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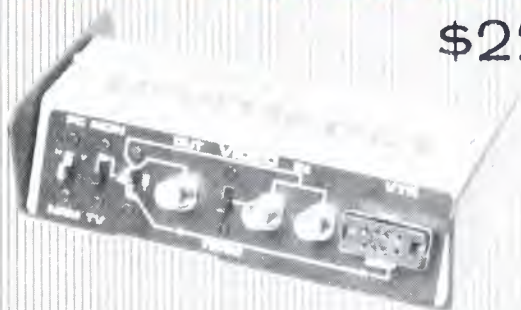
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BROADCAST[®] engineering

The journal of the broadcast-communications industry



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About the cover

Our cover photo shows two large-diameter antennas at East Coast earth station, designed and built by Harris Corporation. Our lead article on domestic communication satellites begins on page 3 (Photo courtesy of Harris Corp.)

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The 3400 Series is Grass Valley Group's new range of high performance, cost effective video and pulse distribution amplifiers.

All models feature differential input and six source-terminated outputs. Most types have provision for a cable equalizer submodule. The latter provides a fixed degree of equalization. Other models allow equalization to be controlled from the front panel to provide continuous adjustment up to a maximum determined by a cable equalizer submodule.

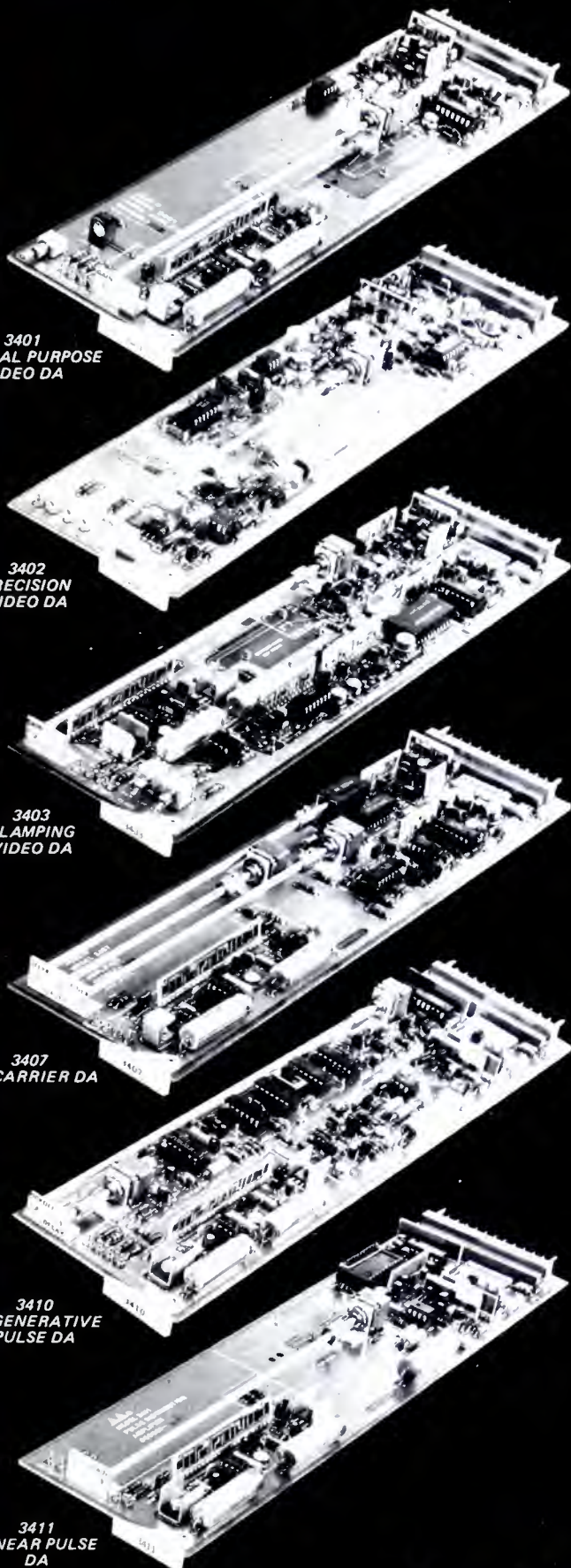
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DIRECT CURRENT FROM D.C.



December, 1977/By Howard T. Head and Harold L. Kassens

FCC Staff Upset

The new FCC chairman in one of his first actions dictated that the present 8:00 AM to 4:30 PM office hours be changed to 9:00 AM to 5:30 PM to accommodate the people the commission is to serve. A large group of the staff was opposed to such a change, and the chairman has agreed to delay the change until January 1, 1978. There may be further delays.

TV Modulation Monitors

The FCC's field trucks are finding an increasing number of TV stations violating the aural modulation rules [73.682(a)(23) and 73.687(b)(7)] when using an FM subcarrier for telemetry purposes. It seems that many stations are relying on the aural modulation monitor when setting the permissible 10% injection level but the monitors were never intended to read accurately at frequencies in the 40 kHz region.

Inquiry Into Amateur Call Signs

The commission has ordered an inquiry (Docket No. 21418) based on its own information indicating that certain applicants and licensees in the Amateur Radio Service may have made payments of cash or other consideration in connection with issuances of amateur licenses, upgraded licenses or call signs for which they were not qualified. The commission indicated that such practices may be in violation of law or FCC rules and raise questions regarding qualifications to become or remain--amateur licensees. What wasn't said by the FCC in the order but reported in the trade press is that someone inside the FCC appears to have been receiving the "payments of cash or other consideration."

FM Interference to TV Channel No. 6

In the past, the FCC has been extra careful in making grants to educational FM stations on the lower FM channels 201 to 210 (88.1 to 89.9 MHz) because of the potential interference to television re-

continued on page

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DIRECT CURRENT FROM D. C.

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ceivers tuned to TV channel 6 (82-88 MHz). In a recent commission decision, a 10-watt educational FM station was granted for channel 208 (89.5 MHz) and the objection of the channel 6 station was denied. However, the FCC has required the educator to prove, during the equipment test period, that any interference has been alleviated or program test authority will not be granted. This seems to be a new policy.

FCC Installs TTY

The commission has installed a teletype system for the deaf at its Gettysburg office to enable those persons to have access into the data system there. A teletype has been in operation in the FCC's Consumer Assistance Office for some months to aid the deaf in obtaining regular FCC information. In Gettysburg: (717) 334-9235. In Washington: (202) 632-6999.

The Receiver of Tomorrow

In the continuing saga of the "receiver to cure all TV allocation problems," the unit designed and produced by Texas Instruments is now in the hands of the staff at the FCC Laboratory. They are conducting studies to see if it meets the specifications originally agreed upon. The chief engineer of the commission has stated that the report will be completed by January 1. The subject is of interest because rumors imply that the receiver would make it possible to assign adjacent TV channels in the same city. It also is suggested that land-mobile channels could be squeezed closer together.

Long Distance AM Interference

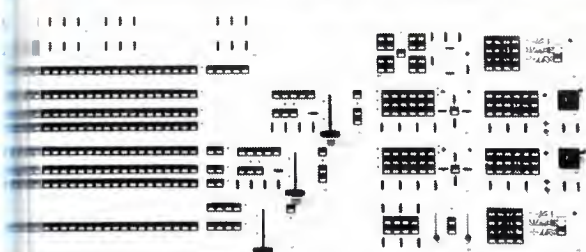
In response to complaints originating with the telecommunications authorities of New Zealand (New Zealand?), the commission is now making plans to investigate possible interference between clear-channel stations on the West Coast of the U.S. and AM stations in New Zealand. The problem arises from plans to change the allocation of the AM band from carriers centered on 10 kHz intervals to 9 kHz.

In the upcoming tests, a station in Los Angeles will be shifted from 640 kHz to 641 kHz and the New Zealand station from 1070 kHz to 1071 kHz. The theory is that the 1 kHz beat note will have the potential for greatly increased interference. Attenuation of the skywave over these long paths is expected to be much less than typical skywave attenuation since the reflections from the earth's surface on which long distance skywave propagation depends will occur at regions of high conductivity, namely, the surface of the ocean.



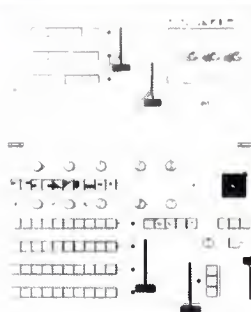
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industry news

Competition opens for 1977 news photographer, station awards

Competition has opened for the 1977 "Television News Photographer of the Year" and "Television News Photography Station of the Year" awards, sponsored by the Eastman Kodak Company and the National Press Photographers Association (NPPA).

The Kodak/NPPA "Television News Photography Station of the Year" award recognizes a local broadcasting station that provides outstanding coverage of events surrounding and affecting the community it serves.

The "Television News Photographer of the Year" award honors the individual press photographer whose work exhibits both skill and professionalism in a variety of news story categories.

Winners in each category are selected based on examples of their work in any four of the following categories: spot news, general news, sports, feature, and mini-documentary.

The television news competition is open to all NPPA members as well

as individuals eligible for membership.

Entries must have been broadcast first between January 1, 1977 and December 31, 1977. Entries, submitted on either 16mm film or ¾-inch tape cassette, must be postmarked no later than January 31, 1978.

For more information, contact Sheila Keyes, chairperson, Television News Photography Competition, National Press Photographers Association, 1819 N. Grismer Avenue, Apt. C, Burbank, CA 91504.

Sony to open U.S. video technology center

Sony Corporation of America is establishing a U.S. video technology center to provide systems technology in the video field, and to deal with the technical development of peripheral equipment.

The center, to be located in the San Francisco Bay Area, will serve

as a comprehensive technical base for institutional video.

According to Sony, plans to open the U.S. center resulted from the continuing demand for institutional video equipment and related products. This demand has increased rapidly as the range of video users has expanded to include business,

industry, as well as broadcast, educational and medical areas.

Taking into consideration the future trends of the market, Sony intends to turn the center into a major development and production video base for general institutional uses and special professional purposes.

Sponsorship identification subject of FCC action

The Federal Communications Commission has issued a public notice to remind licensees of their obligation to insure that proper sponsorship identification announcements accompany all commercial matter, and to set down the requirements in this area.

The FCC action is in response to the widespread licensee failure to make appropriate sponsorship identification announcements, as required by Section 317(a)(1) of the Communications Act of 1934, as amended, and Section 73.1212 (a) of the FCC's Rules, in identifying commercial matter as such when the commercial nature of a message is not clear from its content.

This failure arose in connection with a nationwide "teaser" campaign conducted by a religious organization, and in connection with commercial messages paid for by

the federal and state government entities and local public service organizations, as well as trade associations.

Licensees cautioned

The FCC said that "sponsorship identification is a critical aspect of broadcast operation and licensees are cautioned that failure to adhere to the requirements set forth herein will subject them to the full range of sanctions authorized by the Communications Act."

Section 317(a)(1) of the 1934 Communications Act reads, in part: "All matter broadcast by any radio station for which any money, service, or other valuable consideration is directly or indirectly paid, or promised to or charged or accepted by, the station so broadcasting, from any person, shall, at the time the same is so broadcast, be announced as paid for or

furnished, as the case may be, such person..."

Section 73.1212(a) of the Commission's Rules, implementing Section 317(a)(1) of the Act, provides that the required announcement shall state, "(1) that such (commercial) matter is sponsored, paid for or furnished, either in whole or in part, and (2) by whom, or on whose behalf such consideration was supplied..."

The purpose of Section 317 of the Act and Section 73.1212 of the Rules is to require that the audience be clearly informed that it is hearing viewing matter which has been paid for when such is the case, and that the person paying for the broadcast of the matter be clearly identified. Accordingly, a sponsorship identification announcement must state in language understandable to a

continued on page

THE SONY 25" MONITOR.

A 25" professional video monitor, from Sony?

It sounds too good to be true.

All that brilliant Trinitron or. All that state-of-the-art technology. All that world-famous Sony quality control.

And all in a screen size (measured diagonally) that will make a sizable impression on a king-size audience.

Professionally speaking, the monitor is one of our biggest achievements.

It uses a brand new system called Beam Scanning Velocity Modulation, to give you crystal-sharp picture clarity.

And it has the kind of connectors and controls a professional monitor ought to have. Like provision for external sync. Dual input. Automatic degaussing button. And notch filter switch.

With features like these, our 25" monitor should be a huge success.

And that's what has us worried.

For years, you see, we've built our reputation on superb small-screen monitors and receivers.

Now, we've got a giant-screen monitor that's just as superb.

Who knows where it will end?

SONY®

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Registered trademark of Sony Corp.
Model PVM-2550 Trinitron Color Video Monitor

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For Literature Only Circle (7) On Reply Card

Why you should continue Plumbicon® TV tubes in

The future for ENG grows brighter and more exciting with each passing day. The same can be said about the $\frac{2}{3}$ -inch Plumbicon, the TV camera tube that made Electronic News Gathering possible and practical at the same time.

Reflecting our continuing commitment to provide the broadcast community with state-of-the-art Plumbicon tubes—(it was a Plumbicon tube that revolutionized color TV broadcasting in 1964)—we invested almost four million dollars in the development of the $\frac{2}{3}$ -inch Plumbicon tube, most of it before the first ENG cameras were even introduced. Very early in the game, we felt that electronic journalism, with the support of modern tube and camera technology could surely add a new dimension to television broadcasting.

Even with that confidence, the phenomenal acceptance of Plumbicon-equipped portable cameras nearly overwhelmed us, as it did everyone else. In just 18 months we have supplied almost 4000 of these tubes to U.S. broadcasters!

In a market of such magnitude, it was not unexpected that other $\frac{2}{3}$ -inch camera tubes would arrive on the scene, sooner or later, with the usual "ours is better than theirs" claims. We feel that much conflicting and contradictory information has been given to the broadcast industry, regarding these new tubes. In the final analysis, only you, the broadcaster, can judge the *system performance* of these tubes and compare their performance *in the camera* with the Plumbicon tube.

In the meantime, we offer some of our own experience on the system performance of the Plumbicon tube compared to the Saticon (Registered trademark NHK/Japanese Broadcasting Corporation), one of these recently arrived new products.

Sensitivity Sensitivity is the criterion in ENG. It is the parameter in the field, where you have no control over light. You need the Plumbicon tube's greater sensitivity to maintain an acceptable signal-to-noise ratio in your final edited news story. Even in those near impossible lighting situations, you are more assured of producing a useable picture with a Plumbicon-equipped ENG camera than with the same camera equipped with the Saticon.

Resolution Your final, edited tape is the criterion by which you must evaluate ENG system performance. Your pick-up tube should always be selected on that fact in mind.

Resolution specifications are a good example of this principle. Plumbicon tube sensitivity gives enough latitude for aperture correction with a little loss in S/N ratio, to achieve the required 100% modulation depth at 5 MHz, but the resolution of most ENG systems is limited by the videotape equipment used. From the system performance point of view, therefore, a pick-up tube chosen solely for its resolution specifications have no positive effect at all on picture quality.

Lag The Plumbicon tube has lag characteristics that are so favorable that it can be used entirely without bias light. If your camera provides bias light, it simply improves the Plumbicon's lag characteristics. The Saticon *must* use bias light or its pictures will be seriously degraded. In the middle of a news event, should a bias lamp burn out!



specify $\frac{2}{3}$ -inch our ENG cameras.

Temperature Stability

The Plumbicon's photoconductive layer is stressed at temperatures in excess of 175°F. The Plumbicon tube can tolerate temperature variations that may take the photoconductor to 160°F. The Plumbicon tube tolerates 160°F ambient without damage of any kind. The Saticon, however, will experience partial or complete layer separation at these temperature levels after a few months. It is totally conceivable that your ENG camera will experience temperatures which will cause the Saticon tube in your camera to reach a critical life condition.

Based upon actual operating experience with the Plumbicon, rather than on statistical accelerated life testing, you can expect 2 to 5 years of service, depending upon usage practice.

Burn-in The Plumbicon exhibits no, or very little perceptible picture burning (burn-in) especially in highlights. The Saticon, on the other hand, has been observed to have a noticeable characteristic of "hanging-up" in bright highlights and also tends to exhibit picture sticking after a camera has been focussed on a scene for any length of time.

Registration The Plumbicon tube incorporates a precision gun assembly for controlled geometry registration. Our final testing includes a computerized registration check which matches each tube's performance with a data base which includes readings on previously tested tubes. Should the tube fail to match up to this data base, it is rejected. This is added insurance that your camera will maintain precise registration even after you change your original Plumbicon tubes. Needless to say, you do not have to replace the Plumbicon tubes on "sets."

Storage The Plumbicon can, of course, be stored for many months without deterioration. But why store TV camera tubes? Storage means money. Amperex service to the broadcast industry is justly famous. Delivery of replacement tubes anywhere in the USA within 24 hours is routine. In extreme emergency situations, we have shipped tubes clear across the country in as little as eight hours.

We expect you to make your own comparisons and we are sure your findings will agree with ours. One of the things that may not be apparent from your comparisons is the fact that Plumbicon TV camera tubes continue to stay abreast of the needs of the broadcast industry after more than ten years of production which has put almost 150,000 Plumbicon tubes into broadcast stations around the world.

When you specify Plumbicon tubes in your ENG cameras, we deliver a lot of experience.

For more information, contact:
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Telephone: 401-762-3800.

Amperex

TOMORROW'S THINKING IN TODAY'S PRODUCTS

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continued from page 8

majority of the audience that the station has received consideration for the matter broadcast and from whom that consideration was received.

Public confused

The failure of many licensees to identify properly the paid promotional announcements of federal and state government entities or quasi-government and local public service organizations is also confusing to the public because licensees often broadcast such announcements free of charge. This failure frequently results when the entity or organization purchasing time uses the same, or a similar, announcement that it uses for broadcasts in free time. These announcements generally refer to the entity or organization by name only, with no indication the message was paid for as opposed to broadcast free by the station as a public service. The FCC stressed that the sponsorship identification rules pertain to these announcements just as they pertain to any other matter the station is paid to broadcast.

Confusion also can arise in connection with trade association commercial announcements which promote member goods and services. These announcements sometimes suggest that use of member goods or services is consistent with the public interest and thus may be perceived as public service announcements if not properly identified. All such announcements must clearly state the name of the sponsor and indicate, in the manner set forth above, that time for the message was paid for.

Maximum TV power restrictions revised

Restrictions on the maximum effective power permitted to be radiated above the horizontal plane by a television broadcast station have been revised by the FCC.

The change accommodates the radiation characteristics of high-gain television antennas that use beam tilt to control and shape the vertical radiation pattern. It was requested by the broadcast equipment section of the industrial electronics division, Electronic Industries Association (EIA).

[Electrical beam tilt is the shaping of the radiation pattern in the vertical plane of a transmitting antenna by electrical means so that the maximum radiation occurs at an angle below the horizontal plane. Mechanical beam tilt is the intentional installation of a transmitting antenna so that its axis is not vertical, in order to change the normal angle of maximum radiation in the vertical plane.]

The FCC explained that vertical radiation pattern control accomplished by beam tilt was achieved through either electrical or mechanical means or a combination of both.

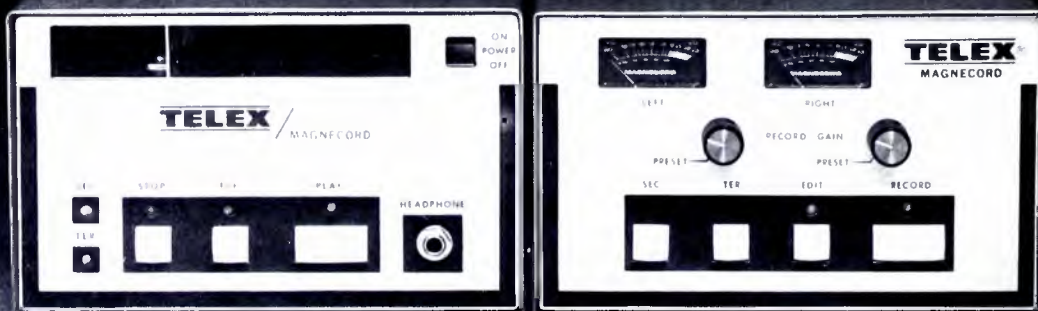
The Commission noted that by controlling the angle of radiation in this manner, a station's service area may be optimized without causing harmful interference to other stations.

