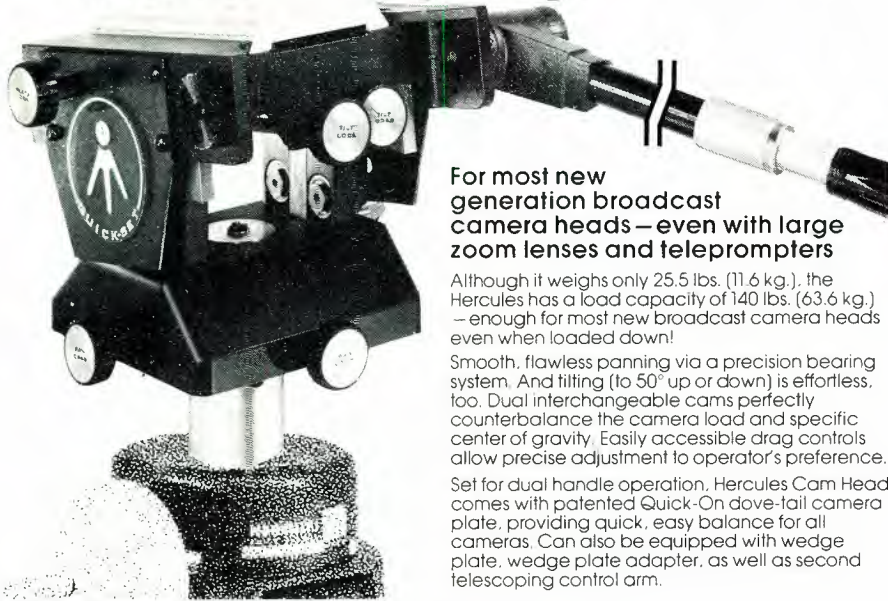
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# Introducing the new QUICK-SET Hercules Cam Head with 140 lb. capacity.



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Set for dual handle operation. Hercules Cam Head comes with patented Quick-On dove-tail camera plate, providing quick, easy balance for all cameras. Can also be equipped with wedge plate, wedge plate adapter, as well as second telescoping control arm.

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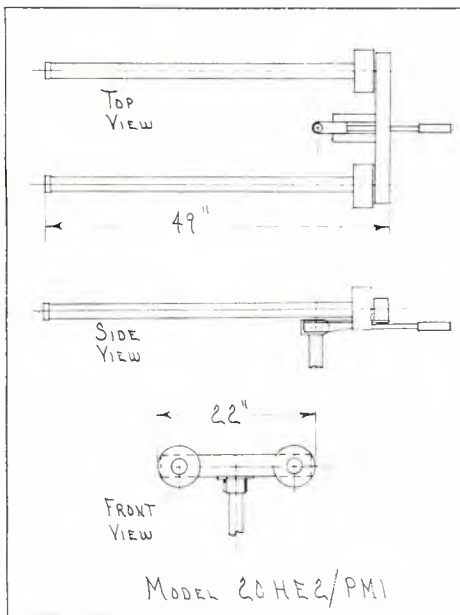
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## Antenna

Continued from page 46

quality of circular polarization for FM radio. This is the ratio of the maximum vertical component to the maximum horizontal component. This term describes the radiated power in each polarization, but does not necessarily describe the type of radiation formed when the two signals are combined. The combined shape may range anywhere from a circle, through a family of ellipses, to a straight line, without a change in the polarization ratio.

For antennas used in television broadcast, the term **Axial Ratio** has become the parameter to describe the degree of circularity. Axial Ratio is defined as the ratio of the major axis of the polarization ellipse to the minor axis. The axial ratio is typically expressed in dB.

Let's take a few minutes to see how the axial ratio of a circularly polarized TV antenna figures into the overall transmitting system. Figure 6 illustrates how an elliptically polarized signal can be represented as the vectorial sum of two circularly polarized signals that are rotating in different directions.

In the case of pure right hand circular polarization, there is, of course, no left hand component. As the amount of left hand component increases, the result of vectorial addition becomes elliptical as shown, and at the point that both the right hand and left hand components are equal, linear or slant polarization results.

To realize the effect of axial ratio, let's again refer to a simplified diagram showing a circularly polarized transmitting antenna with a less than perfect axial ratio, a reflecting surface and a circularly polarized receiving antenna.

Assume that the signal radiated from the transmitting antenna contains a large right hand component and a small left hand component as shown in Figure 7. As before, the receiving antenna will receive two signals—one from the direct path and one from the reflected path.

As we noted before, the reflected signal will reverse polarity. However, this time there will be a small right hand component from the reflected path present at the re-



ceiving antenna due to the imperfect axial ratio of the transmitting antenna. If this component is large enough, and if the delay time is sufficient, a ghost will be seen on the receiver connected to the receiving antenna. The axial ratio of the transmitting antenna is therefore an important factor in determining the quality of a circularly polarized antenna.

### Testing Circular Polarization

At the 1974 NAB Convention, RCA conducted live demonstrations of a circularly polarized TV set. Both horizontally and circularly polarized transmitting and receiving antennas were used with this test.

By providing a reflected path to the system with a built-in delay and by switching between the horizontally polarized system and the circularly polarized system the degree of ghost reduction could be observed on monitors.

Using the horizontally polarized system, a great degree of ghosting as the result of the multipath condition could be seen.

When both circularly polarized transmitting and receiving antennas were employed, however, there was a dramatic improvement.

Let's review now the circularly polarized TV test performed in Chicago from the Sears Building by WLS-TV. Two 100 foot tall, 12 foot diameter steel cylinders are mounted at the top of the Sears Building, with the WLS-TV transmitting antenna located on the west cylinder of the building.

Two separate arrays were used at WLS-TV for their test—one a circularly polarized three-layer system and the other a two layer horizontally polarized system.

The azimuthal patterns of the horizontally polarized antenna, and of each component of the circularly polarized antenna, were made as equal as possible to provide correlation of the measurement data.

The supporting cylinder affects antenna performance, and had to be simulated on the test range during the initial design phase.