Current rules require that the maximum effective power radiated in any direction above the horizontal plane be as low as the state of the art permits and not exceed the effective power radiated in a horizontal direction in the same vertical plane.

The Commission said this requirement, written before high-gain antennas,

continued on page

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Telex/Magnecord broadcast cart machines run cool and steady. So cool no ventilation is required, so steady not even voltage or frequency fluctuations will alter their speed. Thanks to our dc servo flutter-filter drive.

The MC series offers broadcasters a host of options, including field convertability from mono to stereo or play to record and, of course, end of message, secondary/tertiary cue tones. Designed for type A or B carts, the MC series meets all NAB specifications, offers full immunity to EMI and RFI, is remote controllable and automation compatible with CMOS digital logic. Audio muting, air damped low voltage

dc solenoid and fast forward are standard features on every MC unit.

Four broadcast cart machines to choose from in the Telex/Magnecord MC series. Running cool and steady. With a pleasant surprise—they're affordable.

For detailed information please write:

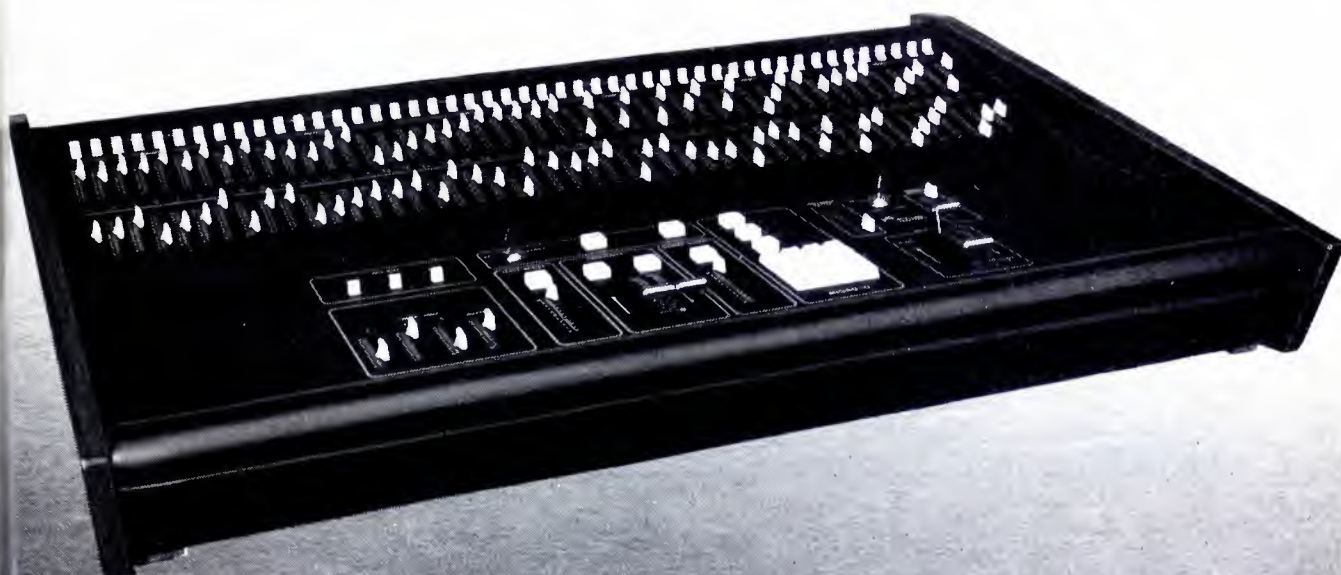
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sor controlled. Micro-Q offers timed crossfades, cue insert, preview and submastering. For your newscasts, commercials or more sophisticated production, be creative with your lighting — memorize it the Micro-Q way. Ask for your new Micro-Q brochure.



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www.americanradiohistory.com

continued from page 12

tennas with beam tilt were developed, was intended to assure that a station did not radiate excessive power above the horizontal.

The EIA pointed out that antenna beam tilt could cause the power radiated at some angle above the horizontal to exceed the horizontal power radiated and thus be in violation of the rules, although power in any direction above the

horizontal would be below the maximum power radiated by the main lobe that was tilted downward to achieve better service area coverage.

The new rule provides for these radiation characteristics by specifying that effective radiated power above the horizontal plane be as low as the state of the art permits, and in the same vertical plane may not exceed the maximum effective radiated power in the main lobe that can be either horizontal or below the horizontal, if beam tilt is used.

Program determines interference to satellites

A computer program designed to inform a system designer of the degree to which a proposed terrestrial communications system might interfere with existing satellite systems has been developed by the Office of Telecommunications (OT).

Eldon Haakinson and David Skinner, engineers at OT's Institute of Telecommunication Sciences, devised the program, called ORBITCHECK.

Program ORBITCHECK is a response to domestic and international regulations limiting the power of an antenna beam pointing of terrestrial system transmitters towards the geostationary orbit. Output for Program ORBITCHECK consists of detailed summaries of how close planned system's antenna beam points toward the geostationary orbit for various atmospheric refraction conditions. In addition, the program's output shows whether the planned system is in compliance with regulations; ORBITCHECK therefore of potential value to spectrum managers.

A report entitled "Power and Beam Pointing Restrictions for Geostationary Orbit Avoidance: Program ORBITCHECK User's Manual" describes the program, its limitations, and its use. The report (Report 77-119) is available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The cost is \$6.

Ground terminal seminar scheduled for Kansas City

A three-day seminar on satellite earth terminal technology is scheduled for Kansas City, Missouri from January 16-18, 1978.

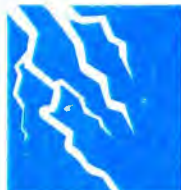
The seminar, conducted by Hughes Aircraft Company's microwave communications products, is one of a series on ground stations used by CATV system operators to receive satellite-transmitted television programs. It will be held at the Holiday Inn, Kansas City International Airport.

Technical management personnel from both broadcast stations and CATV systems will be briefed on theory and practice entailed in the use of satellite receiving terminals.

The seminars are tuition-free; registrations are accepted on a first-come/first-served basis. For further information, contact Robert, Hughes Microwave Communications, Products, Building 237, Box 2999, Torrance, CA 90509.

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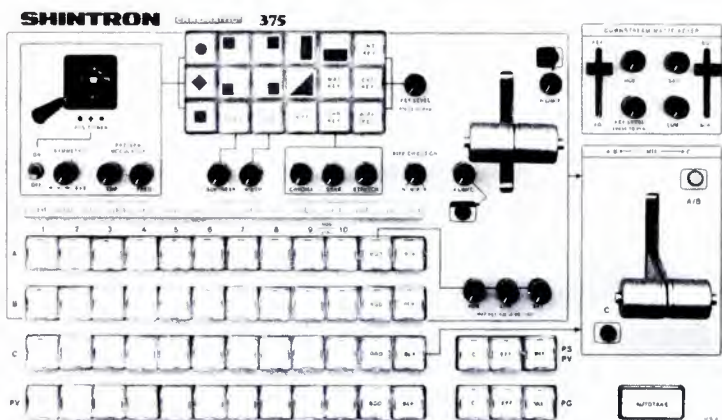
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news briefs

Videodisc study group formed

About 30 people attended the organizational meeting of SMPTE videodisc study group, according to VideoNews. Representatives from RCA, MCA, Thomson-CSF, several government agencies, broadcasters and software producers agreed to the need for SMPTE to look into videodisc technology.

The group is looking into the possibility of SMPTE acting as an arbiter in videodisc standardization procedures (as it has been in the 1-inch helical standards discussions). A major report is due April 1978.

New digital effects device used for World Series

For the first time, a digital effects device featuring up to four time picture expansion was used live on the air during ABC Sports' World Series broadcast. The new device by Micro Consultants, is the Quant DPE 5000 (DPE standing for Digital Production Effects).

Features include variable reduction or compression from full frame down to the size of a postage stamp, variable picture positioning, picture freeze, and automatic noise reduction.

Ampex updates helical recorders

Ampex Corporation plans to update VPR-1 helical recorders already delivered and on order to meet the Type "C" format currently being developed by a committee of the Society of Motion Picture and Television Engineers (SMPTE).

Station totals released

The FCC has announced the following totals for broadcast stations on the air as of September 3, 1977: AM radio, 4,508; FM radio, 2,973; FM educational, 913; UHF television (commercial), 211; VHF television (commercial), 514; UHF television (educational), 158; VHF television (educational), 101.

NRB convention scheduled

The 35th annual convention of the National Religious Broadcasters scheduled for January 22-25, 1978 at the Washington Hilton Hotel in Washington, D.C. Speakers include Abe C. Van Der Puy, NRB president; Malcolm Muggeridge, British author and television personality; and author Marabel Morgan.

continued on page

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NEC's all-new MNC-71/CP

The reliable ENG camera!

Cinema Products Corporation announces the introduction of a totally new ENG camera of such high quality and reliability that we are proud to put our name and logo on it.

Manufactured by NEC—the second best broadcast equipment manufacturer in the world—the MNC-71/CP represents a major technological breakthrough in the use of advanced integrated circuitry techniques.

NEC is the *only* manufacturer of ENG cameras to use large scale integrated (LSI) circuits, dramatically reducing the number of individual circuit components in the camera. As a result, the MNC-71/CP is significantly more stable in performance, as well as 7 to 14 times (!) more reliable in circuit operation.

With the introduction of this remarkable ENG camera, Cinema Products and NEC provide the perfect combination for the electronic side of a *balanced* TV-news situation.

Cinema Products' commitment to the television news gathering industry remains the same as it has been with the CP-16, widely recognized as the finest newsfilm camera in the world. We will provide the MNC-71/CP with the same reliable backup: liberal warranty terms, an extensive dealer organization, centrally-located warehouses fully stocked with modular replacement components, and full factory support. And since NEC directly manufactures *all* circuit components for the camera, you are guaranteed a full supply of replacement parts for the life of the camera.

As our track record with the CP-16 shows, no one understands better than we do how vital it is for the TV-news cameraman to have a reliable camera to work with.

Remember, you can't go "live" with a *dead* ENG camera! So, make the most of your ENG dollar with the MNC-71/CP, the *reliable* ENG camera with *reliable* CP backup!

Cinema Products is the exclusive distributor of the MNC-71/CP throughout America. For further information, please write to:

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units a run for their money. Power amplifiers, parametric equalizers and a series of studio monitor speakers that will astound you with their amazingly faithful reproduction.

Panasonic pulled out all stops on their research and development program for this series. Undoubtedly, with the performance, quality and reasonable prices exhibited by this audio gear the "Technics" name will be a major consideration in your future purchasing decisions.

Whatever your needs, RAMKO RESEARCH offers a full line of the highest quality audio equipment available. Turntables, Tape Cartridge machines, a wide variety of distribution, mic, line, power and turntable preamps. Cassette record/play units & reel to reel recorders. And of course the most advanced broadcast consoles in the industry. If it's for the studio we have it.

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Log entries

January

5-8—Electronics Industries Association/Consumer Electronics Group 1978 Winter Consumer Electronics Show. Las Vegas Convention Center Hilton Hotel, Las Vegas.

10—Annual legislative reception of the Tennessee Association of Broadcasters. Nashville.

16-18—Satellite earth terminal technology seminar, conducted by Hughes Aircraft Company Holiday Inn, Kansas City International Airport, Kansas City, Missouri.

16-20—National Association of Broadcasters joint board meeting. Cerromar Hotel, Puerto Rico.

16-30—National Association of Farm Broadcasters' agricultural seminar at sea. Aboard Queen Elizabeth II sailing from East Coast to Los Angeles.

19-20—First US/Southeast Asia Telecommunications Seminars Program and Exhibit. Hyatt Singapore Hotel, Singapore.

23-25—Imero Fiorentino Associates' seventh regional Television Lighting and Staging Seminar Workshop. Loyola Marymount University, Los Angeles.

22-25—National Religious Broadcasters' 35th annual convention. Washington Hilton Hotel, Washington, D.C.

29-Feb 1—Association of Independent Television Stations' fifth annual convention. Vacation Village, San Diego.

March

4-8—National Association of Television Program Executives' conference. Bonaventure Hotel, Los Angeles.

13-16—Electronics Industries Association's annual spring conference. Washington, D.C.

17-19—National convention of Intercollegiate Broadcasting Systems. Biltmore Hotel, New York.

April

5-8—Annual convention of The National Honor Broadcasting Society, Alpha Epsilon Rho. Aladdin Hotel, Las Vegas.

9-12—National Association of Broadcasters' annual convention. Las Vegas.

23—Florida Association of Broadcasters' spring meeting. Rietz Union, Univ. of Florida campus Gainesville. Twentieth annual Broadcasting Day sponsored by the FAB and UF's College Journalism and Communications, will be the following day.

May

19-20—Spring meeting of Public Radio in America. Hilton Plaza Inn, Kansas City, Missouri. Host: KCUR, Kansas City.

21-24—Southern Educational Communications Association's 10th annual conference. Opry Hotel, Nashville. Host: WDCN-TV, Nashville.

24-27—National Association of Broadcasters radio programming college. Hyatt Regency Hotel, Chicago.

25-27—Music '78 convention. Pick-Congress Hotel, Chicago.

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At a price you don't. Under \$450.



A radical departure in circuit principles, Technics SH-9010 stereo universal frequency equalizer offers the experienced technician and demanding audiophile the flexibility of both a graphic and a parametric equalizer.

The five bands of each stereo channel have a center frequency that's independently variable. By turning the control knob below each slide pot, the center frequency can be varied up or down by as much as 1.6 octaves. So, unlike conventional equalizers with a fixed-center frequency, the SH-9010 has no frequency "blind spots." What's more, each band of the SH-9010 can adjust to overlap the adjacent band to further boost or attenuate a selected frequency width.

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narrow any frequency band. Independently or both at the same time. Which means you can balance an entire string section or eliminate an annoying little hum.

Technics SH-9010. Compare specifications. Compare prices. And you'll agree there's no comparison.

THD: 0.02%. FREQUENCY RESPONSE: 10 Hz-20 kHz (+0, -0.2 dB). 10 Hz-70 kHz (+0, -3 dB). GAIN: 0 ± 1 dB. S/N: 90 dB (IHF: A). BAND LEVEL CONTROL: +12 dB to -12 dB (5 elements x 2). CENTER FREQUENCY CONTROL: +1.6 oct. to -1.6 oct. BANDWIDTH (Q) CONTROL: 0.7 to 7.0. CENTER FREQUENCIES: 60 Hz (Variable 20 Hz ~ 180 Hz), 240 Hz (Variable 80 Hz ~ 720 Hz), 1 kHz (Variable 333 Hz ~ 3 kHz), 4 kHz (Variable 1.3 kHz ~ 12 kHz) and 16 kHz (Variable 5.3 kHz ~ 48 kHz). SUGGESTED RETAIL PRICE: \$449.95*

Technics SH-9010. A rare combination of audio technology. A new standard of audio excellence.

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Tell us what it has to do. There's an Ampex AVR-2 for every videotape assignment in your station.

If you already have a complete production/editing setup, you probably don't need a lot of accessories for your AVR-2. Order it with basic manual controls, and it's ready to go to work.

You might want Super High Band Pilot. It comes with optional switch selection to augment the standard High Band Color circuits, and it adds valuable depth to your multi-generation production work.

If you're just now growing into more advanced production work, then you're going to want the EC-2 Edit Controller.

This complete, sophisticated stand-up time code editing accessory can put you in command of as many as seven additional (similarly equipped) machines working in any combination of master/slave for production or multiple dubbing service.

Modular construction means an easy fit for your AVR-2, no matter where you want to use it—at a remote location, in your tape room, or out in the mobile van.

AVR-2 is the quad recorder that grows. Every accessory for this machine is available upon initial purchase or at any time in the future when you're ready. Tell us what it has to do, and we'll recommend the model that suits your needs.



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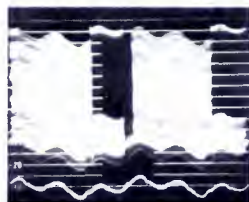
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people in the news

Radio/Television

Terrell Metheny is the new president and general manager of radio stations WRIT and WBCS, Milwaukee. Metheny will oversee the switch of WRIT from all-news format to country and western. Metheny was vice president-general manager of radio station KJET/KWIC, Beaumont, Texas.

The Anti-Defamation League of B'nai B'rith has presented its first Distinguished Public Service Award to **John W. Kluge**, president and chairman of the board of Metromedia, Inc., and to **H. Peter Kriendler**, president of the "21" Club. **Burton M. Joseph**, national chairman of the League, said the award was established "to honor eminent leaders of our time outstanding humanitarian achievement of lasting benefit to the community and nation."



KLUGE



KUNTZ



DELKE

Jack Miller is the new president of the Colorado Broadcasters Association. Miller, general manager of KCOL-AM/FM in Fort Collins, succeeds **Carl Anderson**, president of KREX-AM/FM/TV in Grand Junction.

Steven Russell Messer is now the chief engineer of radio station WHFB-AM in Benton Harbor, Michigan. Messer formerly was chief engineer of WAMM-AM, Flint, Michigan.

Manufacturers/Distributors

Kenneth J. Rice has been appointed an RCA broadcast equipment sales representative in the southern United States. Rice is responsible for marketing RCA's line of radio and television studio and transmitting systems in eastern Texas, Louisiana and Arkansas.

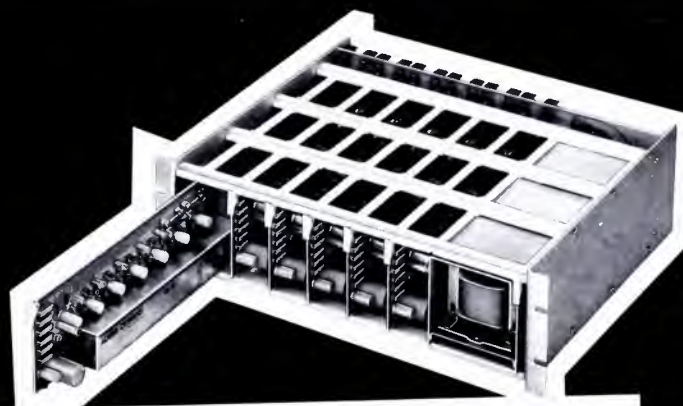
In further action at RCA, **Julius Koppelman**, **Peter Peterson** and **Roy H. Pollack** were elected to the board of directors. The board also accepted the resignation of **Howard R. Hawkins**, an RCA executive vice president and a director, who is retiring after 31 years of service.

Gary L. Kuntz has joined Cohu, Inc., as sales engineer for the northern California sales region. Kuntz was national sales manager for government accounts with Telemation, Inc.

As advertising administrative manager for Sh Brothers, Inc., **Ruth Delke** will be responsible for development, implementation and budgetary control of advertising space programs. Delke has been with the firm since August 1975, as an advertising expediter.

continued on page

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people in the news

.....
continued from page 22

Also at Shure Brothers, Inc., **Lee Habich** will be responsible for planning, development and implementation of all sales promotional activities as the new sales promotion manager. Habich comes to the company from Beltone Electronics Corporation.

Richard Betts has been appointed general manager of the imaging devices division of EEV, Inc. Betts formerly was general manager of the English Electric Valve North America Limited Buffalo facility.

William A. Buckman has been named vice president of manufacturing operations for Dytek Industries, Inc. Buckman previously served as manager of manufacturing operation for Computer Image Corporation.

Andrew Szegda has been appointed vice president and general manager of Cerro Communication Products. Before joining the firm, he was a general manager at Automatic Radio Manufacturing Co.

Herman Schkolnick was appointed vice president-sales of broadcast television products, a new position at Ikegami Electronics (USA) Inc. Schkolnick came to Ikegami from Philips Broadcast Equipment Corporation, where he spent seven years as manager of professional color products.

Stig Edgren joins the staff of Imero Fiorent Associates Inc., production consultants to the performing arts. Edgren has experience in lighting and stage design, having worked with such performers Lou Rawls, Dionne Warwick, Ben Vereen, Issa Hayes, Tony Bennet and Lena Horne.

Elected to the newly created post of vice president administration, at the 3M Company is **Donald Selleck**. Selleck joined the company in 1941 as a controller, becoming controller in 1962 and vice president and controller in 1972.



BUCKMAN



SZEGDA



SCHKOLNICK

Edward W. Watts has rejoined Cetec Corporation as corporate vice president, a title he last held from 1968 to 1971. Watts was also president of Instrument Specialists Inc., until the firm was acquired by Fluke Manufacturing Co. Watts then joined Fluke as western regional manager.

Audio Designs and Manufacturing, Inc., has appointed **Larry W. Mandziuk** director of engineering. Mandziuk has been employed by Audio Designs as a senior project engineer since November 1975.

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Joe Roizen (right), BE's video editor, and Ron Merrell (center), editorial director, talk with Joe Flaherty at the SMPTE conference in Los Angeles. (Photo by Donna Foster Roizen.)

news feature

Has CBS launched another revolution?

By Joe Roizen

Video Editor, Broadcast Engineering,
and President, Telegen

Joe Flaherty, vice president
of engineering for CBS,
talks with BE about applying
the film technique to TV
videotape productions.

It wasn't long ago that CBS collected an Emmy for its innovative role in starting and spreading ENG. Joe Flaherty, vice president of engineering for CBS, rightfully accepted the gold statuette, since he had been instrumental in leading his network [and subsequently others] into that form of news coverage.

This year Flaherty has launched another drive to proselytize TV program producers into yet another unique method of production, which he calls "film style" electronic image generation. This method is attracting a lot of attention from the large studios as well as smaller production houses, and may alter the way in which many future TV shows are shot, packaged, and distributed. To learn more about this new technique employed by

CBS, BE arranged for a private interview with Flaherty, and also

"Our present goal is to make these pictures as good as 35mm feature film stock, and we believe we have demonstrated this with our Studio City installation."

tour of the Studio City facility set up as a working model of a "film style" TV studio. First the interview.

BE: Why a new approach to TV program production when it seems that all the hardware has finally been perfected for the old way?

continued on page 2

More performance per pound for ENG from NEC.



In a pinch you could use NEC's portable MNC-61A color camera in your studios. It delivers that kind of quality. Yet this field-ready, backpackless camera weighs less than 20 lbs. And the weight is evenly balanced for easy shooting from the shoulder.

Use of large-scale integration keeps power consumption at only 25 watts, so you can shoot extra hours if necessary. And you have a choice of Plumbicon* or Saticon** tubes.

To give you more flexibility, the MNC-61A is designed to take C-mount or Arri-mount lenses. Everything's been thought through to give you peak performance for every pound your cameraman carries, every dollar you spend.

It could only come from one of the world's largest and most experienced makers of broadcast equipment. And it does. That's NEC. Write or call us for details.

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*N. V. Philips, **Hitachi

CBS revolution

continued from page 26

Flaherty: We want to maintain the creative flexibility of the film system which has dominated prime-time TV for the last 25 years; however, we want to replace the medium (film) itself with videotape because of all its inherent advantages.

BE: Is the system we saw in operation at Studio City the ultimate package for film-style electronic TV production?

Flaherty: No, this is a first step toward our eventual goal. We started with a multi-camera system, but we think we will eventually go to single-camera shooting to make it even more like the film style we are emulating.

BE: Do you consider this a significant change in program production methods for CBS?

Flaherty: Yes, and not just for CBS. This new technique of TV program origination is as important to the production of entertainment pro-



"We see the future single-camera arrangement for 'film style' electronic production as an improvement over what we are showing right now."

grams in Hollywood as the first demonstrations of ENG in Washington, D.C. ('71) were to the television broadcasters who saw it then. (Interest was to equalize 16mm news film with portable ENG equipment and we have succeeded. Our present goal is to make these pictures good as 35mm feature film stock and we believe we have demonstrated this with our Studio City installation.

BE: The pictures look good, how about the sound?

Flaherty: The new one-inch helical VTRs that we are using have better sound than the 35mm film, and there are three full-quality audio tracks available. We will give the viewing public better images and better sound with this new system.

BE: Do you expect the other networks to adopt the CBS methods of future production?

Flaherty: Actually the networks today make little of their own entertainment programming; most of it is acquired from independent producers. We have built a model

continued on page

STOP TAPE DELAY ENDS HERE



THE TIME TUNNEL

The Time Tunnel digital audio delay system is here. A professional broadcast quality six second audio delay that is virtually maintenance free.

The Time Tunnel utilizes a digital memory system to provide consistent high quality audio reproduction month after month year after year. Unlike tape delay systems, the Time Tunnel has no moving parts to wear, no preventative maintenance necessary and the performance does not degrade with time.

The Time Tunnel is offered in two models, TDG-1 with a 15Khz bandwidth and the TDG-2 with a 7.5Khz bandwidth. Both models have a frequency response flat within $\pm 25\text{db}$ and a total harmonic distortion of less than $.5\%$.

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CBS revolution

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set-up to show others how it works and how to establish the system. We expect that the operation and economic advantages inherent in this system will attract other producers to follow suit.

BE: Is the system made up of standard pieces of hardware and how much of an investment is it?

Flaherty: We have spent a year putting together mostly standard pieces, although we did have to engineer a few items which were not available from manufacturers. The overall investment is much less

than in a typical TV studio because there is less hardware (no control room, no production switcher, no fixed lighting, etc.) and fewer people needed, reducing both capital cost and operation expenses.

Our analysis shows a substantial saving per episode in a typical sitcom series. We took a few of our normally filmed programs like *The Betty White Show* and shifted to tape with equal or better results and considerable savings in time and money. We see the future single camera arrangement for "film style" electronic production as an improvement over what we are showing right now.

The Studio City TV Center

From the outside they look like typical film stages, domed barns clustered in a group with some outdoor sets and prop storage on the streets between them. Enter one and it still resembles a film set with the lights attached to the scenery or hung from the rafters. No lighting grid, no glass-windowed control room, no blue cyclorama stretching to the ceiling. Instead, a permanent-looking set whose only break with film tradition is the presence of four studio TV cameras with their tri-axial cables snaking out of a side door. But it also differs from normal television in that the lighting is set up by a cinematographer and the camera lenses are set at an aperture and left there. No further adjustments are made except for minor trim on master gain controls.

The director and crew work on the stage just as though they were shooting a film. At the edge of the floor, in front of the audience section, a rolling cart carries four black and white monitors so the director can look at what the individual camera shots are.

The camera outputs aren't switched; everything each camera picks up during the scene is recorded on a separate one-inch helical VTR connected to it. The electronic recording and program rough cutting is done in a mobile unit which looks like a modified house trailer.

This unit is parked next to the sound stage and can be moved to another one when necessary.

The van contains five one-inch recorders, appropriate terminal and monitoring equipment, and a small control room with a VTR synchronizer that keeps the helical

machines in frame lock at all times. A small switcher/fader panel completes this rudimentary set up.

Adding up the benefits

Flaherty explained some of the benefits while the tour group was on the shooting stage. First, the set stays on the stage because it's cheaper and the studio isn't special. The tri-axial camera cables eliminate "fire hose" problems with earlier color cameras. The cinematographer calls the shot on lighting and f/stops, and there are no changes.

In fact, the staff feels as if they are working on film and that's where their creative skills are at their best. They use 90-minute reels to do the editing with no stops, and often complete a half-hour show in three hours. The program master tape then goes to a production house for final editing.

Bill Nicholls shepherded the demonstration of the editing sequence in the van. A section of *The Betty White Show* was used as an example.

The three VTRs running in-frame lock replay what each camera saw. A fourth recorder is fed from the switcher and the cuts, fades or dissolves are made on cue. Since original takes are always available they can be previewed, altered, or redone at anytime. The heart of the system is a synchronizer built by CBS to lock the VTRs in constant step.

Time code is identical on each tape for any scene. By calling up particular frame number, all recorders will search that point and

continued on page 3

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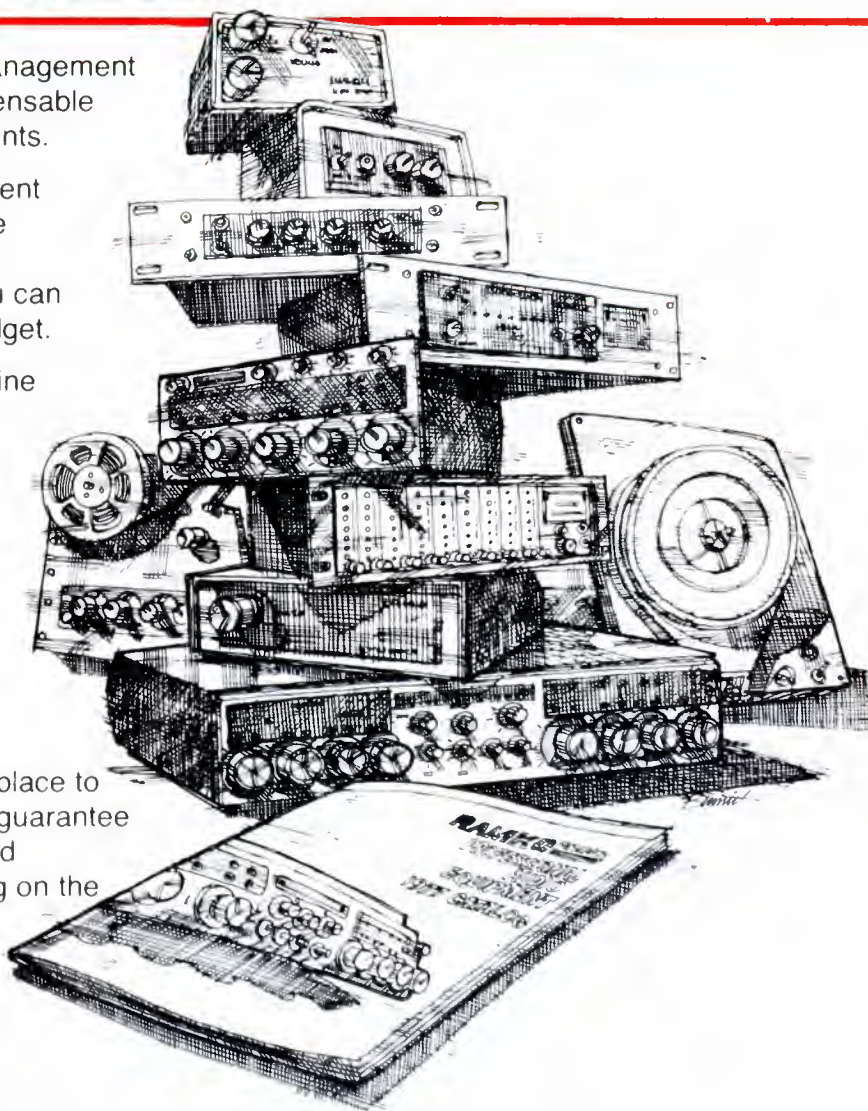
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CBS revolution

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park within a few frames. After play command, the recorders quickly lock up in absolute frame number synchronization. Warning lights flash to alert the operator in case any malfunction. The great advantage is the slow/stop motion capability of the helical VTRs and retention of a recognizable image to 30 times normal speed while searching an edit point.

Audio also is handled in a special way: the two sound tracks on tape are recorded separately with one track being dedicated to dialogue only and the other one audience reaction and dialogue.

According to Nicholls, the operation in the mobile unit complete 80-85% of the show. The rest routine post production, including titles, credits, bumpers, open and close sequences or freeze frames done with a disc. Currently this is done by transferring the master program tape to quad because that's what most post-production facilities are equipped with. Nicholls expects to go to full post production with one-inch helicals because they are satisfied with both the multigeneration picture quality and a sound quality of these new VTRs.

Summary

The demonstration was indeed impressive, and if Flaherty's figures are correct, they should certainly interest other program producers.

Sitting in the control room of the mobile unit and watching the VTRs on the monitors back up or roll forward to a selected frame number is conclusive evidence that the system is fast. Parked on several frames with easily readable time code in the picture makes precise identification of cut points which can be jogged in and out one frame at a time. The "moviola" (videola?) approach should gladden the heart of any dyed-in-the-wool film editor. The picture hold color up to 10 times play speed (however the sound goes Michael Mouse!) and stay identifiable black and white up to 30 times normal, a feature that must accelerate selection of scenes by a considerable factor.

But most of all, the simplicity of the installation and its inherent mobility must surely mean that film-style television production using these kinds of electronic packages will have a great impact on the future of program production television.

TeleMation Announces First-Half Earnings

(SALT LAKE CITY, UTAH)—TeleMation, Inc., reported first-half profit of \$257,000, or 25 cents per share, on revenues of \$4,709,000. This compares to a loss of \$536,000, or 52 cents per share, on revenues of \$4,754,000 for the first half of 1976.

Results for the three-month period ended June 30, 1977 were a net profit of \$213,000, or 21 cents per share, on revenues of \$2,414,000 compared to the loss of \$314,000, or 30 cents per share, on revenues of \$2,339,000 for the three-month period ended June 30, 1976.

The above figures are after extraordinary credits resulting from reduction of taxes by use of a tax loss carry-forward. Profits before the extraordinary credits were \$144,000, or 14 cents per share, for the first half and \$120,000 or 12 cents per share, for the second quarter.

W. Paul Warnock, president of the video equipment manufacturing and television production company, said that the return to profitability in the first half of 1977 was due to the substantially improved performance of the hardware portion of the company's business. "TeleMation Productions, our television production studio in Chicago, continues profitable as in recent years," he stated.

He attributed the improvement in the company's hardware business to a continuing strong demand for the company's principal products and to extensive action taken at year-end 1976 to bring the company's expense level into line with revenues. Mr. Warnock pointed out that backlog at June 30 was \$1.7 million compared to \$2.1 million at December 31, 1976. "The return of our hardware business to profitability has been very gratifying to us at TeleMation. The dedicated efforts of all our employees have made it possible," he said.

TeleMation, Inc. A Salt Lake City based manufacturer of professional television equipment, maintains offices in San Francisco; Minneapolis, Danbury, Connecticut; Washington, D.C.; and London. TeleMation also operates a television commercial production division in Chicago.



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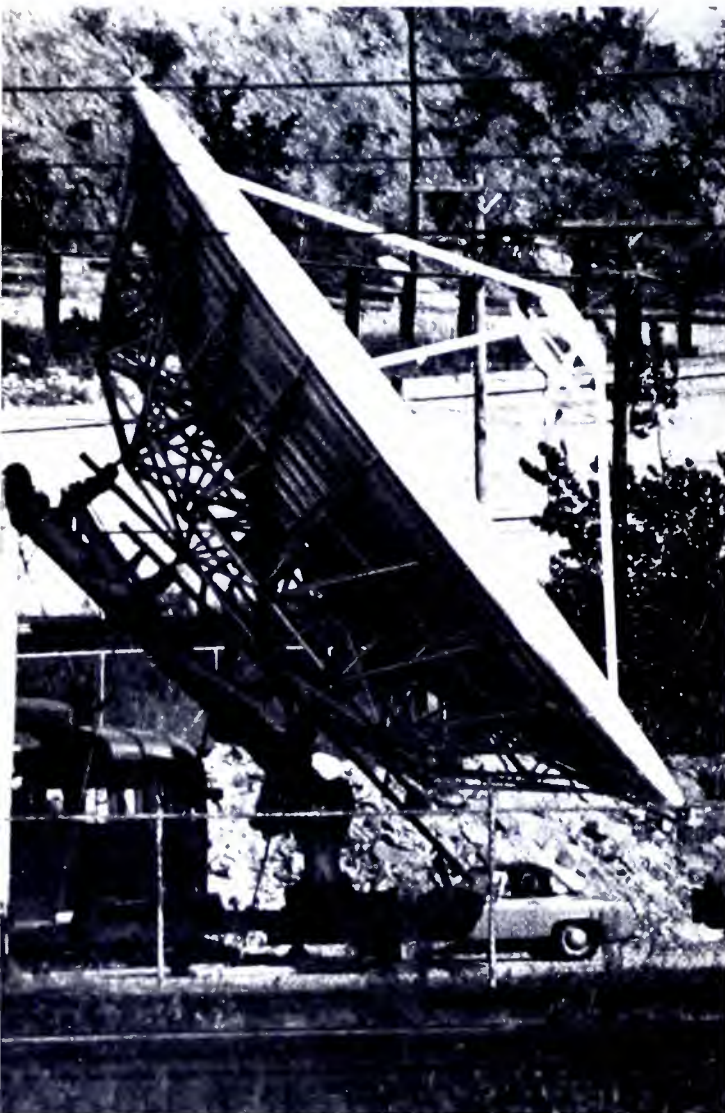
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Domestic communications satellites and broadcasting:

They're here now!

By Raymond Meyers



This Westar mobile earth station was used to relay television coverage during the 1976 Republican National Convention in Kansas City. (Photo by Donna Foster Roizen.)

Most people in broadcasting still believe domestic communications satellites are used only occasionally by major television networks for around-the-world coverage of major sports events (such as the Olympics) or news coverage of some political hot spot. The fact is that direct satellite-to-station program distribution is just around the corner. If your radio station has a network affiliation, there is a good chance you will see a small-aperture satellite receiving antenna mounted on your roof in the not-too-distant future.

There are several reasons why radio networks are planning to use domestic satellites to distribute programming. Namely, satellite distribution is far less expensive than land line services; and, the technical quality is superior. A 15 kHz audio circuit via satellite, on a cross-country hop, is no more difficult to achieve than a cross-town hop is for a local station. Other reasons include increased reliability of service and less equipment, resulting in fewer possible sources of problems.

Looking back

In 1963 SYCOM became the first communications satellite placed in a synchronous orbit, an orbit which makes the satellite appear to remain in the same place in the sky. Since then, other satellites, such as EARLY BIRD, ATS, and INTELSAT, have made satellite communications commonplace for the U.S. government and other users.

Nine years later, ANIK became the first geostationary synchronous satellite orbited for domestic service. There are now three ANIKS, which are used primarily to tie Canada's population centers together, as well as to communicate with the nation's more remote outposts.

Western Union placed the first U.S. private industry domestic communications satellite in orbit in 1974. Built by Hughes Aircraft Company and dubbed WESTAR I, it was placed in a geostationary synchronous orbit above the equator (about 22,300 miles above the surface of the earth) at 99 degrees west longitude. Since that time, others have joined WESTAR I to provide communications satellites at four to five degree intervals (actually, thousands of miles apart at that distance above the earth).

American satellites orbited include ATS-6 in 1974, a NASA satellite which is the most powerful communications satellite to date. ATS-6 was used to conduct broadcasting experiments in the Rocky Mountains, Alaska and Appalachia. It is presently positioned over India.

Others are SATCOM satellites, operated by RCA for domestic private industry use; INTELSAT IV-A, with a capacity of over 6,000 voice channels and two data channels; another WESTAR; and finally in 1977 COMSTAR, owned by Comstat and leased to AT&T.

Broadcast user satellites

Of all satellites, the ones of most interest to local broadcasters are the WESTAR and SATCOM satellites.