After the testing cycle was completed, the antennas were shipped to Chicago and installed on top of the building late in 1973. Each antenna was provided with a separate feed system to provide an easy means of switching between hori-



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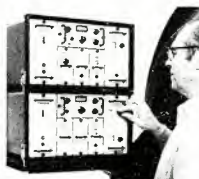
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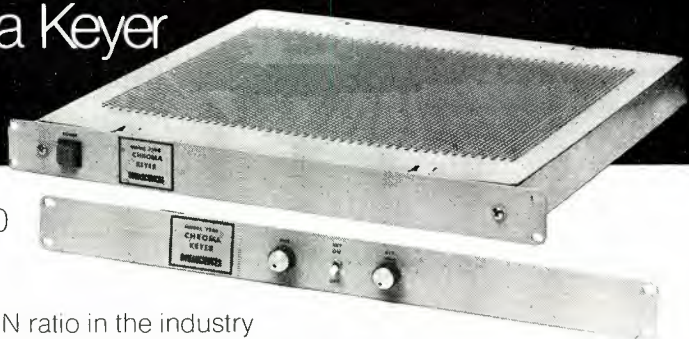
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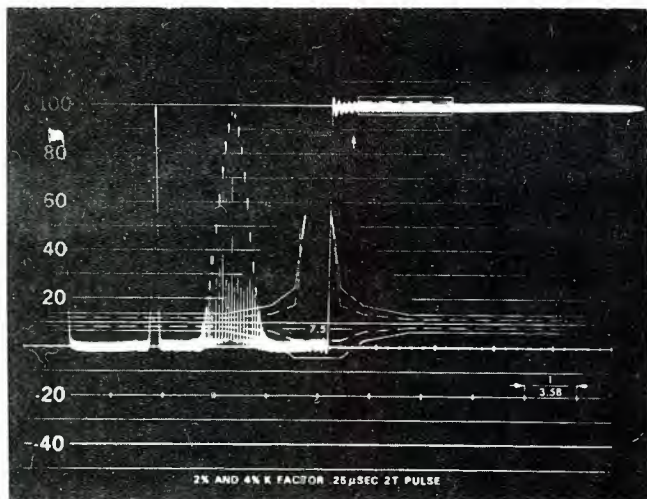
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*Continued from page 73*

zontally and circularly polarized modes of operation.

The first on-air tests were started in January, 1974. After a series of initial tests assured that there was no increase in co- or adjacent interference and the circularly polarized signal caused no degradation of the received picture, the FCC granted permission in May to use the circularly polarized antenna on a continuous basis rather than only during off-air hours.

The off-air pictures shown illustrate measured comparisons between the horizontal and circular modes of operation.

First, let me assure you that the test pattern shown on the left is not typical of the TV signals in the Chicago area. It is one of the worst case conditions and was obtained using the horizontal mode of transmission. In other words, both horizontally polarized transmitting and receiving antennas.

With the same conditions, and at the same test site, but now using circularly polarized transmitting and receiving antennas we see an improvement in picture quality on the right.

#### **Equipment Considerations**

Let's discuss now some equipment considerations involved in circular polarization.

For the broadcaster contemplating circular polarization, the equipment to be considered is, of course, the antenna itself, the transmission line connecting the antenna to the transmitting station and the tower. The second item is the transmitter.

Many possibilities are involved but we can discuss system packages that will be useful to the majority of broadcasters. The circularly polarized antenna will have an approximate total gain of unity per wavelength of aperture—or approximately one-half per wavelength for either the horizontally or vertically polarized component. Since most broadcasters will probably maintain their present horizontal ERP using a circularly polarized antenna with the same aperture as their present antenna, it follows that a transmitter of twice the present rating will be required.

A typical lowband VHF station presently using a 6-bay horizontally

BROADCAST ENGINEERING



polarized antenna and a 25 kilowatt transmitter, will now require a 50 kilowatt transmitter and a 6-bay circularly polarized antenna.

A typical highband package for circular polarization may range from a 100 kilowatt transmitter and a 9-bay circularly polarized antenna to a 50-kilowatt transmitter and an 18-bay circularly polarized antenna.

There are more options available to the UHF broadcaster than to the VHF broadcaster. Unlike most VHF stations, who are operating at maximum ERP, approximately 95 percent of all UHF broadcasters could more than double their present horizontal ERP and still not be at the maximum 5 megawatt limit.

A second UHF option would be to increase the illumination of the principal market area through the installation of a new horizontally polarized antenna with higher null fill. The new antenna might also have lower overall gain and be coupled with a new transmitter of higher power.

The third option, of course, is to utilize circular polarization. Only a thorough investigation on an individual basis will determine which option is best for the individual UHF broadcaster.

In summary, circular polarization for television is a subject that has to be considered by the industry as engineers search for ways to improve television reception for the viewing public. There is little or no argument about the theoretical benefit of ghost reduction, but beyond that, there is considerable controversy. The FCC has the ball now and is weighing together the potential advantages, and the various comments received as the result of their proposed Rule Making.

#### Illustration Credits

The author thanks the following individuals for permission to use the illustrations found in this article:

Figures 1 and 2: Fred L. Zellner, Jr., from his paper, "Circular Polarization in Television Broadcasting".

Figures 3, 4, 5 and 7: Dr. Matti Siukola, from his paper, "Circularly Polarized Antennas for Television".

Figure 9: Neil M. Smith, from his paper, "Report on Field Tests of Circular Polarization in Television". □

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The broadcasting and cablecasting explosion has reached Europe and most certainly Italy. Today with its 249 FM stations and 72 TV stations that broadcast throughout its 116,316 square miles, Italy is one of the most communicable nations in the free enterprise world (with its 12.8 million receivers, Italy is the sixth nation in the entire world with the most substantial number of TV sets).

Because of such a position it couldn't afford a lack of an adequate news gathering and reporting service, therefore it has dictated the creation of an Italian Communication Service Agency, that will be known as ITALCOM.

At present ITALCOM, with its five reporters, will provide an Audio News Service from USA and Canada for the various Italian speaking radio-TV stations in Italy and abroad (there are 48 Italian speaking radio-TV stations outside Italy).

In the immediate future ITALCOM plans to provide a Video News Service.

Until two years ago the Italian broadcast was monopolized (since 1944) by the government controlled RAI-TV (before by another monopolistic government agency).

With its two television networks (Channel 1 VHF reaching 98.3 percent of the population, Channel 2 UHF 91 percent of Italian citizens) RAI-TV transmits yearly 5,912 hours of TV programs followed daily by 26 million Italians, against 36,000 hours by independent TV stations. With its three AM radio networks RAI transmits yearly 46,296 hours of audio programs listened to by 17 million Italians, against 749,278 hours by independent radio stations. For watching the government censored black and white RAI-TV programs the viewer is taxed four cents per day plus sitting through a half dozen sets of commercials (each set containing several announcements).

The independent Italian stations are based on the American model, supported by private industrialists, politicians and paid advertising. At present 13 TV stations broadcast in color (PAL) and 20 others are ready to switch to color.

In the Peninsula there are 61 cable TV, there is an annual Cable TV Expo in Milan and a TV Federation called FILET (Italian Federation Independent TV Stations).

With manpower of 19,230 the new industry has practically forced 45 percent of Italian Electronic companies into manufacturing broadcasting equipment.

A prime time RAI-TV commercial cost 8,334 dollars for a 100 seconds spot (network). Italian territory is also covered by foreign radio-TV stations that broadcast in Italian, they are:

Tele Capodistria (PAL) reaching 18.4 percent of the Italian population, has the second largest covered area. The color programs of Tele Capodistria are transmitted from Yugoslavia, the cost for a 30 seconds prime time announcement is 3,063 dollars.