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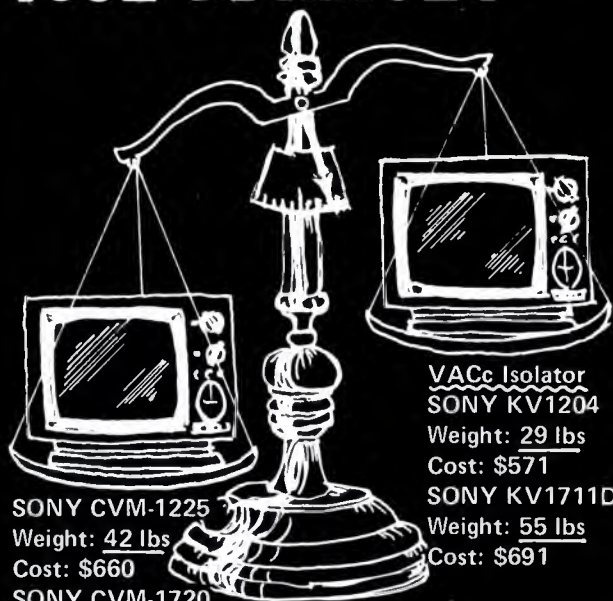
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lites. These are the active "birds" in the business distributing domestic programs. To understand better how these satellites will serve us, let's take a quick look at how they operate.

Satellite operation

The WESTAR satellites, operated by Western Union, are not very large: complete with the petal-like antenna reflector, they stand little more than 12 feet high and are about 6 feet in diameter. The main body of the satellite is a 6' x 6' cylinder with its perimeter covered with solar cells to recharge the satellite's onboard batteries. On top of the cylinder are the antenna feed horns and antenna reflector, which are designed to throw an elliptical pattern back to the earth.

The antenna feeds and reflector are mounted on a motor assembly which rotates the antenna. When the satellite is orbited, it is given a spin to stabilize the attitude of the satellite, so it won't wobble. If the satellite wobbled in orbit, the pattern of radiation would move around, making the satellite very difficult to track. The satellite might rotate so far off axis that the antenna would no longer look at the earth.

Since it is necessary to spin the satellite, the antenna is rotated in the opposite direction of satellite spin, but at the same rate.

The satellite systems

There are three basic systems operating inside a satellite. The first is the control system, consisting basically of units used to orbit, stabilize, and de-orbit the satellite if necessary. Its receiver takes commands from the ground station to perform various onboard functions, such as adjusting the attitude

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The Wall Street Journal's 4.5-meter (15-foot) receive-earth station located near Kissimmee, Florida. (Photo courtesy of Western Union.)

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This domestic communications satellite transmit and receive station in Rayburn, Texas is operated by RCA American Communications, Inc. The dish antenna, 33 feet in diameter, carries private line telephone, facsimile, television and data communications, serving the needs of government, business, and the media. (Photo courtesy of RCA.)



They're here now

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the satellite and turning on and off equipment. It also has a transmitter to tell the ground station what is happening aboard.

The power system consists mainly of batteries, solar cells and a charging-regulating unit.

The third system is the group of transponders, or the transmitter-receivers that relay the signals from one earth station to another. This is the part of the satellite of prime interest to the broadcaster. Hams using 6- and 2-meters probably will view the operation of the transponders as being similar to amateur repeaters. The fact remains that this is exactly how they operate. (The term "transponder" is one most of us will associate with aircraft equipment used to identify airplanes on flight control radar screens. Nonetheless, the term has been given to these satellite devices, so that is how we will refer to them.)

On the WESTAR satellite, there are 12 transponders. The receivers operate in the 6 GHz common carrier band; the transmitters operate in the 4 GHz common carrier band. Both bands are shared with terrestrial long-haul microwave links used by U.S. telephone companies.

Each transponder, which consists of a receiver, a down converter, and a traveling wave tube transmitter, is capable of a bandwidth of 40 Mhz. The way the communication earth-to-satellite-to-earth systems were originally set up (using 51-foot dish antennas located in key cities) it is possible to load as many as 1,200 communications channels onto each transponder.

With transponder power outputs typically 15 watts, the 51-foot dishes are necessary to get this many channels. The 51-foot dishes at 4 GHz have tremendous gain.

Using small-diameter receiving antennas (which have less gain) requires more power per channel to get a noise-free signal back to earth, thus fewer channels can be put on one transponder. From this, you should conclude that the more effort required to get noise-free channels back to earth, the fewer channels are available, as opposed to how wide the bandwidth of the channel is. Largely, though, each transponder is capable of carrying only one 4.3 MHz TV channel, plus its associated audio channel of up to 15 kHz.

If all the available channels on the satellites over the U.S. were used to carry television (and they are not), a total capacity for 156 television channels would be available. We should note here that the SATCOM satellites are using cross-polarization which allows for 24 transponders on each satellite.

Audio channels

When it comes to audio channels only, Western Union has decided a good trade-off is from eight to ten channels per transponder. This depends on the size of the receiving earth station antenna, audio bandwidth and noise tolerance of the total system. The audio bandwidths offered by most satellite operators are 4 kHz, 8 kHz and 15 kHz. They also are offering monophonic and even quadraphonic, if it is requested.

Getting back to earth

At this point, it may be important to back up a few years and take a brief look at earth stations operated by end users such as cable TV, television, radio broadcasting and newspapers.

At an international meeting of the world's communications leaders in 1974, technical standards for communications satellite earth stations were proposed. It was determined that receive-only stations in order to allow 4-degree spacing of satellites, should have antenna specifications that meet a mathematical value of $32-251^\circ \theta$ ($\theta = \theta$). This meant that communications satellites would operate on the same frequencies, with low power transponders, a good G/T (gain-over-noise temperature, which is similar to signal-to-noise ratios), and good side interference rejection from terrestrial signals.

When calculated, this became a 9-meter (30-foot) diameter dish with a Low Noise Amplifier (LNA, sort of super antenna preamp) that had a thermally stable noise temperature of 70 to 100 degrees Kelvin (that required thermal cooling). For reception of TV signals this is still a requirement if a good noise-free picture is needed. However, 30-foot dish-type antennas are not the only configuration that will meet this criterion.

All domestic communications satellite services are handled by the common carrier section of the Federal Communications Commission.

It is apparent that regulation of satellites (since they constitute a common carrier service) should have been handled by a board of qualified persons who understand the kind of technology involved in satellite communications. Most technicians know that there is more than one kind of antenna which will receive distant signals, and more importantly, that not all antennas look alike.

However, the common carrier section of the FCC wrote rules stating that in order to meet FCC requirements for earth receive-only stations, you had to use a 9-meter (30-foot) dish antenna. It made no difference that the physically smaller horns could be located in places where a 30-foot dish would not be permitted, or because of nearby terrestrial circuits on the same frequency, a 30-foot dish could not be adequately shielded and the smaller horn could.

As of January 1977, the FCC has issued new rules

cognizing the use of the 14-foot horns without restrictions, and has opened the doors for less demanding users to apply for the use of smaller aperture (diameter) dishes. Since the FCC has never specified the end use of receive-only terminals, they assume maximum requirements such as those required for broadcast TV circuits.

Many current and potential users do not need equipment that can meet such stringent requirements. One user, *The Wall Street Journal*, sends data signals from its New York offices via WESTAR to several regional printing plants. They have found that a 15-meter (15-foot) dish meets their needs very well. The data, a sort of computerized facsimile, is more tolerant of noise and interference than are television pictures.

The most recent offering and the one most interesting to radio broadcasting is a system developed by Hughes Aircraft called the Satellite Audio Receiving Terminal (model SART-401). This system consists of a three-meter (10-foot) dish on a simple elevation-azimuth (elevation-azimuth) mount. Mounted at the focal point of the dish is an air temperature LNA with a temperature of 240 degrees Kelvin (very noisy by terrestrial systems). All this yields some very high-quality audio signals, and the basic antenna (LNA) system converter is expected to market for around \$100. This is a dramatic decrease in hardware cost for nine-meter systems costing \$150,000 each or for transmit-receive systems running into the millions. It is clear that the equipment has arrived to make satellite-to-studio feeds practical right now.

Getting approval to operate

Although most stations will not need an FCC earth station approval, it might be helpful to know what will be required. Receive-only earth stations, even though they are only receivers, are licensed by the FCC as though they were transmitters. The FCC does this primarily for site protection from interference that could be caused by a telephone company aiming a terrestrial circuit over the satellite receiver.

Since 15 watts more than 22,300 miles away couldn't stand a chance with a 100-watt microwave transmitter a few miles away, the FCC is attempting to preserve quiet zones used by satellite receivers located between the webs of present terrestrial circuits. It also is working to coordinate future expansion of the terrestrial circuits so as not to encroach the known quiet zones.

Before applying for an earth station permit, a frequency coordination study is required. Three consulting firms that do this are Comp-u-con of Dallas, Texas; SAFE (Spectrum Analysis and Frequency Engineering) of Arlington, Virginia; and Comsearch, Inc. of Oakton, Virginia. These firms have all the present existing terrestrial 4 GHz circuits stored in their computers, and they can tell almost immediately if a site is sufficiently quiet for good reception.

Once it's been determined you have a quiet zone, the next step is to find out if you will be allowed to use a satellite antenna at the site. If you will be using a 9-meter (30-foot) dish, the Environmental Protection Agency (EPA) becomes involved.

For 14-foot horns and smaller aperture dishes will require this step. The next step will be local zoning. Again, this will apply normally only to the larger dishes.

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They're here now

continued from page 39

Now the fun begins. At present, if you plan to use a 9-meter dish or 14-foot horn (the only route for TV and cable, but a bit too much for radio audio circuits), you could file one of two FCC forms: a general application form (no. 403); or an earth station application form (no. 435). The basic problem is that neither form really serves the purpose for acquiring approval.

The handful of applications filed have been book-size letters (sometimes referred to as "informal applications") setting forth the applicant's legal and financial qualifications, and specific information about the frequency coordination study, site location, equipment to be used, and details about the installation, such as the mount for the antenna.

To date, nothing is being asked about which satellite you intend to monitor or what you intend to do with the signals received. (The FCC does not specify service; they assume maximum system requirements as for television or multiple distribution use. This is one of those areas which will eventually have to be defined before real growth can occur).

If you want to use the smaller antennas, you will have to submit extensive details on the way the receiving system is to be used, showing that such things as frequency response, distortion, and signal-to-noise ratio of the derived information will meet current FCC requirements. The Hughes Aircraft three-meter (10-foot) dish, with LNA and receiver, produces the following:

Signal-to-noise: Greater than 54 dB
Frequency response: $\pm$ dB 50 Hz to 15 kHz
Harmonic distortion: Less than 1%
Gain stability: $\pm$ 0.3 dB/Day
 $\pm$ 0.5 dB/Month

for a stereo pair:

Gain difference: Less than 0.6 dB 50 Hz to 15 kHz
Phase difference: Less than 15 degrees 50 Hz to kHz

This is impressive for cross-country service comparison to telco circuits.

If the site you pick happens to fall under a distant terrestrial link path, the 14-foot horns and the 10- and 15-foot dishes can be satisfactorily shielded by placing them behind buildings or erecting a simple, metal billboard-like shield. Where such a condition exists, this information should be submitted to the FCC along with the application to show you have created sufficient quiet zone.

Except in the most congested areas, it appears most towns and small cities should not need to conduct frequency coordination studies. Also, a less formal registration of receive-only earth stations would be in order. This would also reduce legal and engineering costs.

Since the FCC has indicated it is going to consider the smaller antennas and less expensive terminals on a case by case basis, the earliest applicants can expect a considerable wait. However, at the rate the commission is changing its attitude about receive-only earth stations, the smaller stations may receive earlier approvals than is presently expected.



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BROADCAST ENGINEER

Setting up the antenna

Once you receive approval and the equipment is delivered, the set up is almost as simple as putting up a TV receiving antenna. First, you must identify true north at the antenna site. One method is to call the nearest weather bureau to find what time the sun will be directly overhead (it is not always at noon).

Another method is to place a plumb bob over the center of the antenna mount and mark the length of the shadow every few minutes from 11 am (local standard time) until 1 pm. The shortest distance will be toward "true north." Draw a line from the plumb bob to this mark. The same holds true if you get the information from the weather bureau. At the time specified (use WWV), mark the end of the shadow and draw a line from the plumb bob to the mark.

The only information you need now is the horizontal (azimuth) and vertical (elevation) angle from your location on the earth to the satellite. Since you know true north, you can draw the angle from true north to the antenna's azimuth with simple measuring tools. Then tilt the antenna back to achieve the proper elevation angle. Once these course adjustments are made, turn on the receiver and while metering the AC voltage, rock the antenna on each axis until a maximum signal is received. It is that simple. One fellow setting up a demo unit did the alignment portion in 10 seconds.

System limitations

Despite all this improvement regarding the state of the broadcast art, you know there must be some drawbacks. You're right! There are some. One, of course, is that something could hit the satellite and

disable it. This is why most satellite carriers have more than one bird in orbit at a time. A simple realignment of the receiving antenna is all that is necessary to go to the backup satellite.

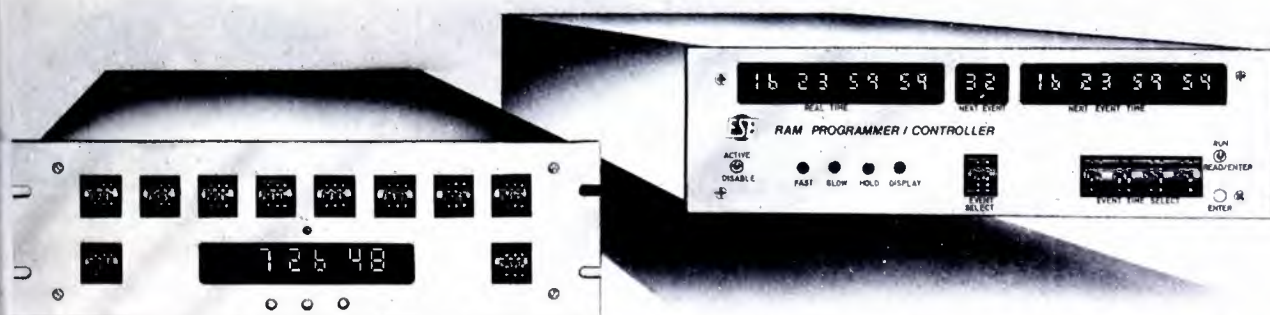
Another problem is one that will always be with us: twice a year, the bird will pass directly in front of the sun. How far north you are will determine how close those two events will occur. At the equator, it will occur just six months apart. The further north you are, the closer together they will get until you are so far north that the antenna's "look angle" will always be below the farthest southward movement of the winter sun.

The sun is very powerful transmitter operating on almost every frequency in the magnetic spectrum. When the satellite eclipses the sun, the weak satellite transmitter is no match for the powerful sun, which has lined up with the satellite and the receiving antenna.

All the receiving system hears for about five minutes is helios-noise, the sound of the sun. These interruptions by the sun are highly predictable, so each station will receive a notice from the satellite carrier or network affiliation, telling exactly when this event will occur, so the station can program around it if it would fall in a network program. □

Editor's Note: Despite these minor complications, satellites are the ultimate high. On a grand scale, the proof will come when NPR stations add their receive-only terminals in the near future. And don't fear for the telephone companies. They will widen their horizons with fiber optics.

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zoom in!

This is the official column of the American Society of TV Cameramen (ASTVC). The ASTVC can be contacted by writing to P.O. Box 296, Sparkill, NY 10976 (914) 359-5985.

Take 1...The 2nd annual ASTVC Awards Dinner

Amidst the plush surroundings of Sybils, the Hilton's private club, the program began with John Cordone, ABC Emmy Award-winning cameraman, making a presentation to Central Dynamics Corporation, with Dick DeBeradinis, acting as corpo-

rate representative, accepting the award.

NBC's Al Camoin, two-time Emmy winner, then presented the Corporate Sponsor Award to Sony Corporation; it was accepted by David MacDonald, general manager of the Sony broadcast division. Camoin made an impressive speech, despite losing part of the text, and ad-libbing the rest of the way. He received applause by thanking Sony for their contributions to the state-

of-the-art; he concluded by saying he felt more comfortable behind camera than behind a podium (Camoin is TD/cameraman; winner of the Peabody award; and, pioneer in the use of the minicam dramatic productions on-location).

Following the Sony presentation, Mike Madigan, ASTVC vice president, presented the ASTVC Community Service Award to Pat Tuffo, who accepted on behalf of WNEW-TV. The award was given to WNEW for its outstanding 12-part documentary, "The Cost of Crime," and in-depth series probing the criminal justice system in New York City.

The National Service Award was given to John Fisher of the American Security Council for the documentary, "The Cost of Peace and Freedom." Janet Doka, ASTVC administrative assistant, gave the award.

John Chancellor was inducted into the ASTVC as an honorary member by Bob Zweck, national president.

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AMERICAN AWARD



John Chancellor

Chancellor accepted the honors saying that "there is a kinship existing between all members of the crew and the anchormen" which is both necessary and important to the successful production of an evening's program. He outlined the important it was to the "on-camera person to know that he could count on the teamwork of experienced professionals. Chancellor appeared to be getting ready to "turntables-around" and "roast" Zweck when Zweck literally ran back to NBC saying (over his shoulder) he had to return for the 11 o'clock news.

Mike Madigan brought the program to a close by wishing everyone "Safe home!"

Fiber roots growing in communications industry

By Ron Whittaker

Broadcast Engineering updates its coverage of fiber optic communications, as an increasing number of companies take a closer look at the advantages this new technology offers.

It was exactly one year ago that **Broadcast Engineering** outlined to its readers a fascinating and revolutionary new technology: fiber optic communications.

Much has happened in optical fiber (OF) technology in just one year. Some 200 companies are now in the field. And it is estimated that more than \$500 million is being poured annually into R&D to refine LEDs, PINs, laser light launchers, connectors, and the hair-sized fibers, themselves.

Numerous new OF links have been initiated around the world in broadcasting, CCTV, computer imaging, telephone services, and in the aircraft industry. In short, OF communication technology has taken root.

How it works

Figure 1 shows how the OF principle works. The video and audio signals modulate a light transmitter—an LED or a micro laser beam. (The latest solid-state

lasers being used are no larger than a grain of salt.) The light then passes into and through the optical fiber, which acts as a waveguide for the modulated light.

At the terminal end of the fiber there is a PIN diode or silicon photodetector sufficiently biased (50 volts or so) to be responsive to the high-speed light fluctuations. At this point, the light signal can either be re-amplified (as illustrated) or, after being amplified about 20 dB at the terminal end, the converted light signal can go on its way as a normal 1-volt television signal. The concept is extremely simple.

The optical fibers are about 90 microns thick, which makes them about the size of a human hair. (Figure 2 shows an OF going through the eye of a standard sewing needle while conducting light.)

The fibers typically are fabricated from two types of glass. The central core has a very high refractive index and is made from a highly

purified glass (see Figure 3). Around this core is a layer with a lower refractive index, which serves to guide the light down the core by means of total reflection at the interface. To transmit over long distances the OF core material must have an extremely low absorption coefficient, far beyond that of conventional types of glass.

Attenuation emerges from two sources: (1) light scattering due to both opalescence at the interface, and imperfections and bubbles in the glass; and, (2) from overall absorption throughout the glass fiber.

The lowest attenuation for most fibers is about 820 nm (light frequency). Unfortunately, it is difficult to find inexpensive light sources which work well at this frequency.

Light at 950 nm meets relatively high fiber resistance (about 10 times that at 820 nm), but this extra absorption is offset by the fact that LED sources in this range are generally much brighter.