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# PEOPLE IN THE NEWS

**Paul Bergquist** is the new President of Philips Broadcast Equipment Corporation, a wholly-owned subsidiary of North American Philips Corporation... **Andrew Brakhan**, Vice President of Philips Audio Video Systems Corporation, has been appointed Vice President and General Manager of that organization.

**Harry W. (Bud) Pearson** joins A.F. Associates, Inc. as Engineering Manager... **Charles P. Ginsburg**, Vice President-Advanced Development for Ampex Corporation, has been honored with membership in the Society of Motion Picture and Television Engineers (SMPTE) for his pioneering work in the development of videotape recording.

**Joseph Novik** has been appointed Marketing Manager at Belar Electronics Laboratory Inc. ... **Frederick B. Bundesmann** joins the Robert Bosch Corporation as National Sales Manager for U.S. sales of Fernseh television equipment.

**John Donnelly** has taken the post of Marketing Services Manager of Ikegami Electronics, Inc. ... **Gordon Lund** is the IGM Western Sales Representative.

**John Macfarlane**, Eastern Regional Sales Manager, Computer Image Corp., Denver, Colo., has been re-assigned to helm the new mid-west based Computer Image Production unit in Chicago... **Gerald M. Zuckerman** has been appointed Chief on the Legal, Advisory and Enforcement Division of the Safety and Special Radio Services Bureau.

**Lee. C. Hanson** has been appointed as Assistant Executive Director of the Association of Maximum Service Telecasters, Inc. by the AMST Executive Committee... **Jack B. Chapman**, President and General Manager, KGAK, Gallup, N.M.; succeeds **Wayne C. Cornils** as a member of the Radio Board of Directors of the National Association of Broadcasters... **Cornils**, President and General Manager, KFXD AM/FM, Boise, Idaho; will join NAB as Director of Membership.

**Kathryn Hilton**, Director of Research for the National Cable Television Association, has been named a Vice President of the Association... **Don Shaffer** has been added to the KOLO-AM, Reno, NV staff as News Director... **John Gunn** transferred to the sales department of KOLO.

**Rand Gottlieb** has been promoted to Director of Broadcast Acquisitions for Cox Broadcasting Corporation... **Louis J. Kaib** has moved to the position of Sales Manager-Television Services for Cox Data Services.

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## Editorial Billboard

### What's Ahead For BE

In all of us there's a spark of the gambler's spirit. That willingness to take a chance...to guess at what's coming...feeling that luck is on our side. Every Saturday's game is covered in pro bets and office pools. The smart dollars are seldom put on whims or perennial underdogs.

Tapping the pulse of the broadcast industry and the manufacturers who supply the industry, keeps **BE** running in high. We're not going to ask anyone to take a flyer on the possibility of a trend developing. While we all are betting our lives on broadcasting, **BE's** task is to make the risks minimal on all sides. How? There's no better way than to take a look at our game plan for '77.

There's a time to be theoretical and there's a time to be practical. In the past we have published 12 articles on logic theory for digital circuits we're likely to encounter in broadcast equipment. In 1977 we're going to have Harold Ennes on the line with a new feature called "Logic Lab". It's a monthly column based on practical troubleshooting of digital circuits. We hope it'll develop into a clearing house for engineering problems at stations and at the manufacturer's bench.

How about **ENG**? Well, we've got to remember that the history of broadcasting is based upon **ENG**, so we will expand our efforts into **RENG**! That's right, radio electronic news gathering. And whether for TV or radio, the approach will be practical. That starts in January.

We'll be talking a lot more about audio and the way it's processed and what you can do about it. And early in March we're going to deliver to you what we consider to be the most complete pre-NAB convention issue ever.

Throughout the year we'll be paying a lot of attention to production problems that have an engineering base. Under a new feature heading "Production Spotlight," we'll even go as far out as improved makeup techniques. Engineering is still our long suit, but we've found that more and more you can't say any one broadcast activity belongs solely to one department. They are interwoven and unforgivingly related. This is why **BE** will talk about what **ATS**, antennas, and facility changes mean to the engineer and the station.

Yes, we're going to dig into automation, mini-computers, and new systems. We'll look at satellites, radio and TV equipment roundups, and what the FCC expects you to know. And if you feel we're not cracking your toughest nut, drop a line to **BE** and we'll get cracking. After all, this is a crossroads magazine. Of course, we can't reach all our goals without your help. This is **your** station magazine, and if you want to make the most of it, send us your news, new ideas, even your Blue Bananas.

We're betting on a great year.

*The Editor*



# NEW PRODUCTS

## Digital Still Store System

A new Ampex digital recording system was unveiled election night by the CBS Television Network.

The Electronic Still Store (ESS) system is capable of storing thousands of color slides and still pictures magnetically on computer disc packs for use in television broadcasting. It is the first broadcast product to use digital recording techniques for video images.

ESS is a joint development of CBS and Ampex Corporation.

"In this unique new system, computer and video technology are combined to bring together the advantages of high-density storage, rapid access, and reliability," said Charles A. Steinberg, vice president of the Ampex audio-video systems division.

ESS electronically converts the analog television signal into digital form and stores the information on magnetic disc packs. Slides and stills can be randomly selected from bulk memory with an access time of less than 100 milliseconds.

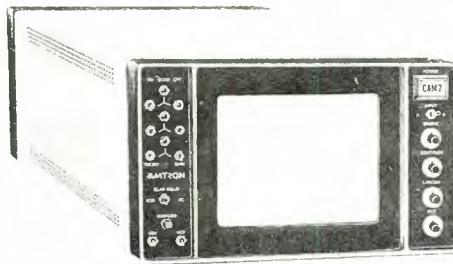
The basic ESS system can store up to 1,500 video frames on-line for immediate random access. Disc pack shelf storage is virtually unlimited.

Access to the system is through keyboard controls located at the electronics rack, or from remote access stations. Up to eight access stations can be incorporated in the system, each equipped with a keyboard terminal and alphanumeric readout.

Access priorities can be assigned in any manner desired, depending on the number and location of terminals, and the operating requirements of the station. A key-activated lock out feature provides file protection by preventing inadvertent or unauthorized erasures of any images stored in the memory.

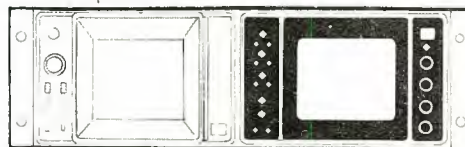
In addition to the record and reproduce modes of operation, ESS

## What's New?



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Professional in every respect, the Amtron AM-5 features the ultra-dependable, single-gun Trinitron® color system. Professional, too, are the extras—R-G-B gun switches, A-B selection of video input, internal/external sync, tally light and pulse-cross.