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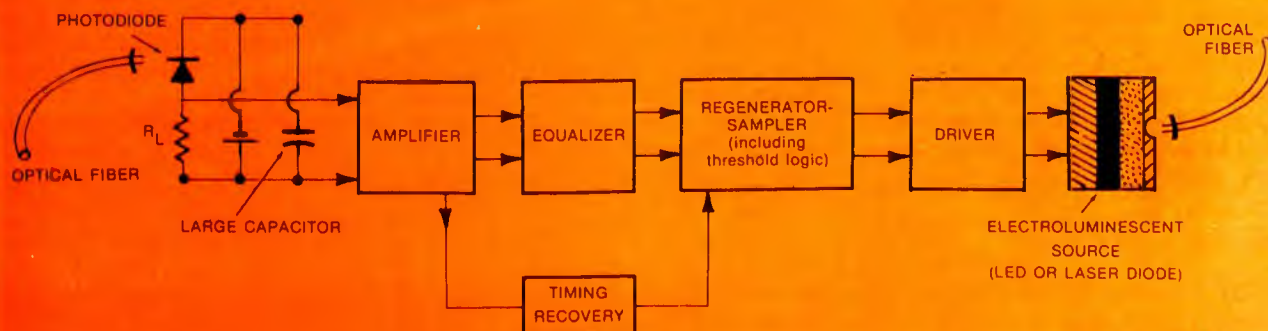


Figure 1 A repeater-amplifier for an optical fiber link would look something like the above, with a photodiode in series with a load circuit and power supply with a large capacitor by-pass. An AC-coupled amplifier is in parallel with a large resistor. The rest of the unit consists of an equalizer and a regenerator, which feeds the driver for either an LED or photodiode. Optical fiber links of over 10 kilometers (6 miles) now are possible before repeater-amplifiers are needed.

Fiber communications

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The best balance between minimum cost and absorption, and maximum LED speed and effective-

ness, seems to be at about 904 nm. For this reason the 904 region is used in most system designs.

Light transmitters are of two basic types: coherent and incoherent. Coherent emitters, or lasers, provide high-power and spectral purity, but still have some temperature control and longevity problems.

The most common incoherent light sources are LEDs. Although LEDs are less efficient and produce only about 1/1000th the peak light power, they are more reliable and have a longer life. LEDs also have the advantage of direct modulation, which makes the transmitters simpler and less expensive.

Abundance of advantages

Before proceeding further, it might be well to put things into better perspective by outlining the many impressive advantages represented by this new communications medium.

Super broadband

Many GHz of bandwidth per single 90 micron fiber are theoretically possible. Even now in an Atlanta Bell labs field test, a 640-meter cable with 72 pairs of glass fibers is carrying almost 50,000 simultaneous telephone conversations. The fiber bundle, not much bigger than a clothesline, is doing the work that several copper cables (each as thick as a man's arm) would do.

Whereas one ¾-inch coaxial cable can handle approximately 45 TV channels, a single hair-thin OF cable can handle about 170 TV channels. An OF cable with six glass fibers can carry more than 1,000 TV channels.

Uniform attenuation

The many significant problems surrounding frequency-related attenuation are eliminated with the OF medium, so there is no need for frequency equalization.

It should be noted that the rating of dB loss per kilometer, foot, or whatever, probably will be replaced in OF with something called "radiation transfer index" (RTI). The RTI takes into account dB attenuation;

but, in addition, it also includes such things as the light-gathering capacity of the fiber, the special ratio of the core to cladding or coating, and the exit angle of the light propagated.

So, in short, RTI will represent the radiated light left over after coupling and propagation losses.

Low loss

Tremendous progress has been made in light transmission capabilities in glass fibers. Although a beam of light normally will be stopped in conventional glass after a few feet, the highly purified glass now being used for OF communication is transmitting light up to six miles (10 km) without amplification. With simple repeater-amplifiers this distance could be extended almost indefinitely.

By comparison, coax links—depending upon quality, etc.—require re-amplification five to ten times more often.

Immune to outside interference

Since light is being conducted instead of RF energy, the familiar problems of RF interference are eliminated. Even if an OF sheath opens and external light hits the OF, most of the light will be absorbed by coatings or cladding. In the unlikely event that outside light would find its way into an OF, static or noise still wouldn't result, just a gradual attenuation of the signal. This also means that the OF signal couldn't be shorted, grounded or affected by moisture.

No problems with leakage

Once again, a troublesome problem is eliminated since RF isn't involved. Cross-talk, induction and leakage are not a concern. (The problem of illegal interception also is virtually eliminated.)

Safe

Related to the above are safety from sparks in explosive atmospheres and safety from electrical hazards.

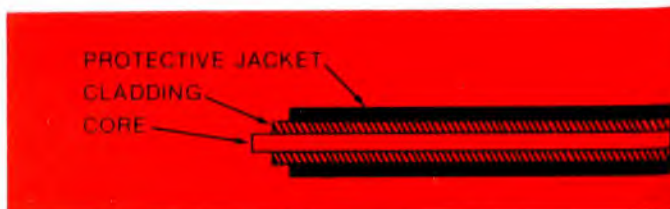
Insensitive to temperature variations

Unlike copper or aluminum conductors, OF is not affected by



Figure 2 A standard-size sewing needle is used to illustrate the extremely small size of a piece of optical fiber. The fiber is 90 microns thick, which is about the size of a human hair. (Photo by Ron Whittaker).

Figure 3 Optical fiber waveguide. Optical fibers typically are fabricated from two compositions of glass. The core, which has a very low absorption coefficient, is surrounded by a second type of glass (cladding) with a slightly lower refractive index. Light is guided down the core by means of total reflection at the interface. A jacket protects and insulates the fiber.



temperature variations (up to 1,000°

Extremely small size

The OF is only about 90 microns thick, which, as stated earlier, is a little larger than a human hair. (A micron is one-millionth of a meter.) Since the extremely small size is a little impractical to work with, and since the OF strands must be protected, the fibers are encased in a sheath which typically brings the diameter up to about 1 cm in diameter. Then, numerous fibers are encased in the "cable."

As fragile as coax

There might be some argument on this depending upon criteria, but because of an outside coating (such as Teflon™), the fibers are very durable. In fact, in experimenting with the OF strand used in the "top-of-the-needle picture," the cable could loop the OF and pull it out to the size of a dime. When it was released, it snapped right back to a straight line, undamaged.

Lower cost

This point also depends upon how it is configured. Since there isn't high-volume production at the present time, prices are probably as high as they will ever be. Keep in mind, though, that the main ingredient in fiberglass fiber is sand—something that there always will be plenty of. In contrast, the cost of copper fluctuates greatly, and is somewhat beyond U.S. control. In the last 10 years, over 10 billion pounds of copper have been used in making communication cable. At a billion pounds of copper per year in the U.S.'s unpredictable world market, obviously there is a need to look closely at alternative media.

The current price for the highest quality OF is about \$1 a foot. Low quality OF runs as low as a few cents a foot. However, once high-volume production gets off the ground, OF costs should drop dramatically. This means the cost could be appreciably below coax and twisted-pair copper wire.

Even with today's costs, some engineers maintain that OF is cheaper than coax when operating expenses and long-term costs are taken into consideration. But, with so many variables present this early in the game, bottom-line costs are impossible to determine.

Lightweight

The weight of OF links ends up as a small fraction of that of coaxial cable when total channel-

carrying capacities are considered. By some calculations, the weight savings are between 75% and 95%.

This has caught the attention of the aircraft industry, where each pound of weight can save as much as \$1,000 over the lifetime of an airplane. According to one estimate, OF technology could reduce the weight of an aircraft by 1,000 pounds (.5 metric ton).

Higher information transmission speeds

This advantage would not be a major one with broadcasters, but computer companies have found that conventional copper wire interconnections constitute a bottleneck for high-speed computers. To get around the copper wire limitations, many computer manufacturers already have moved into OF.

On the horizon is something called "integrated optical circuits" which can perform well over 100 million operations a second. At these ultra-speeds the information in 30-40 books could be transmitted in a fraction of a second.

Current applications

Currently, OF links are being used throughout the world in dozens of applications.

Japan has launched a \$15 million OF project that will eventually link 300 TV homes near Osaka. Service will be two-way and will include numerous home communication services, in addition to CATV.

The British Post Office has installed a 12 km OF system in East Anglia. Rediffusion Engineering in Hastings, England is using a 1.5 km cable which provides trouble-free service to 34,000 subscribers.

ITT is planning trial installations in Britain and the U.S. In addition, there are dozens of OF links, both experimental and permanent, now in operation throughout the U.S. Probably the first major TV application was the Teleprompter Manhattan Cable CATV link from receiving antennas to the head-end DAs 34 floors below.

In summary

And so it appears that as 1978 begins, some 12 years after Kao and Hockham first brought the theoretical potential of OF to the attention of the scientific community, OF has definitely taken root.

With almost a half-billion dollars being invested annually in R&D by 200 companies, and with a wide range of new digital technology opening up, some dazzling progress in this exciting medium should be expected in the next few years. □

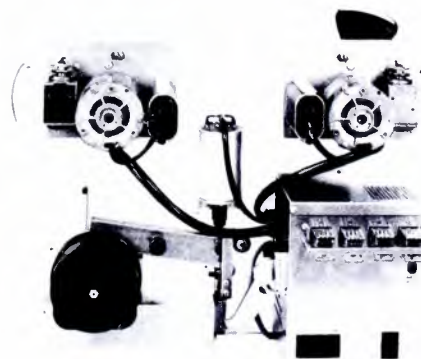
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More Details Circle (37) on Reply Card

SMPTE technical conference features production techniques

By Joe Roizen

The SMPTE's new formula for single annual national conference once again has proved a major drawing card for the latest membership reunion held in October at Los Angeles' Century Plaza Hotel.

There were a good number of distinguished visitors from abroad including James Redmond, the BBC's genial director of engineering; Michel Oudin, technical director for the SFP, France's national network; and Lord Veda of Outer Space. Each made presentations to the membership.

The technical sessions

The SMPTE ran concurrent technical sessions broadly categorized as film- or television-oriented. While this report concerns itself primarily with the electronic side, it is interesting to note that the newest television production techniques being instituted or proposed lean toward film methods, but substitute electronic imaging and recording for the film medium.

Monday's opening session,

Conference attendees had an opportunity to visit the many technical exhibits. (Photo by Donna Foster Roizen.)





Members of the post-production panel enjoy the Q & A session. Left to right: Tom Keller, Art Schneider, Bernard Laramée and Blair Benson. (Photo by Donna Foster Roizen.)

which C.B.B. Wood of the BBC presented Sir Charles Curran's paper reflected the director general's view that film was still the major medium in European TV operations. He indicated that television services actually consume more film than the cinema industry and that, notwithstanding efforts by TV engineers to make quicker and simpler production methods via electronic picture generation, there was little probability that film consumption would diminish in the near future. He felt that although electronic production is making progress, camera mobility, sensitivity and ease of editing will always give film the edge.

During the Monday afternoon sessions, chaired by Bill Connolly of the gamut of papers reported a wide range of new techniques. Heille McMann, speaking for a group of researchers at the Thomson-Labs in Stamford, gave some sampling details about their new digital noise reducer for NTSC video signals. It's the same unit shown at NAB earlier this year but it works better now and a tape with a marginal 40 dB ratio at the input becomes a high-quality 52 dB signal at the output.

G. Newhauser of RCA followed with a review of the latest in color camera pickup devices, the Saticon. This tube now going into ENG and EFP cameras has a set of desirable characteristics as the author described.

Coming back to digital, the Grass Group's paper by Michael

Patten described a combination device they first exhibited at the NAB show. Called Digital Video Effects (DVE), it combines a GVG switcher integrated with an NEC frame store with complex processing of the video signal special effects rivaling film or specialized optical methods used up to now.

Microprocessors also were featured in a paper written by Kiyoshi Inoue of Ikegami and presented by H. Schkolnick from their Long Island office. This presentation covered automatic set-up on camera characteristics not covered by the built-in features. This add-on device can set up cameras in four minutes and properly adjust such things as RGB pedestal, RGB gamma, registration, and others.

The last paper, presented by Mr. Guisinger, was a joint effort by Messrs. Morizono, Chemira and Koguma of Sony in Tokyo. This reviewed the design concepts which went into the development of a lighter, more efficient, portable VTR for ENG applications. Weight and size reduction came from plastic and light metal materials, moulded or die cast for rigidity. Efficiency was achieved by low-power coreless motors, permanent magnet "keeper solenoids" and many C-MOS ICs.

The camera operator is provided with monitoring LED indicators in the viewfinder, thus warning that something may have gone wrong and further checks should be made. An "in-camera editing" arrangement is included; this backspaces the tape at the end of each scene so

an "assembly" style recording is made.

The post-production day

The importance of this aspect of television operations was evident in the assignment of a full day for papers and two panel sessions that drew on experts in the field. The topic chairman, Bill Orr of CMX, opened the morning session.

Milton Shefter of CFI introduced the opening paper given by Christiane Coutel and Bernard Pauchon of the Societe Francaise de Production. They described time code editing techniques used with quadrex recorders at the Buttes Chaumont studios in Paris. The authors showed a SECAM-NTSC transcoded 3/4-inch cassette of a series of typical program segments edited in France.

While the style was different from most American productions, the results were visually attractive and obviously well done artistically.

Art Schneider, one of Hollywood's best known tape editors, followed with a tutorial on the history of videotape editing from razor blades to computer assistance. His major message to producers who want to cut costs was "do your homework on Umatics." He also estimated that "off-line" operations cost one-third of "on line" where 2-inch quad tapes are used for mastering.

Sterling Davis of Metromedia described their newest unified videotape editing system with multiple "off line" video, separate synchro-

continued on page 48

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SMPTE

continued from page 47

nous audio sweetening, and "on line" quad capabilities. Davis pointed out that the differences between off-line and on-line are beginning to blur because of the recent introduction of high-quality 1-inch helical recorders with still-frame capabilities. This theme was echoed by a few others during the conference.

Davis credited microprocessor interfacing for being able to mix 21 machines (6 quads, 9 cassettes, 4 audios, 2 switchers) into a smooth multipurpose system with maximum redundancy in case of any breakdown.

Jack Calloway of Vidronics and John Streets of Merlin Engineering collaborated on the next paper which Streets presented. He described a unique custom-built multiple quad duplicating facility which employs 10 transports with shared electronics and a central control capability. After the tapes are threaded, it takes minimum staff to handle the system.

The last paper during the morning session by Gary W. Jones of Faulkner Associates in Little Rock, Ark.

(presented by Phil Squires of Metro media) extolled the virtues of time code editing in small market stations. He claimed the addition of time code in a small station operation improved talent, directing and planning. Time code also speeds up non-paying segments and thus free time on the machines for revenue producing activities, he said.

The morning papers were followed by a panel session which included the authors plus Len Lauk, a network manager for the CBC. Lauk, opening remarks, made with considerable cheek (with tongue inserted), questioned the need for a this expensive and complex gadget that depletes the CBC's coffers while adding little to program quality or content. In closing comment he suggested that the SMPTE perhaps should foster papers explaining the latest intricacies in electronics to non-technical types (like himself) so they can better assess the value of such devices in their operation.

Audience questions to panelists followed no particular theme, but

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as noticeable that film-oriented members wanted to know what it took to make the transition. Coutel was asked if film editing was prerequisite to VTR editing. She replied, "No, but it would not hurt."

Joe Flaherty of CBS chaired the afternoon session and got off to a good start by telling the audience that tape was inherently cheaper than film.

Bernard Laramée of Milestone Productions described the Hollywood Editors Guild view of the future. Laramée explained that the Guild has recognized the need for training their members to handle tape editing. They have installed a CMX System 50 and contracted for on-time code editing set up.

Clair Benson gave George Gould's paper on post production at Teletronics. Benson's major point was that the editing system of the future should be a modernized version of the random access, light pen actuated CMX 600 of which only a few were ever built. (Teletronics has one that Benson swears by.) He described a few modern color correction techniques by electronic means which provide high quality and great flexibility.

Audio post production came under the scrutiny of Tom Keller of WBH in Boston. He described the audio pitfalls of a quad VTR and said many of them could be avoided by good design and better tapes. Their own tests have shown that the penetration of the video head affects audio quality. By the time the tape back out the head so the picture disappears, the audio is what. He predicted that the 1-inch machines will be better in this regard.

The last paper was given by Bob Pfannkuch of Bell and Howell, who previewed the expanding market for video production hours in the future. According to Pfannkuch, the future of video production is an assured one with large growth areas in feeding the appetites of not only the extended broadcast operations, but also the new markets such as electrical, educational, government, and consumer.

The afternoon panel convened with Al Malang of TAV joining the group and made a short statement. The questions again leaned toward Laramée's presentation on the future role of film editors in video. There also were questions

continues on page 52

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SMPTÉ

continued from page 49

directed at the other panel members about the interplay between off-line and on-line, in view of the new VTRs being introduced, and on the direction of future VTR editing systems if electronic production techniques change. Several panelists agreed with the morning speaker Sterling Davis that the two techniques will blend as time goes on. At least one panelist visualized that film-type electronic production would shift emphasis away from complex editing systems at least during the major portion of the production cycle.

The electronic production day

Co-chaired by Fred Remley and Bob Paulson, the afternoon session on electronic production started with a large screen projection of a program shot entirely on EFP equipment. Using a TK 76 on a Steadicam and BCN 20 portable VTR, Ray Piper of Unlimited Productions explained that the takes were auto assembled on the BCN, transferred to quad for editing, and via Image Transform for large screen showing. The results were impressive, especially since Piper said there were 1147 edits in 27 minutes of program material done with a CMX 340 X.

Flaherty's following presentation reviewed CBS' progress with the "film style" electronic system they

have installed at the TV center Studio City. He said film still dominates TV prime time by a 70:30 ratio, but this would continue shrink as the techniques they are instituting become more widespread.

Flaherty's major point was that with this kind of equipment, film companies can get into TV electronic image generation without discarding the creative talents already on hand. MTM, which was completely film-oriented, now is using this system for two current sitcoms, *We've Got Each Other* and *The Betty White Show*.

James Redmond of the BBC then showed the current production techniques used by his organization. Some of his statistics were interesting since they affirmed that electronic production yields the most program hours in their operation. According to Redmond, the lion's share of new programming (67%) is done with TV cameras, 31% is done on film, and a mere 2% comes in via satellite.

The BBC also has taken great care to color-match film and electronic images so they can be inserted into each other without objectionable color shifts. (Author's note: the color matching unit is called TARIF, which stands for Technical Apparatus for the Rectification of Inferior Films.)



Frank Fleming of NBC (standing) chaired the "Is Technology Killing You" panel. Seated panel members are (left to right): Henry Zahn, Renville McMann, Joseph Polousky, Frank Davidoff (blocked from view), Marcel Auclair, Anthony Lin, Vern Pointer, and Marc Sanders. (Photo by Donna Foster Roizen.)

BROADCAST ENGINEERING

Michel Oudin of the SFP gave a similar summary of television in French network studios. The SFP is an organization of more than 3,000 employees with studios in Paris and elsewhere. Oudin also declared that film was still better adapted for drama production, but he showed how the SFP is employing a single-camera production technique with electronic equipment to cut cost. They are experimenting with portable cameras such as the Microcam and 1-inch helical VTRs like the MKN. They still edit on 2-inch quad, but eventually that will change, Oudin said.

This year the SFP will produce more than 2,000 hours of programs which feed the three national network channels, TF1, A2 and FR3. Oudin expects the single camera "film style" production with EFP equipment to provide good program quality at considerable savings in the future.

Henry Zahn of Fernseh provided a comprehensive description of his company's Type B helical recorder, the BCN series. Zahn stressed that the format already was ratified by the SMPTE Working Group and that several hundred machines are in operation, the bulk in Europe, with more in North America.