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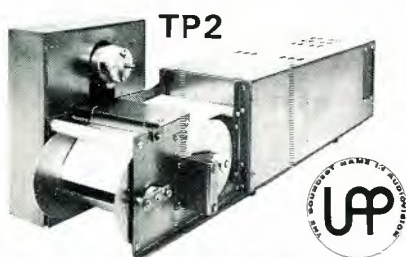
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- ★ **ROLLING TITLES** — accepts typed, written or drawn "visuals" on standard 4X6 cards or adding-machine paper for continuous "crawl".
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## Ultra Audio Products

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can rearrange selected stills in any sequence for inclusion in a program; and two independent video outputs permit preview, dissolve, mixed and special effects to be performed in the normal way at the studio switcher.

For More Details Circle (90) on Reply Card

### Digital Tape Timers

The TT-4 and TT-5 Digital LED Tape Timers have been introduced by **Convergence Corporation**, according to John Campbell, vice president of marketing.

Campbell stated that when used in combination with Convergence's ECS-1 Joystick Editor, they provide a continuous readout of tape time in minutes and seconds for both playback and record videocassette recorders in an ECS-1 editing system.

Both the TT-4 and TT-5 can be used in combination with the ECS-1 to facilitate rapid scene location or for measuring scene or program lengths on helical videocassettes. ENG news stories can be

accurately timed while they are being edited; educational, industrial or medical training tapes can be quickly assembled with random-accessed scenes on multiple source tapes.

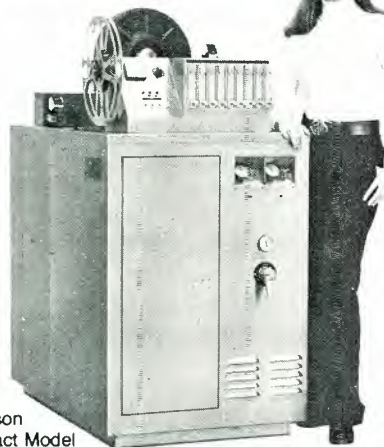
The large, bright LED displays may be reset to zero or preset to any number up to 59 minutes and 59 seconds. Accuracy in both systems is maintained by counting control track pulses from standard videocassette tapes. The record channel automatically switches to the 60 Hz AC line in the assemble record mode to constantly provide a readout of accumulated program time on the edited master tape.

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### Time Base Corrector

**Sony Broadcast** has announced the availability of its new BVT-1000 Digital Time Base Corrector. The unit employs a newly developed A/D system and is designed for both high band and helical video tape recorders.

The BVT-1000 is sold in a no-



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options configuration and includes velocity and drop-out compensators, full processing and full NTSC advanced sync. It combines a wide window of  $\pm 2$  H with a moving window concept to help hold picture lock, even with wide error excursions.

The BVT-1000 will handle both direct and processed heterodyne modes and includes anti-gyro circuitry helpful in time base correcting portable recorders.

For More Details Circle (94) on Reply Card

### Portable VTR, Camera Ensemble

Panasonic has introduced a portable VTR and camera ensemble, models NV-3085/WV-3085. The ensemble features a full hour of continuous record/play, instant field playback on the camera finder, standard video output connector, and the ability to record

### SBE Journal

Continued from page 18

signal over no signal at all. We would propose limits of 110% for high power and 20% for low power.

It is also our opinion that automatic technical logging be an essential part of the ATS system. We submit that the presently required operating parameters be logged at intervals of not more than six hours. Since modern transmitters exhibit a high degree of frequency stability, continuous monitoring serves no useful purpose. However, the various frequencies should continue to be measured on a monthly basis and the results entered in the station's maintenance log.

The Society feels that, once a viable, fully automatic transmission system is developed, it can provide high-quality broadcast service to the public, while relieving the licensee of the present operation log requirements and providing for better utilization of the staff. However, the transmitter should not be "locked and forgotten." Rather, it should receive good maintenance, be inspected on a periodic basis, and have its integrity, as well as that for the entire ATS system, documented and certified once a year. This maintenance, inspection, and documentation should, of course, be performed by the holder of a first-class radio/television operator's license.

## Eliminates Fade Outs in Wireless Microphone Systems



The Vega Model 63 Diversity Receiving System is designed to virtually eliminate problem noise and signal dropouts that are occasionally encountered when a wireless microphone is used on a set, in studios and in theatres. Send for complete details and specifications.



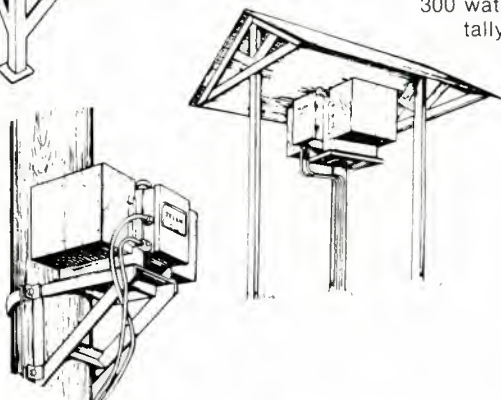
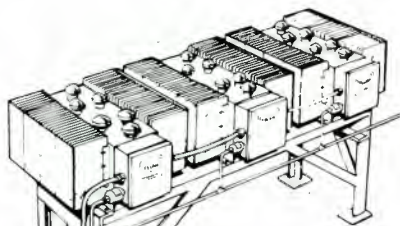
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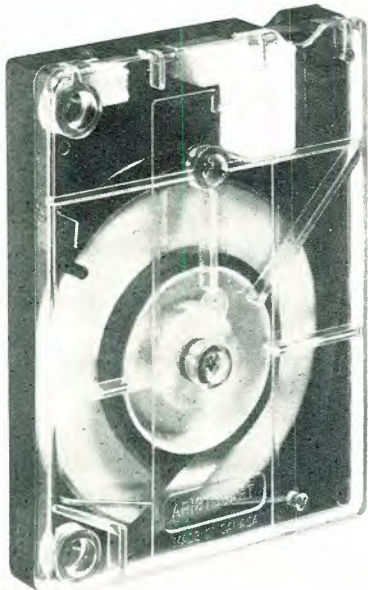
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directly on five-inch reels of tape that have been removed from standard EIAJ half-inch cartridges.

Applications of NV-3085/WV-3085 include, among others, the production of educational tapes, the study of traffic patterns and industrial processes, the recording of news and community events, home recording of family, and the production of alternate media programming.

Synchronous video and audio is assured by a single trigger-grip control on the camera. Video and audio record levels are controlled automatically. The standard zoom lens and a full 32 minutes of recording capacity on 1200 feet of tape permit versatility in production and convenient full-sequence shooting. The camera's whole image 1½-inch viewfinder monitor allows a full view of subjects. Horizontal resolution is greater than 300 lines for image clarity and fidelity.

For More Details Circle (95) on Reply Card

### Three-Tube Camera

JVC Industries, Inc. has introduced the NU-1800U Color Camera, the newest in JVC's series of advanced three-tube, professional quality units with built-in camera control unit (CCU).