This paper covered the existing
continued on page 54

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SMPTE

continued from page 53

configurations, including a newly introduced 20-pound portable and future systems using twin cassette decks for automated studio operation.

The next paper by Mr. Morikawa of the Japanese network NHK, explained how mobile vans belonging to NHK are pooled and assigned on a need basis to individual

stations, thus effectively cutting costs and improving duty cycles of mobile vehicle usage. One statistic he gave was rather pointed: the number of programs using one color camera and one VTR doubled between 1975 and 1976 and is still climbing.

The session closed with Scott Gibbs of KPIX (Westinghouse, San Francisco) giving a vivid description of how the Evening show is put together on 3/4-inch cassette equipment.

Advanced technology session

The Friday morning session chaired by Charles Ginsburg, Ampex dealt with the latest in technology and got off to a good start with a paper on fiber optics. A. Tenne-Sens of Canada. He differentiated the system response 10 Hz to 16 MHz from the DC to 2. MHz response of the optical fibers themselves. The major limits are transducers and electronic systems which encode and decode the signal. Non-linear distortions increase with the modulation factor of the signal and it's hard to get straight line response overall.

Joseph Roizen of Telegen followed with a report on teletext technology now in use in about five countries around the world. Roizen described the well-established CEEFAX system used by the BBC for their 100-page "magazine of the air" service viewers, and the IBA counterpart known as ORACLE.

He also showed typical service provided by French TV with a teletext system known as ANTIOPE. Developed by their research facility in Rennes, this system permits allocating everything from a few lines in the vertical interval to a full set of picture lines for digital data transmission.

Robert McKenzie of Ampex explained the Hilbert transform chroma processing in his company's Electronic Still Store. Using a subcarrier sampling for digital conversion and comb filtering of chroma information, McKenzie described various optimization techniques for best picture quality. It is difficult to fully separate luminance and chrominance signals when there is vertical movement in the image but the technique of rocking subcarrier phases can help.

Gene Leonard of Da Vinci Systems was next with an electronic proposal which, if adopted, should replace carpenters and scene painters in TV studios.

Leonard pointed out that the major element in TV image manipulation is the access to every picture element in a digital frame store.

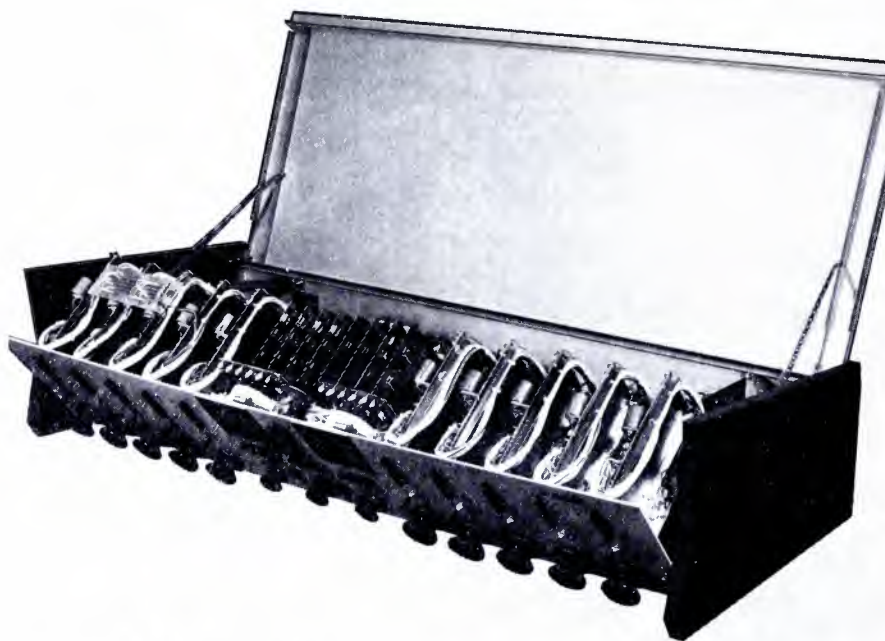
Mr. Eto of Hitachi closed the session with yet another approach to digitizing video signals by bit separation. Eto's method is to initially convert only the RGB signals up to 1 MHz and to send the signals via a separate channel. There appears to be no end to ways of slicing up the same pie, the question and answer session proved that the proponents of 4X or band splitting don't reconcile well with each other.

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Revitalizing the Emergency Broadcast System

By Joseph J. Conte

EBS Program Manager National Weather Service

Since the early days of CONELAP (Control of Electromagnetic Interference), the broadcasters have been hearing muffled federal platitudes about organizing the local and national broadcast stations into cohesive warning dissemination networks. Even as recently as today, the broadcasters are playing the waiting Thomas role, where seeing is believing.

Oddly enough, the many voices of the past that rebuked attempts to emulate organized local and state broadcast station networks are now reduced to a few. A basic reason for this is a joint program organized by the broadcast industry (NIAC), National Weather Service (NWS), Federal Communications Commission (FCC), and the Defense Civil Preparedness Agency (DCPA).

Since the formation of the Emergency Broadcast System (EBS) on October 1, 1976, EBS seminars and workshops have brought together representatives of the broadcast stations, NWS, Civil Defense, state and local officials in 38 states. (Figure 1 shows the states where seminars and workshops have been held and where future ones are scheduled.) The multi-agency coordination involved to schedule a program of this magnitude is unbelievable. An important factor, however, is that this is a two-year program with a schedule as well as a purpose.

After December 1, 1977 and continuing into July 1978, the schedule of seminars and workshops will be complete. EBS sessions will be held in seven states, Puerto Rico, and the Virgin Islands. The last few months of the two-year effort will be directed to follow-up activities. The idea is to complete EBS plans and procedures for each state, possession, and trust territory in the U.S.

Forty-three states are currently

involved in developing EBS plans and procedures for large segments of their states. Several states have completed, and have operational, plans and procedures to use EBS at both the local and state levels to disseminate short-fuse natural and man-made disaster warnings to the public. They are Connecticut, the District of Columbia, Georgia, Maine, New Hampshire, New Jersey, Ohio, and Rhode Island. With minor exceptions, almost every state visited has at least one operational area plan with procedures to use the EBS for a local emergency.

The FCC recently sampled 570 broadcast stations throughout the country and asked them how many times they've activated the EBS locally or statewide since the start of 1977. A survey of responses from 420 stations shows the EBS was

activated 594 times for state or local emergencies.

Broadcaster enthusiasm for EBS has increased perceptibly since 1975. In Utah, Henry Hilton, EBS state chairman, wrote an EBS song which was sung at their state seminar and workshop. In North Carolina, Carl Venters, EBS state chairman, put on an EBS skit at their sessions on "How To and Not To Broadcast an EBS Message."

The 95% increase in EBS activations, as well as the song, the skit, and invitations to hold seminars and workshops in so many states, points to a perceptible increase in broadcaster enthusiasm for EBS. Named here are only a couple of the many responsible and serious EBS state chairpersons and broadcasters who, as usual, are strong advocates of public service. Who said revitalizing the local and state EBS won't work?

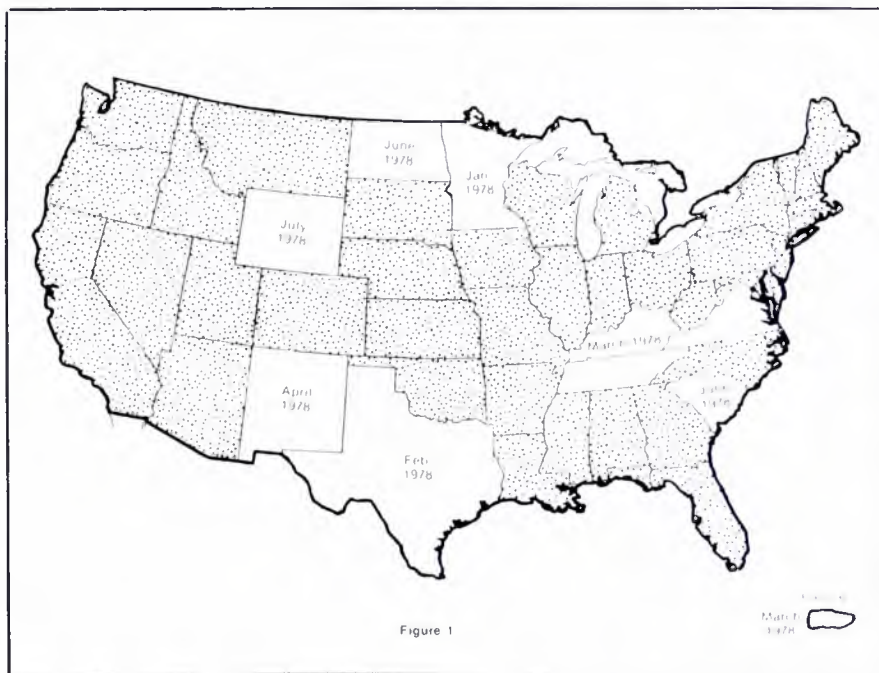


Figure 1

Light beams audio for WJIB's celebration

By Michael Scheibach

When Boston's radio station WJIB-FM celebrated its 10th anniversary recently, history was made as WJIB became the first radio station in New England to use laser technology in a remote broadcast.

During the station's birthday weekend in September, it took its show "on the road" by setting up mini-studios in a GMC Motor Coach located in Boston's Waterfront Park. Then, by using a "beam of light" from atop the Motor Coach, the station broadcast back to its main

studios on Commercial Wharf, approximately 1,000 feet away. To allow station personnel to monitor the remote operation, a television was installed in the vehicle to transmit to the studio.

Jim Howard, WJIB's chief engineer, decided to use the laser system after seeing it at a trade show. Howard realized that the new optical transmissions system, developed by American Laser Systems, Inc., could be adopted for a remote broadcast since it would be



Jim Howard, WJIB chief engineer, stands on top of the Motor Coach to align the laser system during remote broadcast.

The remote van, with the laser system on top, was parked in Boston's Waterfront Park during WJIB's birthday celebration.



easier to install than telephone lines and was capable of transmitting up to 2,000 feet. The station then contacted Lake Systems Corporation, a local distributor, which furnished the system (model 761) for a special remote broadcast.

The 761 uses an infrared optical carrier, thereby avoiding FCC licensing requirements to transmit any one volt composite video signal from sources such as TV cameras, VCRs, or demodulated microwave basebands, plus multi-channel high-fidelity audio.

According to Howard, the system is very portable, and eliminates the need for installing cables. More importantly, it transmits studio-quality sound under all weather conditions, except extreme fog.

Although Howard does not believe WJIB will use the laser system on a regular basis, he did say the station might use it for future remotes conducted during special events.

While it has been known for some time that video signals could be sent over short hops, not much attention has been given to audio signals on optical carrier systems. In fact, the bandwidth capabilities are similar to that of optical fibers. Hundreds of audio signals could have been sent on the same beam. If there is a problem, it's that the bandwidth is so wide that other signals may hop a ride and arrive unmixed. This, of course, can be eliminated by special filters.

Beautiful music

The laser demonstration was just part of WJIB's birthday celebration, however. The station, broadcasting "beautiful music" 24 hours a day, first signed on the air September 15, 1967, and in honor of such occasion, WJIB launched its celebration by land, sea, and air, in addition to laser beam.

Governor Michael Dukakis proclaimed September "WJIB Month" in Massachusetts. And Boston's Mayor, Keven H. White, declared September 15, 1977 as "WJIB-FM Radio Day" for "providing New England listeners with fine quality music, news, and public service programs from its location on historic Commercial Wharf since 1977." Commercial Wharf was renamed "WJIB Wharf" for the event. The station also received congratulatory telegrams and letters from throughout the state, and from its congressional delegation. WJIB led these, as well as taped messages of congratulations from several public officials, during its birthday celebration. □

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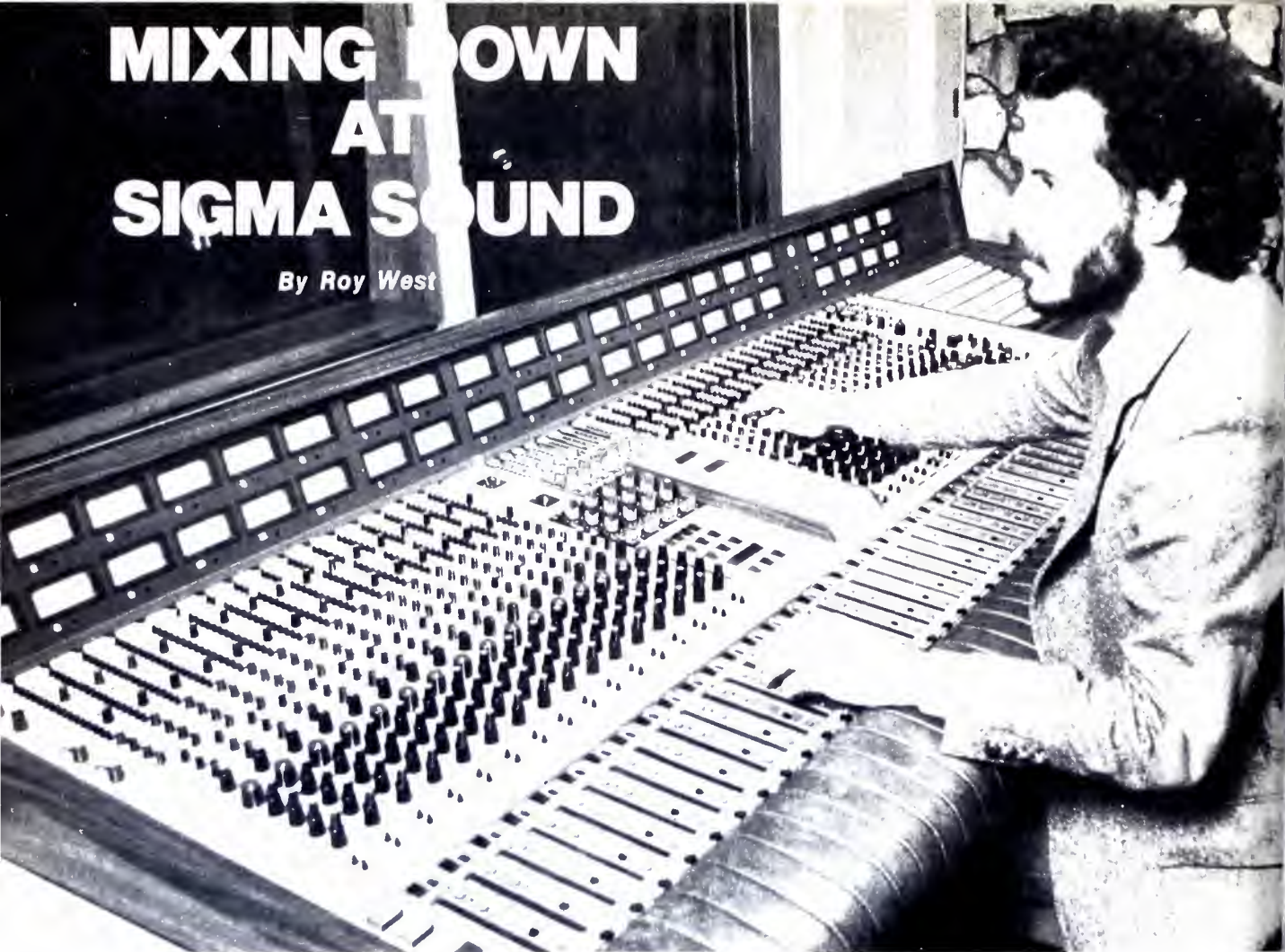
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MIXING DOWN AT SIGMA SOUND

By Roy West



Gerald Block works a recording session at Sigma's studio 5 in New York. The center panel on the custom-designed console has auxiliary equalizers, and controller and group functions, giving the engineer more control and flexibility. (Photo by Ray Garcia.)



The engineer's view of the recording studio. (Photo by Ray Garcia.)

When new recordings arrive at the broadcast studio, many of us tend to take for granted the vast improvement these offerings provide in audio quality over their predecessors of a few years ago.

How often do we stop to consider that the success of today's "sounds" is often the result of a continuing revolution in recording techniques led by a relatively small group of creative engineers, manufacturers, and sound studios who continually strive to improve the "state-of-the-art"?

One example of this effort is Philadelphia's Sigma Sound Studios. Founded in 1968 by Joseph D. Marsia, former Philco research technician turned audio engineer, Sigma Sound has emerged in the past 10 years as the producer of the "Philly Sound," a distinctive blend of Rhythm & Blues with strings, horns, and other instruments usually associated with classical music.

The current star of the electronic show at Sigma is a combination of 12-track recording with automated digital memory and readout.

The console was designed by the Sigma engineering staff and custom manufactured by MCI in collaboration with Allison Research of Nashville. The audio chain was intentionally kept as straight forward as possible; it contains only four operational amplifiers from mike to module output, and is transformerless at all high-level points. It has

"Sigma Sound has emerged in the '70s as THE producer of the 'Philly Sound' "

several engineering conveniences designed to allow quick set-up during live sessions, including: an automatic cue system with manual override; automatic level presets for track bouncing and doubling; custom equalizer, including a 12-frequency, two-slope high-pass filter; module status LEDs cluster grouped; module mode switching facilities on master or individual basis; depth dimension held to within limits which permits reaching the top of the module from a sitting position;

and stepped controls on all critical functions for resetability.

The console faders, an independently functioning unit, are digitally encoded using the Allison Research "Memory Plus" system. The fader position is physically changed by moving an endless-loop touch band whose upper half is

exposed under the fader escutcheon. The electrical position is indicated by a moving point of light emitted along a row of 32 LEDs under the fader touch band. The fader resolution is .25 dB per step and fader drift is impossible due to digital control.

continued on page 60

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Mixing Down

continued from page 59

The level setting, on/off (mute) status, solo status, and group master assignment are all fader-relation functions which are independently transmitted in digital format to a modulation package which absorbs the information and translates it into a low-level audio signal. This signal then is recorded on one track of a master tape during a mixdown. When reproduced from the tape and received by the automation system

in audio form, the movement of all faders, all mute, solo, group master conditions, and level changes are recreated aurally and visually in real time with absolute accuracy. Automation-assisted mixing with this system is precisely repeatable and is not affected by tape-speed variations, machine alignment, drop outs, or data punch in's.

To anyone who remembers "live" (or "real time") recording and mixing, the computerization of audio recording and mixdown is most apparent in what happens to the people in the control room. The

nervousness and frazzle have been replaced with an easy-going interactivity and self-assurance. The ability to break down a composition into component groups, even single instruments and vocals, then recombine them into final form, has released the artistic side of the engineer.

The result of the Sigma-McAllison collaboration is that more options have been given to the operator, without exceeding the capabilities.

Simple comparison with recordings made only a few years ago is sufficient to illustrate the vastly improved potential of today's engineering technology.

The storage/retrieval possibilities of automated audio cut the time needed to produce the desired result; however, instead of getting down and going home earlier, the

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is sufficient
to illustrate the
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potential of today's
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technology."*

engineer can apply his extra hours to seek better reproduction of a sound mix.

Joe Tarsia, never satisfied with standing still, believes a studio must constantly stay ahead, regardless of cost—or risk the even greater hazard of obsolescence and loss of position in the field.

According to Tarsia, the interplay between user and maker has produced most of the advance in the field, and while larger companies have the money and people for in-depth R & D, the little person has an offsetting virtue of being a better listener.

"Above all," Tarsia says, "an engineer should not say, 'We've got just what you need,' but 'What do you need?'"

Tarsia, who still spends at least three days a week "at the board" and functions as both president and chairman of the board, heads a team of 32 technicians and specialists now located in two studios in Philadelphia and one in New York.

In charge of the technical side is Wayne Wilfong, director of

"The ability to break down a composition into its component groups, even single instruments and vocals, then recombine them into final form, has released the artistic side of the engineer."