Designed to meet the standards of video studio use, even when operated by non-technical personnel, the self-contained camera offers a stable picture and compatibility with most color studio systems. Designed for industrial and educational A/V departments as well as cable TV companies, the versatility of the new camera provides capabilities that fit most operational growth demands.

The NU-1800U achieves sensitivity, resolution and precise color registration by combining the three-tube system with efficient dichroic-mirror color-separating optics. The color encoding system is NTSC-type. A high signal-to-noise ratio of 46 dB at f/2.8 with illumination of 250-foot candles assures sharply defined picture fidelity. A +6 dB gain switch instantly doubles sensitivity for low-light conditions. For reliability and ease of servicing, 2/3-inch electrostatic focus/electromagnetic deflection tubes are em-

ployed and all key circuits are on replacement plug-in modules.

A built-in color bar generator allows optimal adjustment of a color TV monitor and color balance can be adjusted by checking the reference indicator in the viewfinder. Color temperature compensation for 3200°K or 6000°K is accomplished by flipping a switch on the camera control panel.

The NU-1800U Color Camera is fitted with an f/1.8 Fujinon 12.5-75mm (6X zoom) lens with manual or automatic aperture control. C-mount lenses in the one-inch or 2/3-inch tube formats also can be used interchangeably.

For More Details Circle (96) on Reply Card

### Automatic Switching Systems

Ward-Beck Systems Ltd., has recently designed and manufactured a series of computer controlled automated switching systems, for application in AM and/or FM radio master control areas. These systems provide control of signal routing, tape decks, transmitter, and radio plant supervision, while operating either from a real time program schedule, or sequentially, and logging all events as they occur.

The system pictured illustrates one of several smaller systems already installed and is used for the operation of a single FM and AM output bus. Other systems for the control of up to 11 stereo FM and AM buses are also in operation.

All systems utilize one or more Data General "Nova" Computers as the primary control element. Input/output devices provided include keyboard, teletype, and tape cassette. All audio switching is done by balanced solid state crosspoints which are both transient free and noise immune. Switching by "cut", "fade-down-fade-up", and "cross-fade" are all provided. Signal loss sensing and automatic fill are also available.

For More Details Circle (97) on Reply Card

### Remote Synchronizer

A new accessory for time base correctors is available from **Micro-time, Inc.**, enabling broadcasters to



receive live or videotaped signals in sync with station timing direct from mobile units up to 59 miles away.

Called the RS-1 Remote Synchronizer, the new device generates advance timing references by genlocking to the station's demodulated broadcast signal. These references are used to adjust or synchronize the signals transmitted back to the station. Reinsertion of station sync on the incoming signal transmission safeguards against any undesired closed loop effects.

The RS-1 eliminates the need for field synchronizers, and can be used with any wide-window TBC at the broadcast station. The resulting signal can be put through a production switcher or special effects generated and aired. Sync and burst LED's on the front panel are activated when the external reference is present. A coarse range dial adjusts phasing to within one-half mile accuracy. Fine tuning to within 140 feet is accomplished with a second control knob. A crystal oscillator provides internal reference when video reference is disconnected or lost. A camera/VTR switch provides three-line advance for VTR operation.

For More Details Circle (98) on Reply Card

### 9.5-57mm T1.9 Zoom

Angenieux Corporation of America has announced the availability of their 6x9.5, 9.5-57mm, T1.9 zoom lens. The Angenieux factory has increased production to make this lens more available.

Previously available in small numbers, the Angenieux 6x9.5 provides a very wide angle (68°) rendered by the 9.5mm focal length. Combined with a photometric aperture of T1.9 and close focusing from 24 inches from the focal plane to the subject, this lens has been a great asset to both the documentary and television news filmmaker.

Slightly smaller than the Angenieux 10x12 (overall length; 7.5 inches measured from the image plane, maximum diameter: 2.68 inches), the 6x9.5 zoom lens weighs only 29 ounces. This new concept in zoom lenses is available in Arri, "C", CA-1, C.P., and other professional 16mm camera mounts as well as with one inch viewfinder for

16mm non reflex cameras such as the CP-16 and LW-16.

For More Details Circle (99) on Reply Card

### VTR De-bugging Logic Analyzer

Pentronics of Hamilton, Ontario has designed a logic analyzer board for installation on the Ampex model ACR 25 cartridge videotape recorder. This unit is capable of identifying the origin of all test

modes and assisting in the debugging of intermittent faults which are often very difficult to diagnose. The analyzer will be available through **Glentronix Limited**, Ontario.

The model PB9000 Logic Analyzer is installed in a spare position in the electronics assembly (#A38). No cutting of existing wiring or harness is necessary since all connections are bridging. Each input to the PB9000 is buffered and its

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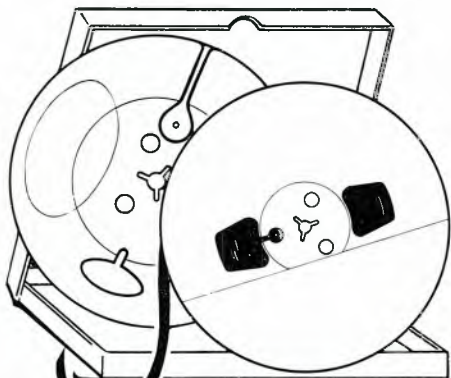
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installation results in one TTL load per connection.

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### Control Track Editing System

Television Research International, Inc. has announced a new control track editing system for On-Line, Off-Line and Electronic Journalism markets. Designated the Model EA-3, the unit features ease of operation, frame accuracy, and portability.

The new editing system can be interfaced to a variety of VTR's, including SONY Models VO-2800/VO-2850, RCA HR-1060, and JVC Models CR-8500U/CR-9300 LU. The system does not require factory installation.

Soon a companion unit, Model EA-6, will be available, which will provide editors with a system which utilizes control track data or SMPTE Time Code (in either standard Bi-Phase or SUN Formats) depending on the encoded data from the BTR's.

Model EA-3 features LSL (Logarithmic Search Level) controls for simple tape transport control, "return to edit" capability for frame trimming, constant speed audio search for syllable accurate audio edits, transport speed, and a rehearse edit mode with automatic cue-back and rehearsal.

For More Details Circle (101) on Reply Card

### Remote Control System

A new digital remote control system, consisting of a TCT-150 Control Transmitter and up to eight TCR-150 Control Receiver(s) is now available from **TeleMation, Inc.** The system provides on/off or normal/alternate remote control of up to 15 functions at each receiver location. These functions can include operation of switchers (including non-duplication switchers), broadcast transmitters, microwave relays, security systems, and other equipment.

The TCT-150 transmitter will accept either front-panel switch commands or TTL logic/contact closure inputs generated by timers or computers. These signals are transmitted via a two-conductor

cable or telephone circuit to the TCR-150 receiver(s), which in turn are connected to the equipment under remote control. Each TCR-150 can be addressed individually.