"Station owners should stay alert to the quality of their sound versus their competition as much home equipment is now so good that formerly small differences now loom large to listeners."

"The limiter is the most misused piece of equipment in any broadcast studio."

Sigma Sound takes stations into account a great deal. Every selection is run through Altec 604E's in Big Red enclosures, then through medium-priced KLH 17's, and finally an average table radio—constantly being monitored for response on

each.

The end product of all this is to give the musical artists who come to Sigma Sound the best possible vehicle to transport their art to the ears of their fans.

The success of Sigma Sound is evident from their list of clients. Among the many recording artists who have used Sigma Sound are Paul Williams, Charlie Daniels, Elton John, Gladys Knight & The Pips, Harold Melvin, Melba Moore, the O'Jays, Billy Paul, Joe Simon, the Spinners, Andrea True, and Stevie Wonder. □

engineering, who also helps in the design of oncoming generations of equipment that will help maintain Sigma Sound's competitive edge. Harry Chipetz, general manager, oversees business in both Philadelphia and New York, while New York's day-to-day operation is handled by Gerald Block and Barbara Tisi.

Sigma has six studios, numbered in the order of their development: numbers 1 through 3 have two track layouts with capacity for editing and dubbing; studio 4 has an automated 24-track layout; number 5 is the newest studio, and is located in New York; 6 is a small editing and copy studio. And, construction has just begun on a seventh studio.

Asked how broadcast stations could improve the quality of present

"The end product of all this is to give the musical artists who come to Sigma Sound the best possible vehicle to transport their art to the ears of their fans."

Recordings, the following comments surfaced:

"Every mono station should get a compatible Stereo Generator to eliminate the 3 dB center channel fold-up which happens when stereo is directly summed to mono."

"Station owners should constantly listen to other stations on a variety of equipment, especially car radios."

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For More Details Circle (47) on Reply Card

From blue bananas to sag tails

.....

Blip, blip, blip goes the needle

All-night announcer, Frank Frey, was KFOG's newest employee a few years ago, when after checking a noise he heard outside, he accidentally locked himself out of the

station.

The result: six straight cuts off of a Robert Goulet album followed by three and a half hours of "blip... blip... blip" as the needle traversed the inside concentric groove.

Using a payphone here in Ghirardelli Square, Frey tried calling the operations manager, but there was no answer. He then tried the chief engineer, and the phone ate his only dime. He and the security man for the Square tried picking the lock. Finally, worried listeners called police in sufficient number that they (the police) arrived at the station

around 5 a.m. (along with some members of the press).

The result was front-page publicity in the evening *Examiner* and incoming newspaper clippings from around the country for a month. A grinning, but chagrined Frank Frey had pulled off the station's greatest publicity stunt—but unfortunately it wasn't in a rating period! Peter V. Taylor, KFOG.

Gulf region is warm and moist

To tell you the truth, I've had enough blue bananas. Let's give equal time to the other end of your column.

Maybe you had to be there that hot, humid June day this year when our weather girl was giving her usual concise national summary. She read it this way:

"...and there is a region of warm, moist, hair around the gulf region..."

She knew what she said, but true to the calling, she forged ahead with nary a break in tempo while the rest of us enjoyed to the fullest the only weathercast I can remember to feature its own SAG TAIL. Anonymous, Midwest gospel station

Disco "Lucey"

A few weeks ago Governor Lucey of Wisconsin was to have a statewide telephone talk show which was aired on many of the radio stations in the state.

Our boardman was all set for the feed and was ready to sit back for an hour of relaxation. He started into the program and found, to his dismay, that the originating station was having some trouble with the feed.

In a panic he grabbed the first record in sight and put it on the air. To his surprise, the record he had grabbed was "Disco Lucy," a selection he will long remember. Tom Lewis, WNFL Radio.

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news briefs

Continued from page 16

Users measure satellite range

GTE Sylvania Incorporated has delivered high-accuracy laser systems to measure the distance between earth and an orbiting satellite to the National Aeronautics and Space Administration (NASA). Precise measurements help scientists document and compare motions of the earth's crust over a period of years. These data and other studies may result in a model that could allow the prediction of a global earthquake pattern by 1985 and local earthquake forecasts by 1995.

Altec Lansing forms Canadian subsidiary

Altec Corporation's new Canadian subsidiary, Altec Lansing of Canada Inc., will be headquartered in Toronto. Headed by Ron Marsh, the firm will provide centralized warehousing for national distribution and central inventory for immediate product availability.

Major advantages of an in-country subsidiary are that it allows customers to be invoiced and pay in Canadian dollars, eliminating currency restrictions and distance barriers, according to a company spokesman.

Varian receives Emmy award

Varian Associates received a Citation of Outstanding Achievement in Engineering Development at the Television Academy of Arts and Sciences' Third Annual Emmy Awards Luncheon honoring creative people in television.

The award cites Varian for improving the efficiency of UHF klystron tubes so that they use about 100 less electric power, thereby reducing a TV station's energy consumption, while still producing the same transmission output.

W&T orders satellite earth terminal

A 10-meter diameter satellite earth terminal has been ordered by Scientific-Atlanta Inc. by W&T Long Lines. The model 8002 10-meter earth station antenna has a special reuse feed to operate with the satellite; this feed provides simultaneous transmit and receive capability on the same polarization. Included with the antenna is a sub-reflector assembly containing fully redundant high power amplifiers, up and down converters, and 56 bit data modems.

Broadcasting bill introduced

In a hearing before the House Subcommittee on Communications, the Carter Administrations' long-range authorizing legislation for public broadcasting (H.R. 9620) was formally presented. The Subcommittee generally praised the bill but was concerned that it seemed incomplete when compared to Carter's earlier message.

But, according to Office of Telecommunications Policy consultant Frank Lloyd, the bill was presented far enough in advance of any

legislative action that several specific technical amendments would be added.

Video production facility planned

RCA Americom Services, Inc., plans a new facility to provide videotaping production editing and playback services for television programmers and distributors.

The new facility, which will be located at RCA Americom's Vernon Valley (New Jersey) Earth Station, will be capable of performing sophisticated videotape editing. (1)

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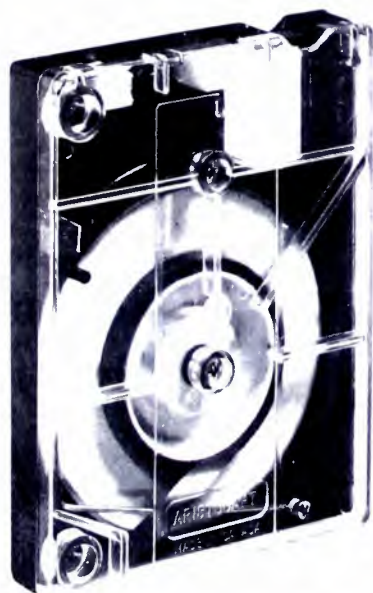
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radio workshop

Harris joins the AM stereo crowd

By Peter Burk

It's time once again to put down the soldering iron and look over our shoulders at our accomplishments for the past 12 months, and see what might be in the "in" basket for next year. We'll also unscrew the front panel on the Harris CPM AM stereo system and see what makes it work.

1977 instant reply

Last year at this time, ATS was high on the "wish list" for 1977. A promised, the commission delivered an ATS package which allowed FM and nondirectional AM stations to install a "magic black box." Several manufacturers rushed to have hardware available in time for the

Figure 1

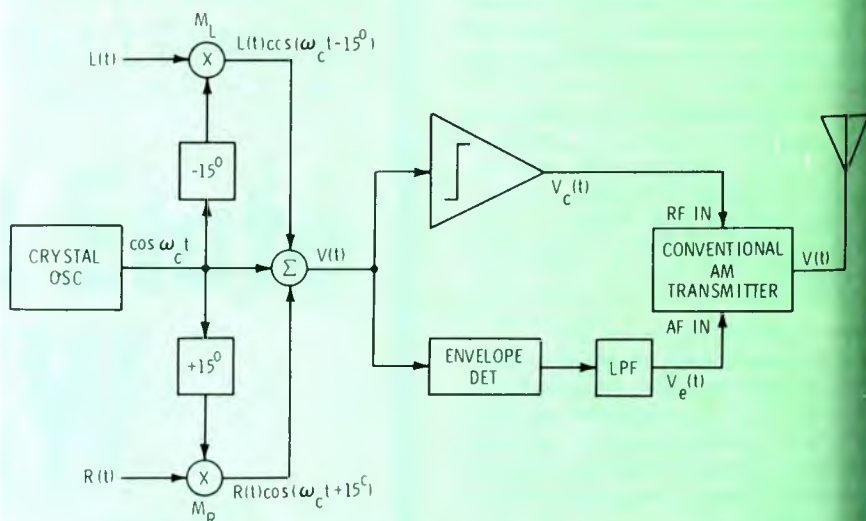
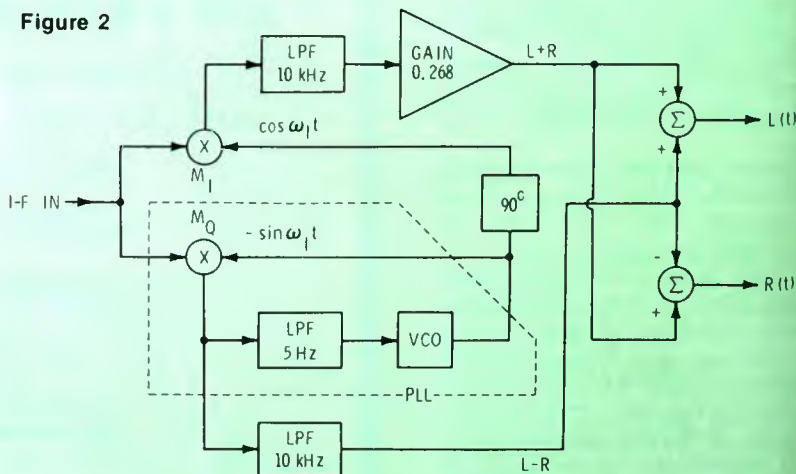


Figure 2



Washington NAB. Most contenders demonstrated imaginary systems that might be produced. In fact, the buzz word at the show was "ATS compatible," whatever that meant. In reality, few dollars were spent on broadcasters on ATS systems. A cloud labeled "let's wait and see" seems to be hanging over the whole concept. Rules to permit AM sectionals and TV stations to operate under ATS were projected in late 1977. If broadcasters are paving the floor in anticipation, they are doing it very quietly.

Finding the missing channels

Last year, we wrote in these pages that results of the commission's tests on FM quadraphonic would be out by mid-1977. A report is now out, but the journey will still be a long one for quadraphonic proponents. The new deadline for comments is December 16, 1977. Again reply comments due January 15, 1978.

AM stereo, on the other hand, has gained momentum. Several of the proposed systems have changed hands during this year, and perhaps no other subject has caused so many voices to be raised at various conventions and seminars across the country. The National AM Stereo Radio Committee has conducted tests on the systems submitted to them. Several others are being submitted directly to the commission.

Harris Corporation, the Johnny-come-lately in the AM stereo competition, has added another three-letter acronym to our vocabulary: CPM. That's Harris-ese for Compatible Phase Multiplex. Let's take a look at how this system works.

Compatible phase multiplex

The basis of the CPM system is a pair of amplitude modulated signals separated in phase by 30 degrees. The left-channel modulation is applied to a carrier lagging the right channel by 15 degrees, and the right channel to a carrier leading by 15 degrees. The sum of these two is the transmitted signal.

The received signal is broken down into two parts. Information appearing equally on both left and right channels arrives in phase and forms the L+R signal. The difference channel information (L-R) does not contribute as much to the L+R signal since it is rotated by 30 degrees.

Transmitting CPM

Of course, it isn't necessary to use two transmitters to produce the two phase-related signals. The left and right audio channels are fed into a stereo generator that reduces the information to an envelope modulation signal and a phase modulation signal. The envelope signal goes into the transmitter audio input just like a mono signal.

The phase information is used to phase modulate the RF signal from the oscillator.

To get a better idea of how the CPM signal is produced, study Figure 1. The oscillator at carrier frequency is shifted by plus and minus 15 degrees and fed to two balanced mixers. The two mixer outputs and the carrier frequency

continued on page 66

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AM stereo

continued from page 65

are all summed to produce the CPM signal.

A clipper removes the amplitude modulation from the CPM signal, (similar to the limiter in an FM receiver) and produces a regulated carrier to be fed to the transmitter in place of the original oscillator. The only difference is that the carrier is phase modulated with the difference information.

An envelope detector recovers the audio (basically L+R) from the CPM signal. This signal is applied to the normal audio input of the transmitter.

Receiving CPM

Harris points out that there are a variety of ways to receive CPM. One method uses a synchronous detector with a quadrature output, such as a phase locked loop. One output is L+R, the other is L-R. An audio matrix derives left and right as is presently done in FM stereo.

Another method would employ two product detectors, one 75 degrees ahead of the carrier, the other 75 behind. This method would require no matrix, since the oscillator drive would cancel out the undesired channel.

Figure 2 shows a typical receiver for CPM. Up to the detector, the receiver is a conventional superhet. The IF is applied to the input of the phase locked loop which basically demodulates the different channel information. A 90-degree phase shift from the phase-locked VCO output produces L+R information when mixed with the original IF. The L+R and the L-R outputs then are fed to a conventional audio matrix to produce left and right channel audio.

The pilot

We all know that it isn't stereo if a little blue light doesn't come on at the receiver. Harris suggests using a 20 Hz to 25 Hz sine wave at 9% modulation on the L-R channel to light the light. (9% L-R modulation is the same as 2.5% envelope modulation in terms of sideband amplitude.) The tone would not show up on mono receivers since it is on the L-R channel, and would be out of phase on the two channels of a stereo receiver, so Harris feels that little or no filtering of the pilot would be necessary in the receivers.

What does AM stereo sound like?

Listening tests have been conducted with all of the proposed AM

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take the plunge into stereo if the system doesn't match current monaural performance.

This brings up another point to ponder: Many stations are presently boosting the high end of the audio in an attempt to compensate for receivers that roll-off rapidly. The receiver manufacturers want to take advantage of the AM stereo conversion to produce wideband receivers. (They would, of course, equip such a receiver with a low-pass filter to permit noise reduction when listening to a weak signal.) Listening to a competitive AM signal today on a wideband receiver is, at best, a discouraging experience. Even if receivers with wide bandwidth become available to the public, AM broadcasters will still be faced with having to process the audio for the plethora of cheap, monaural receivers that will be with us for a long time.

The point of all this is that to demonstrate that a system—any system—is capable of high quality doesn't really bring us within reach of making AM sound like FM.

We have a choice to make: Either cater to the \$10 portables or produce a high-quality sound for the sake of the expensive wideband receivers. We can't do both. Let's make this decision carefully. ☐

ereo systems. Under the right conditions, they all work and they sound good. Listening to a recording of an off-the-air stereo signal, or listening to a demonstration with a low-power transmitter, the audio is amazingly clean and the separation is good.

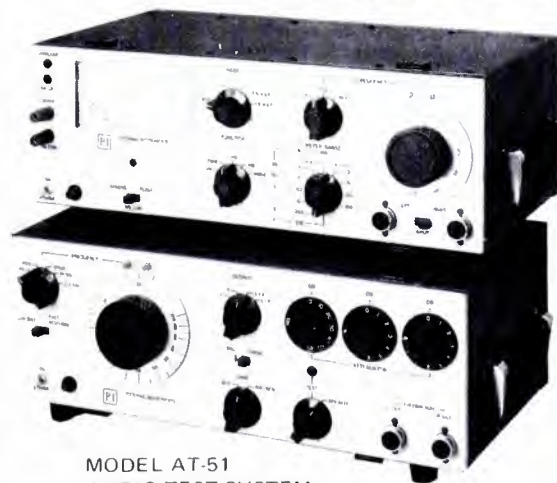
What is difficult to evaluate is the performance of the entire system, including receivers. Listening to a 200 modulation monitor and listening to a \$20 table radio are two different animals. Of far greater importance (at least in the beginning) is the system's monaural performance. Many FM stereo stations have failed to take mono reception into account, as is evidenced by the phase cancellation heard on mono receivers. (All of the station's employees listen in stereo and forget that a large part of the audience is listening in mono.)

Let's hope that we don't fall into the same trap with stereo AM. Obviously, stereo set saturation will be very low initially. If the monaural performance is substandard, the first station in the market that converts to stereo has just taken a step backward. Once every station in the market has converted to stereo, things will even out again. But it will be a tough decision to

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IEEE reviews latest FM quadrasonic and AM stereo arguments



Norman Parker of Motorola engages Leonard Kahn
in debate over Motorola's stereo system.

By Dennis Ciapura

As expected, the 27th annual IEEE Broadcast Symposium yielded a lot of excitement, and some surprises as well. The morning session, dedicated to FM quadrasonic and AM stereo, featured such well-known industry leaders as Emil Torick, Eric Small, Louis Doren, Leonard Kahn, and Norman Parker.

FM quadrasonic and AM stereo are two topics which have traditionally lent themselves to heated debates, and one wonders if the adversary relationships existing between the various system proponents will ever fade to cool coexistence. The "catch 22" is that the proposed systems cannot coexist,

since only one FM quadrasonic and one AM stereo system will be selected by the FCC.

Quadrasonic discussion

The FM quadrasonic discussion opened with Louis Doren describing the ins and outs of the QSI discrete system. Doren traced the history

SI quadraphonic to when it was first introduced as the Doren Quadplex System and described the 95 kHz SCA that could be transmitted along with the quadraphonic signal. A set of spectrum analyzer photographs demonstrating the system's compliance with FCC-occupied bandwidth regulations was passed out while Doren explained how the discrete quadraphonic system actually would take up less spectrum space than a simple mono signal. He also pointed out that all the 4 quadraphonic systems are "missing cousins" in that the methods of generating the rear-channel information are very similar, except for modulation details and how the SCA is handled.

On reviewing recent activities of the National Quadraphonic Radio Committee, Doren explained that the two major matrix quadraphonic components, SQ and QS (referred to as "pseudo quadraphonic"), dropped out of the proceedings. We later asked Emil Torick of CBS Technology Center, representing SQ, why he dropped out of the NQRC. He said since the matrix quadraphonic systems could be transmitted under existing rules, there was little point in participating in a committee to recommend a change in technical standards. As you might expect, Torick does not consider the SQ system to be "pseudo quadraphonic." Eric Small, representing the Dynapop/Columbia System, followed Doren and surprisingly, spent little time on the details of that system. Instead he presented an interesting series of slides describing some of the work done by the NQRC, including photographs of some of the installations at broadcast stations. In the end, Small and Doren appeared to work well together in promoting the concept of discrete quadraphonic, with Doren explaining how it is done and Small showing how it was tested.

Although Gerald LeBow was a scheduled panel member, representing Sansui QS, he could not attend due to illness in the family. That meant Emil Torick was left to defend the matrix concept. After making a case for the superiority of the CBS SQ approach over the other matrix systems, Torick presented some charts showing how coverage area based on signal-to-noise ratio for discrete quadraphonic stations would be reduced greatly. Doren and Small were not depressed, to say the least, with Doren suggesting that CBS must have used the worst of the discrete quadraphonic systems for compari-

son. At this point, Torick was pleased to point out it was Doren's system that was tested.

There was some skepticism about Torick's comparative coverage data being based on a 65 dB signal-to-noise ratio, but he maintained that standards for a high-fidelity transmission system should be stringent. There is certainly valid logic in both sides of the argument because, although reduced signal-to-noise at a given distance certainly is not desirable, it is unlikely that many listeners will cease to receive a

station because the S/N has dropped below 65 dB.