The TCT-150 transmitter will interface with TeleMation TMP-1000 or TMP-2400B Digital Electronic Programmers; the TCR-150 receiver provides TTL logic or optional form "C" contact closure outputs and can be connected to a TeleMation SI-2400 Switcher Interface/TMV-305 RF Switching System.

Telephone connection between a TCT-150 transmitter and TCR-150 receiver requires an optional factory-supplied modern within each unit and a dedicated voice-grade telephone circuit.

For More Details Circle (102) on Reply Card

### Mono Console

The **McCurdy SS8400** mono console is a modular, professional audio mixing unit. The features of the Series 8000 Module are integrated circuit technology, balanced input and output stages, provision for insertion of audio processing equipment, front panel plug-in capability and complete compatibility with other modules in the 8000 series, with available options suited to specific requirements.

Standard equipment on the SS8400 mono console is 12 input mixing channels, complete with A/B switching, allowing for 24 audio sources; each mixer equipped with specially designed "conductive plastic" slide attenuator (fader); cue switching provided with fader in maximum attenuator position, and front panel pushbutton to facilitate production procedures; and output from each input mixer is available to either program channel or both simultaneously.

Other standard equipment is input sensitivity switching (two positions), to suit specific mix requirements; two identical program output channels, each equipped with "channel-on" switching, rotary gain controls and VU meters; two monitor preamplifier and control systems, complete with eight input selections; one cue/talkback system allowing three-station communication; and extender module.

For More Details Circle (103) on Reply Card



### Color TV Studio Camera

A new color TV studio camera by **Ikegami** uses an add-on mini-computer for setup cycling. The digital add-on unit automatically cycles the camera in 15 seconds through all setup adjustments including black-and-white balance, flare and gamma correction, video gain, and the eight registration functions.

The HK-312 color camera uses three 1¼-inch Plumbicon tubes; has a better-than 56 dB signal-to-noise ratio; and a zoom lens and camera tube combined in a single assembly for optimum accuracy of optical axis. Class A deflection amplifiers assure maximum linearity.

Automatic black level and balance correction maintain picture quality and brightness in the event of flares from the lens. Automatic horizontal and vertical detail corrector maintains optimum picture resolution. A special comb filter minimizes color noise in the color channel to keep background noise to a minimum.

A high-resolution, tiltable seven-inch viewfinder presents the camera operator with a large-sized, sharp viewing image from any angle, low or high.

The automatic setup cycling faculty can be extended to as many as five remote cameras with the use of a separate computer-control unit (CCU), which accomplishes the task in only 2½ minutes.

For More Details Circle (104) on Reply Card

### Reel-Servo Mod Kit

R-MOD, the reel-servo modification kit for quad VTRs from **Recortec**, has a new automatic search feature which will be included in all R-MODs at no increase in price.

R-MOD provides constant tension tape handling, improved lock-up times, unrestricted remote control in tape shuttle modes, automatic stop at end of reel and a frame accurate video tape timer for both RCA and Ampex quadruplex VTRs.

To use the new automatic search

feature, the operator watches the monitor and depresses the hold button on the video tape timer when he sees the desired playback image to which he wishes to cue. The R-MOD "remembers" this point. After the operator stops the VTR or in the shuttle mode he can cause the tape to automatically cue up to a preroll position by pushing the timer's hold button again. When the operator puts the VTR in the play mode the R-MOD will roll the tape and provide an edit pulse ahead of the selected edit point to turn on the electronic editor.

For More Details Circle (105) on Reply Card

### Transmitter Remote Control

A modular system for digital remote control of AM, FM and TV transmitters has been introduced by **Time & Frequency Technology, Inc.** (TFT).

Called the 7600 Series, the new system is adaptable to ATS operation, and consists of three basic instruments which can be combined to provide from 10 to 80 channels of remote control. The system uses digital, pulse-code-modulated modems and can be linked by telephone wire, STL and SCA, or sub-audible telemetry.

The basic building block of the TFT system is the Model 7610 Digital Telemetry/Control System. It is a stand-alone unit with raise/lower functions and from 10 to 80 channels of telemetry. The 7610 can be expanded by addition of a Model 7615 Status and Direct Control System. This gives users 15 or 30 direct, on/off control func-

tions and 15 or 30 status monitoring channels. The third system component is the Model 7640, a microprocessor-controlled Digital Data Panel. It displays up to 40 meter readings simultaneously, and includes automatic limit alarms. Automatic logging is available as an option.

Users can purchase a complete system or just the basic 7610 and add other system components in the field as needed. A complete line of accessories is available for transmitter interface.

A quick disconnect rear panel allows users to remove instruments without disturbing any of the wire connections between the system and the transmitter or sampling points.

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**RCA TR-60** Video Tape Recorder. Hi Band color with CAVEC. Excellent condition. RCA TR-3 Video Tape Play Back. Hi-Band color with CAVEC. Excellent condition. Write KHSL-TV, P.O. Box 489, Chico, California 95927 or call 916-342-0141. 12-76-1t

**PANASONIC AK900** 3 Tube Plumbicon with remote control and 15 to 150 mm Flexible Control Zoom Lens. Less than 25 hours. \$19,000. 303-455-1122—Denver. 12-76-1t

## EQUIPMENT FOR SALE (CONT.)

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**12 BAY FM ANTENNA,** 3-1/8" Rigid coax, stereo cart and reel recorders, Sparta console, limiters, other audio processing equipment and more. Call Norm Laramie 918-585-5555. 12-76-3t

**DON'T PAY \$150.00—\$280.00** each for VIDEO or PULSE distribution amps. You can save your organization a few thousand dollars, if you have someone who can solder and follow simple instructions. I supply ALL parts, including pre-drilled and etched epoxy card, for building a six output, BROADCAST video or pulse amp. AVAILABLE ONLY PER THIS AD. Will ship prepaid, COD or P.O. from credible CO. TELE-TEC., 8688 ROYAL DRIVE, NOBLESVILLE, INDIANA 46060. VIDEO 3601-VDA PULSE 3601-PDA, complete with instructions \$25.00 each. 12-76-1t

**MUST SELL**—IVC-870C and IVC-760 with TRI editor. One and a half years old. No reasonable offer refused. Call: (815) 968-4683. 12-76-1t

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**HARD WORKING BROADCAST ENGINEER**—1st phone, seeks to re-locate in small to medium market—AM-FM-TV or Educational. 4 years experience FM & UHF TV. Specialized skills: rehabilitation & custom design. Ronald Holmes, 1303 Eighth Ave., Longmont, Colorado 80501. 10-76-3t

**EXPERIENCED VIDEO TAPE** operations and editor. Excellent references. Available immediately. Area code: 203-232-4908, Elliott Cohen, 15 Crestview Circle, West Hartford, CT 06117. 12-76-1t

**TECHNICAL POSITION WANTED:** Either at a station or with engineering company. First class license: military electronic experience. Prefer northeast area. Call Bruce Sonnenburg, (516) 799-4578. 12-76-1t

**YOUNG AMBITIOUS MAN** wants to get started in broadcasting. Willing to learn all phases of radio with emphasis on traffic, sales and news. Has third class license and wants to get started anytime after January 20th, 1977. Will relocate anywhere in southern California. Audition tape on request. Call anytime (415) 828-5240, or write Steve Allen, 7696 Frederiksen Lane, Dublin, California 94566. 12-76-2t

## HELP WANTED

**PATENTED MATV.** \$200.00 day profit possible. Preliminaries \$3.00. Box 809, Boynton Beach, Fla. 33435. 10-76-6t

**TELEVISION MAINTENANCE OR SUPERVISOR**—Electronic or Digital Systems Technicians, or T.V. Servicepersons, for Northern New Jersey or New York area. Send resume to: V.P.C., P.O. Box 268, New Hyde Park, N.Y., 11040. 11-76-1t

**TELEVISION ENGINEER/ELECTRONIC TECHNICIAN**—Needed immediately. Individual with previous experience in operation, maintenance and repair of color television production equipment. Degree preferred. Apply to James H. Thomas, director of Instructional Technology, Allegany Community College, Cumberland, Md. 21502. Allegany Community College is an equal opportunity/Affirmative Action Organization. 11-76-2t

**FM ENGINEERING SUPERVISOR.** FCC first phone required. Audio & maintenance skills, some supervisory experience necessary. Salary open. Mr. Bell, Box 21, Rochester, NY 14601, 716-325-7500. 12-76-1t



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To accommodate a continuing growth pattern, RCA Broadcast Systems is seeking professional specialists in three areas of marketing operations:

**BROADCAST SYSTEMS SALES** Experience in television station operations and engineering, and/or sales experience in radio, television or related technical fields. BSEE or equivalent is required.

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## HELP WANTED (CONT.)

**CHIEF ENGINEER** for broadcast-standard origination facility in southern California area. Maintenance and repair experience with 2" quad and color cameras mandatory; experience with helical scan beneficial. Degree and FCC license not required. Send resume and salary history to CHANNEL 100, P.O. Box 657, El Cajon, CA 92020. ATTN: Program Operations Department, or call (714) 449-2009. 12-76-11

**POSITION OPEN** for professional motion picture camera and photographic audio equipment repairman to maintain TV Station photo equipment and operate color processor. Processor operation will be taught to qualified repairman. Send resume to: F.W.B. Lab., P.O. Box 1118, Miami, Florida 33138. 12-76-11

**TELEVISION ENGINEER WANTED:** Minimum of 3 years experience operating and maintaining studio cameras, audio and RCA video tape. Must have an excellent technical background and 1st class FCC license. Send resume to: Ted Newcomb, Chief Engineer, P.O. Box 32325, Oklahoma City, Oklahoma 73132. 405-848-3311. An Equal Opportunity Employer. 12-76-31

**VIDEO EQUIPMENT SALES**—Manufacturer of complete line of quality video equipment desires aggressive results-oriented individual for sales position in Midwest. Sales experience with manufacturer or distributor desired. Must understand video equipment specifications and operation in broadcast and CCTV systems. Extensive travel (home weekends). Work from home when not traveling. Salary, commission, and leased car. Liberal benefits. Reply to J. Waltrich, Dynasciences, Township Line Rd., Blue Bell, PA 19422. Equal Opportunity Employer. M/F. 12-76-11

**TELEVISION MAINTENANCE ENGINEER**—Experience 5 years maintenance and operation of color TV broadcast equipment including quadruplex. Request BA or equivalent, FCC 1st class license desirable. Apply to: Don Marx, ECC-C, SUNY at Stony Brook, Stony Brook, New York 11794. Equal opportunity/affirmative action employer. 12-76-11

**BROADCAST ELECTRONICS FACULTY POSITION:** To teach the final year of a Bachelor of Science program. The subjects to be taught include two-way communications, Radio Transmitters (A.M. and F.M.), CATV, and Color Television Transmitters. Bachelor of Science degree required plus significant work experience. This is a tenure track position. Apply to: M. R. Halsey, Head, Electrical and Electronics Department, Ferris State College, Big Rapids, Michigan 49307. (616) 796-9971, Ext. 208. AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER. 12-76-21

**TELEVISION TECHNICAL HELP WANTED**—Vital Industries, Inc. has opening for experienced video systems and maintenance engineers and one technical writer. Write: Personnel Dept., Vital Industries, Inc., 3700 N.E. 53rd Ave., Gainesville, Florida 32601. 12-76-11

### VIDEO SWITCHER SALES:

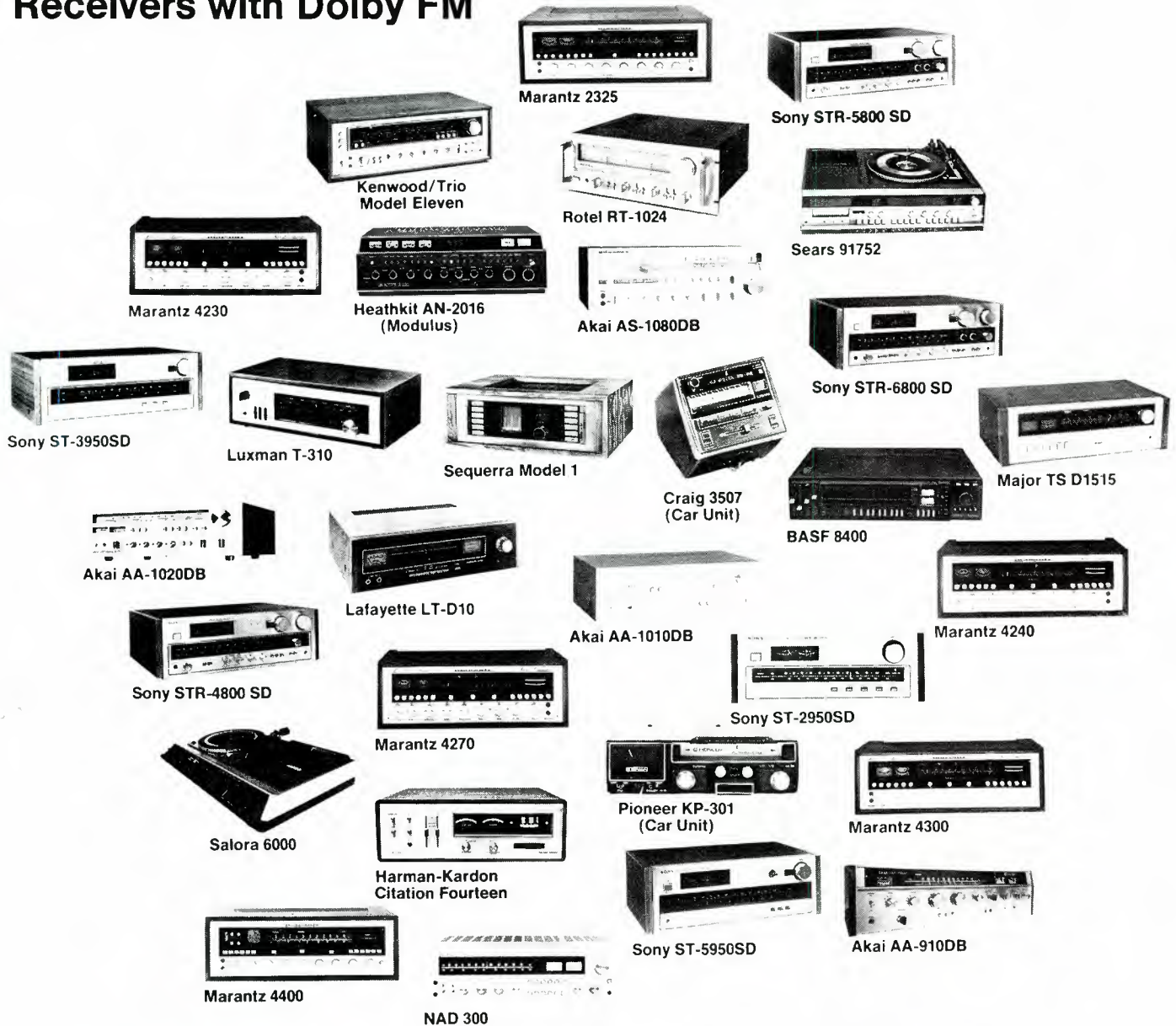
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# They're here Receivers with Dolby FM



Dolby FM was a classic chicken and egg situation. In 1973-74 we first had to convince broadcast engineers of the technical merits of our system. That got the first stations on the air. (And this without any available receivers, only a few enthusiasts with add-on Dolby decoders.) Then our licensees put new receiver designs into the pipeline. Eventually, in 1975, a trickle of receivers with built-in Dolby FM circuits began to appear. And the station list began to lengthen. Now, with the receivers pictured here, and with more than 140 broadcasters equipped with Dolby encoder units, it's no longer chicken and egg. Dolby FM is on its way.

See your hi fi component dealer for more information. If you would like technical details on how Dolby FM works, please write to us.

## The Advantages of Dolby FM

1. High-level high-frequency signal recoverability.
2. Noise reduction.

All FM transmitters have an inherent tendency to overload with high-level high-frequency signals. Conventional stations employ high-frequency limiting to avoid this problem. Such treatment is not reversible by the listener, which means that the limited high frequency components are lost. Instead of limiting, Dolby FM stations use a Dolby B-Type compressor in combination with reduced high-frequency pre-emphasis. This solves the transmitter problem in a way which provides the listener with the opportunity of completely recovering the original signal. About half the Dolby-B capability is used in this way. The other half, not surprisingly, is used for noise reduction. These improvements represent a significant step forward in FM broadcasting quality.

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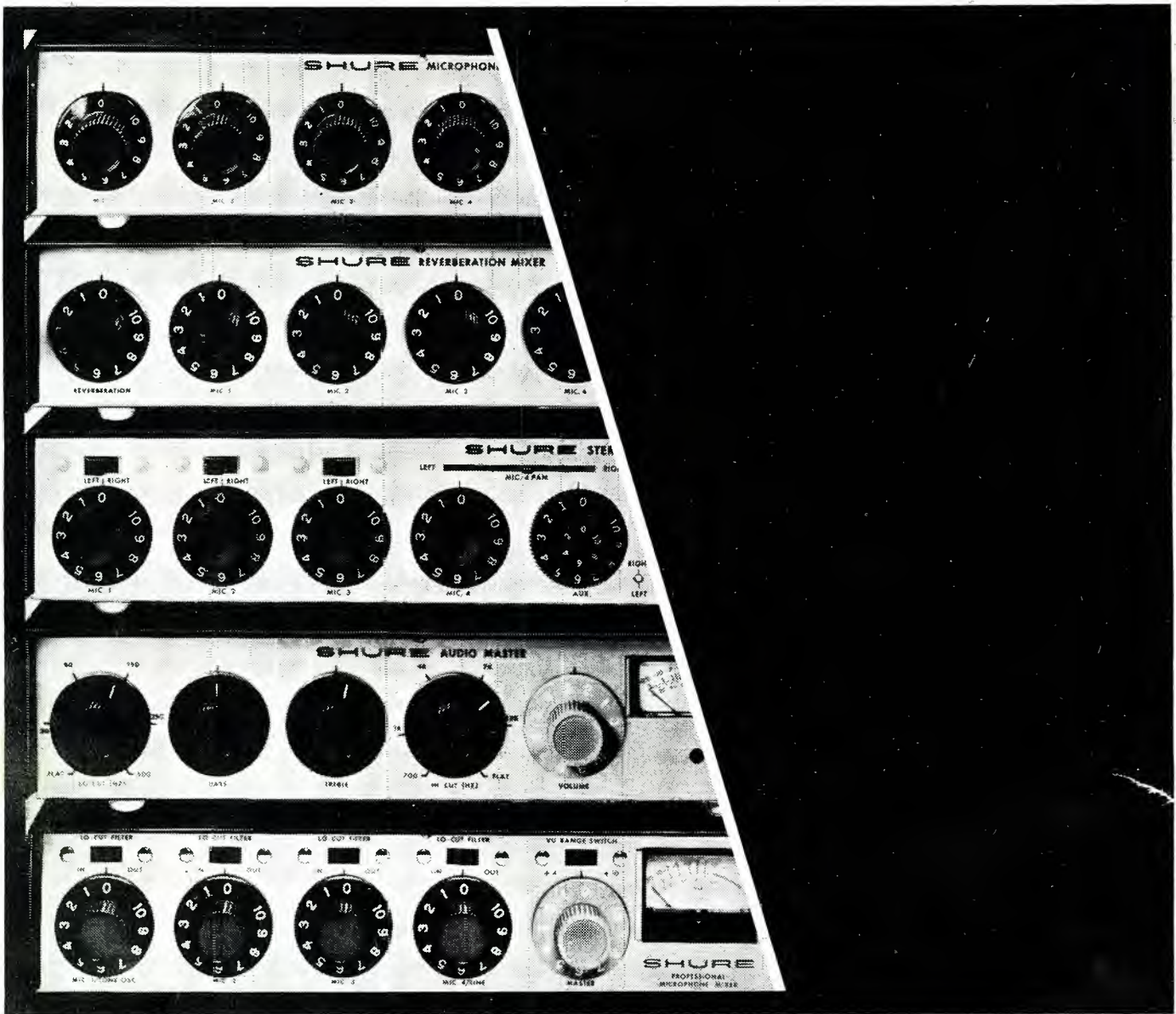
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