Torick's strongest arguments in favor of the CBS SQ technique were in its simplicity, availability of existing SQ records, ease of transmission, and relatively simple receiver decoding. During this discussion, a person in the audience said he'd like to comment about another method of quadraphonic broadcast which had not been covered. The panelists did not object, so the surprise guest speaker

continued on page 70

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er was invited to the podium. He turned out to be Jim Gibson from RCA, promoting the RCA 4-3-4 technique. Gibson suggested that the RCA 4-3-4 system is a good compromise between 4-2-4 and 4-4-4 in that it can do a better job of quadrasonic imagery than 4-2-4, but without as much signal-to-noise deterioration as 4-4-4. Torick once again mentioned that the only quad-

raphonic program material now available in large quantities is SQ 4-2-4.

Opening the discussion to the audience drew questions about integral noise reduction systems, 25 usec pre-emphasis, and a reopening of the coverage question. Small offered an eloquent defense of 4-4-4 based on artistic limitations he felt would be inflected by the less-than-perfect quadrasonic imagery of 4-2-4. He recalled the early musical experimentation of Les Paul and Mary Ford as well as the Beatles,

saying their creativity might have been hampered if there were limitations in multi-track recording. Small said anything but 4-4-4 could be musically inhibiting.

The quadrasonic discussion ended with the basic arguments still unresolved, but everybody's position was a little clearer. Any unbiased observer would have to admit each system proponent had some good points, and the best system depends upon one's priorities.

AM stereo

Chris Payne, NAB vice president, presented a review of current AM stereo systems which participated in the National AM Stereo Radio Committee. The data he presented demonstrated typical performance for the AM stereo system as a group rather than as individual systems. According to the data, if AM stereo finally becomes a reality, the performance will be impressive. Perhaps renewed interest in AM audio quality will make it economically feasible for receiver manufacturers to produce better quality units that will make the broadcasters' audio efforts more effective.

Leonard Kahn, who made an independent presentation describing his own AM stereo system, surprised everyone when he announced that Hazeltine Corp. has entered into an agreement with him to develop Kahn system receivers, thus imparting important prestige to the Kahn effort. In a discussion of the relative merits of this system, Kahn drew questions from the audience as well as some heated responses from Norm Parker of Motorola.

Parker found his way to the stage and told the group in no uncertain terms that the Motorola stereo system did not "split" under heavy modulation as Kahn suggested. Kahn inquired about the accuracy of Motorola's block diagram for the system, maintaining that analysis of the diagram would prove his point. Parker pointed out that actual field tests, witnessed by Chris Payne, showed no evidence of the phenomena Kahn described.

A member of the audience had commented previously about the "emotionalism" of the morning quadrasonic and AM stereo discussions, and Richard Cassidy, sensing an amicable resolution was not at hand, finally adjourned the session. Cassidy, National Public Radio director of engineering and session chairman, had opened the morning activities looking forward to a lively discussion, but at the close was probably grateful that everyone walked away alive.

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by Robert Jones, Director

Why the SBE? Why join? Why support this engineering society? As national director I often hear these questions, and I believe they represent valid inquiries on the part of those asking. Here are my answers. SBE is a national association cutting across all technical levels in AM, FM, and TV stations. Although it cannot be all things to all persons, it does serve a wide base of broadcast-oriented engineers and technicians. Any organization that has grown from a few hundred members to almost 3,000 in just a few years must have some appeal.

What are these appeals? First is the appeal of local fellowship with other radio and TV people through local chapter meetings. There is the opportunity to attend mini-conventions. There is the chance to belong to an organization that responds on behalf of broadcast engineers on issues before the FCC. Joining an organization which supports the Certification Program is another appeal of the SBE, as well as receiving the regular SBE newsletter, *The Signal*. Another appeal is incentive membership and recognition for those achieving special goals and/or plateaus. And, finally, there is the appeal of hanging a respected membership certificate on your wall next to your FCC license.

I believe the SBE, while not perfect, is the best organization representing the field of broadcast engineering. By your strengthening it through membership, it will become an even better organization. I urge you, who are not members, to fill out the accompanying application form (see next page) and send it in today. We all welcome you to the SBE.

Appointments

Patricia (Pat) Satter has been appointed assistant secretary-treasurer of SBE, replacing R. Michael (Vincent) Flanders who resigned to pursue interests outside the field of broadcasting.

Pat has been employed as chapter coordinator since April 1977 and

will continue in this category along with "overseeing" all activities related to the national office.

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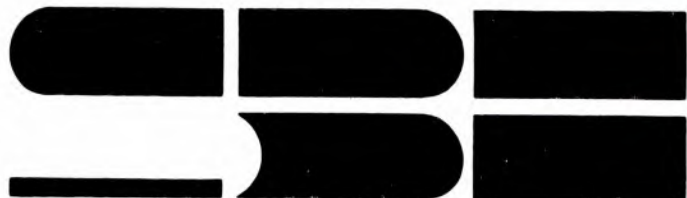
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Klystron rupture warning device

By Stephen Wurzburg, Fort Meyers, Florida

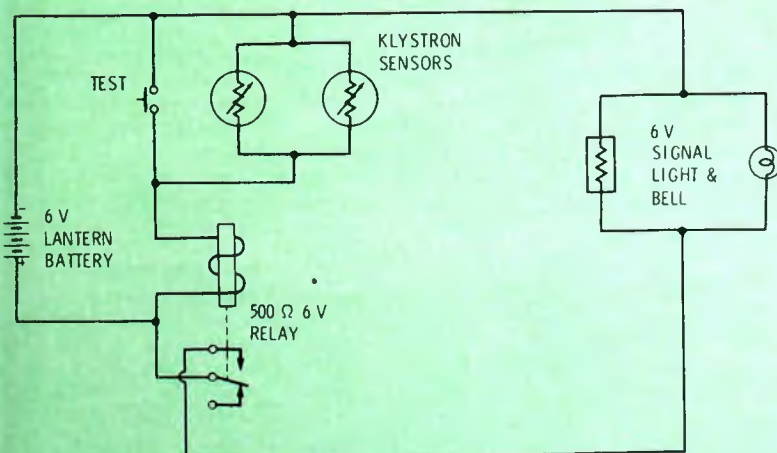
While I was director of air operations at WEVU-TV, Naples, Florida, the station had the misfortune of losing a 953-B Klystron due to a rupture from a ruptured boot finding its way down through the magnet windings to the porcelain cap at the top of the tube. I was asked to devise an inexpensive warning device that would prevent any recurrence of this type of accident. I was able to solve this problem at a total cost of less than fourteen dollars. Eight months after installing this device, a leak developed on the moral side of the TTU-55B Mill, and the unit activated giving the operator time to kill the high voltage before disaster could occur.

Construction is very simple. The heart of the device is the water sensing units. These are constructed using four strips of extra heavy aluminum foil 1½ inches wide and

of sufficient length to encircle the top of the klystron water jackets, leaving a short tab for an electrical contact; two strips of paper towel two inches wide, which have been saturated in a solution of six tablespoons of salt to one cup of water, and then dried. I also used one 2-inch wide strip of masking tape on each tube to insulate the first strip of foil from the klystron water jacket. One strip of foil followed by one strip of paper towel and the other strip of foil are stacked on each other and snugged as tight as possible. Each strip is held in place with cellophane tape. Micro Alligator Clips are used to connect the circuit to the aluminum strips.

When dry, the sensing units have infinite resistance and no current flows. This insures "shelf-life" for the battery. When activated, ioniza-

continued on page 74



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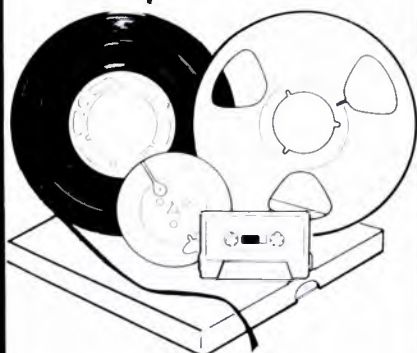


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Station-to-Station

continued from page 73

tion takes place and a current in excess of 15 ma. trips the relay. Tests showed that approximately one tablespoon of water is sufficient to trigger the alarm.

Many refinements could be incorporated into this basic circuit, but in our case cost was a big factor and the unit has served us well. There is no reason why this device could not be used for a remote transmitter. The appropriate relay contacts could be connected in series with the high-voltage switch on the transmitter.

Once the unit has functioned, it is of course necessary to change the impregnated paper towel...but what a small price to pay.

Audio phasing telephone patch

By James Nelson, WGST,
Atlanta, Georgia

This circuit provides a radio station with a telephone patch that eliminates the distortion inherent in the telephone's carbon mike when the announcer is conversing with a caller on the air.

The DJ talks into the studio microphone to talk to the caller on the telephone and is on the air at studio quality at the same time. He hears the caller and himself in his console headphones. By conversing with the caller by using the studio mike and headphones, the DJ doesn't use the telephone handset at all. The call can be put directly on the air or put on audition channel of the board for tape delay. Either way the quality of the DJ's voice is improved considerably over that of the telephone handset.

Figure 1 is a phasing null circuit that eliminates feedback of the DJ's audio through the board, while allowing the DJ and the caller to talk on the air. The DJ audio feeds the base of Q1 and appears 180° out of phase at the output null pot. In-phase DJ audio appears at Q1 emitter to feed his audio back to the telephone caller and to the Q2 emitter. The DJ audio appears at the Q2 collector still in-phase, feeding the other side of the output null pot.

The output null pot is adjusted for cancelling of the DJ audio at the

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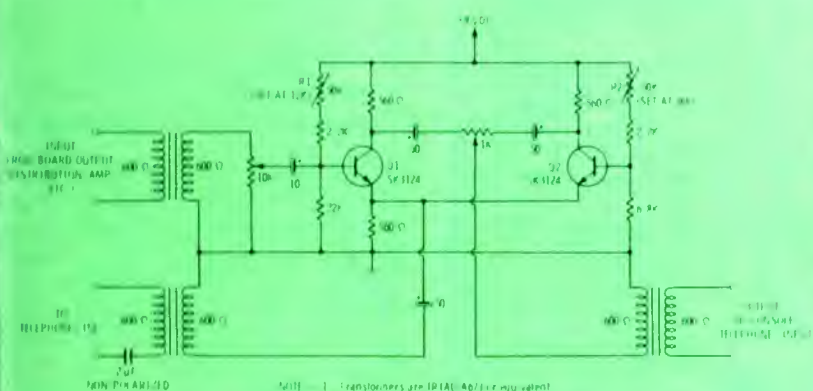
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The *Handbook* can also be purchased directly from the NAB at \$30 a copy for NAB members and \$45 a copy for non-members. Write to: *Station Services Dept.*, NAB, 1771 N Street, N.W., Washington, D.C. 20036.

put, thus eliminating the feedback patch from DJ mike input to hard out back to the telephone out. The DJ audio appears on the hard only at his mike mixer. The telephone caller's audio feeds both Q1 and Q2 emitters and appears at the output in-phase, adding the board's telephone input. The input and output transformers

could be eliminated if they are redundant, or if you are using an unbalanced system. R1 and R2 can be trimmed if different transistors are used. Be sure to adjust the output null control to cancel the DJ audio at the output. Adjust the input level control to keep the DJ audio below the distortion level of Q1 and Q2.

Figure 1



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plagues low-cost spring reverb. As always, you can count on Orban/Parasound's reliability and prompt service.

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For more information on the 111B Dual Reverb, see your local Orban/Parasound dealer or contact



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NRBA convention takes AM stereo in stride

By Ron Merrell

The NRBA national convention and equipment exhibition in New Orleans was a success. Attendance was up, exhibitor numbers were up, and the association's confidence was showing.

As usual, the sessions were on target...even their titles. While AM attendees were listening to a panel discussion on what can be done at AM stations to compete with FM, FMers were listening to a panel whose title was "Like Hell You Will."

You'd suppose the signal source and signal processing would be the focal point of the panels, with AM stereo riding on the side. Yet it was antennas, loading, matching, and the transmitter itself that received the spotlight on both sides of the hall.

AM stereo

The AM stereo panel drew a crowd, but the only news there was a brief introduction to the newly created Harris system. (See Radio Workshop in this issue for a description of this system.) Of course, the panel had to get around to the cost of the AM stereo exciter. Among the companies represented, the prices ran from approximately \$2,000 to \$6,000 for the various stereo exciters now being considered.

Equally important is the influence of the receiver manufacturers who would build AM stereo compatible receivers. Ultimately, they may have more effect on the final decision than the broadcast equipment manufacturers.

Aside from the exciters, its been estimated that conversion to AM stereo may run as high as \$25,000. This figure would depend upon how much equipment was either modified or replaced. After all, the switch to stereo means the AM station (equipment wise), would look very much like an FM stereo station.

Program automation

As reported in the November issue of **Broadcast Engineering**, program automation is coming on strong again. At NAB (now set for April 9-12 in Las Vegas) a walk through the automation exhibits will be well worth your time. State-of-the-art systems are much more flexible, and some feature CR readouts of what has been programmed, including availabilities. One manufacturer is using color coded lines and showing the entries in English.

There's no doubt the NRBA is growing stronger. The interest in AM and FM now is equal, and that's reflected in nearly equal attendance numbers. About the only mistake the association made was their choice of hotels.

Applause for the guests

FCC Chairman Richard E. Wiley and House Communications Subcommittee Chairman Lionel Van Deerlin were applauded during an after their addresses before the convention, but for different reasons. Wiley was departing from the FCC after a job well done.

As for Van Deerlin, it was appreciation for his comments on deregulation of radio and the extension of the license period that drew a thankful applause. Van Deerlin suggested that the license period run more than five years; perhaps as much as 10 years! The turning to personnel changes at the FCC, he said, "We might see a trend toward sharper regulation of your industry. Our subcommittee may be the only voice left in government for deregulation."

New products

On the opposite page we are kicking off the New Products column with a few of the products being shown for the first time. Additional products shown at NRBA will be covered in upcoming issues.

new products

Remote control system

The TFT model 7640 Telescan is a computer-assisted option for the model 7600 remote control system. It also can be used to assist the operation of any remote control equipment or used as an independent system in data acquisition, status monitoring and logging. Both telemetry and on/off status functions for up to 110 channels can be clearly displayed, on command, on the 12-inch CRT. Up to 30 control channels may be called up simultaneously via the keyboard on the CRT unit.

A built-in microprocessor and special software package allow pre-programming of two sets of upper and lower limits of the parameter being monitored, so that central control can be instantly alerted when these parameters are exceeded. The additional feature of automatic or call-up logging provides a permanent record. The Telescan System consists of four major components: a remote scanner, CPU, video display and printing terminal.

For More Details Circle (80) on Reply Card

Audio consoles

The Ward-Beck series R1200 and R2000 radio programming and production consoles allow fabrication of consoles from 10 channels or less up to a total of 20 input mixing channels. Console systems may be supplied for stereo, monaural or stereo plus mono program operation.

Features include: pushbutton A/B input selection on all input channels; front panel input sensitivity control; vibrator for uniform fader settings; illuminated momentary action; silent channel on control pushbutton; cue function operable both by fader

continued on page 78

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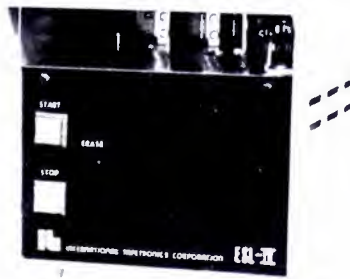
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new products

continued from page 77

overpress or momentary, silent cue pushbutton; Pennv and Giles conductive plastic attenuator with more than 80 dB of attenuation before cut-off, and 15 dB nominal "in-hand" setting; provision for in-

section of optional ancillary processing modules (equalizers, filters, limiter/compressors); illuminated momentary action, silent machine stop and start pushbuttons provided on all line input channels; fully balanced inputs and outputs; flexibility in output metering with alternatives including fixed program 1 meters, plus optional auxiliary meters with selector switch. (PPM metering and other customized meter configurations are available);

and modular system with front panel plug-in access.

For More Details Circle (81) on Reply Card

Tape recorders

The model designation of the new generation of Otari machines is Otari Mark II. Its features include separate transport and electron to allow mounting versatility in rack or console. DC capstan servo with standard $\pm 7\%$ pitch control, plug-in electronics for ease of service, complete accessibility on front and rear panels to electronics adjustments, and an interface jack coupling a dbx or Dolby noise reduction system.

Two versions of the Mark II are available, both with half-track (0.075 or 1.9 mm track) format: two channel quarter-inch and a four channel half-inch. Mounting configurations include rack (standard) and optional table top console or floor console.

For More Details Circle (82) on Reply Card

Slow motion machine

Arvin Echo drew crowds at the SMPTE Los Angeles convention when they unveiled their professional video slow motion machine, the SLO/MO-1.

Aside from its electronic attractions the SLO/MO-1 will be on the market for under \$50,000, a figure that should draw a lot of attention. The unit is transportable by technicians, since its weight is about 100 pounds. When used in the field, Arvin Echo says the unit should be immune to vibration.

SLO/MO-1 features include: high band color, electronic cueing, digital comb filter, digital DOC, and chroma invert. Arvin applied the same design as its EFS-1 head tape drive system, and added a digital processor, including a solid state field memory.

For More Details Circle (83) on Reply Card

12 kW VHF transmitter

A new data sheet and specification sheet on a 12 kW transmitter, model TT-447, utilizing two hybrid combined but totally independent transmitter assemblies to achieve 12 kW output is available from Acrod Industries.

The data sheet describes how low-level IF modulation is utilized to insure performance stability at highest levels of program quality. It includes a description of automatic fault sensing and optional module switching features along with inherent broadcast service quality.

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f hybrid combined power amplifiers included.

The data sheet provides information on the specially designed modulator operating at television IF frequencies; complete specifications are included on visual and aural performance along with service conditions and mechanical specifications for FCC and CCIR systems.

For More Details Circle (84) on Reply Card

Audio consoles

LPB has introduced its expanded line of Signature II series audio consoles, models S-13C, S-15A and S-14A. The S-13C, 8 channel stereo/multicast, S-14A, 5 channel dual mono and the S-15A 8 channel dual mono. Signature II series consoles feature LED peak level indicators built into the VU meter, mono/stereo mike switching on stereo channels, switchable mike preamp gain settings and additional input/output switching.

For More Details Circle (85) on Reply Card

Triple-deck cart machine

Ampro Broadcasting Inc. has introduced the CT5500, a compact triple-deck cartridge tape repro-ducer with all three playback decks driven by a single motor and power transformer.

The "Triple Decker" includes three completely independent controls: cue detection, playback audio, and supply regulation systems.

Transport decks are plug-in and interchangeable for easy cleaning and alignment. All circuit boards are rear accessible.

The CT5500 features full, reliable digital logic control and stepped, no-click FET audio switching. Audio output is +22 dBm. The boards freely interchange with Ampro single-deck systems.

For More Details Circle (86) on Reply Card

Framestore synchronizer

The Quantel DFS 3100 digital framestore synchronizer, successor to Micro Consultants, Inc. DFS 3000, has two fields of store for full picture processing capability. It locks non-synchronous incoming television signals to the station reference for smooth mixing into programs.

The on-air digital production control option is a remote panel that fits into a switcher. Using it, the producer can: initiate frame or field freeze and automatically update the freeze at selected intervals; compress a full video frame to one-quarter size and move it anywhere

on or off the screen with a joystick; select up to five fixed positions for compressed or full frame images on the screen and recall them automatically in any sequence at controlled, variable time intervals; automatically measure the center of a chroma key area and center a compressed picture so when the cameraman pans, the compressed picture automatically follows; automatically wipe or move the picture with controlled, variable

transition time; and make smooth cuts from compressed to full frame pictures.

Options include freeze, heterodyne color time base corrector, video compressor, joystick, remote control of engineering functions, and the digital production control panel.

For More Details Circle (87) on Reply Card

continued on page 80

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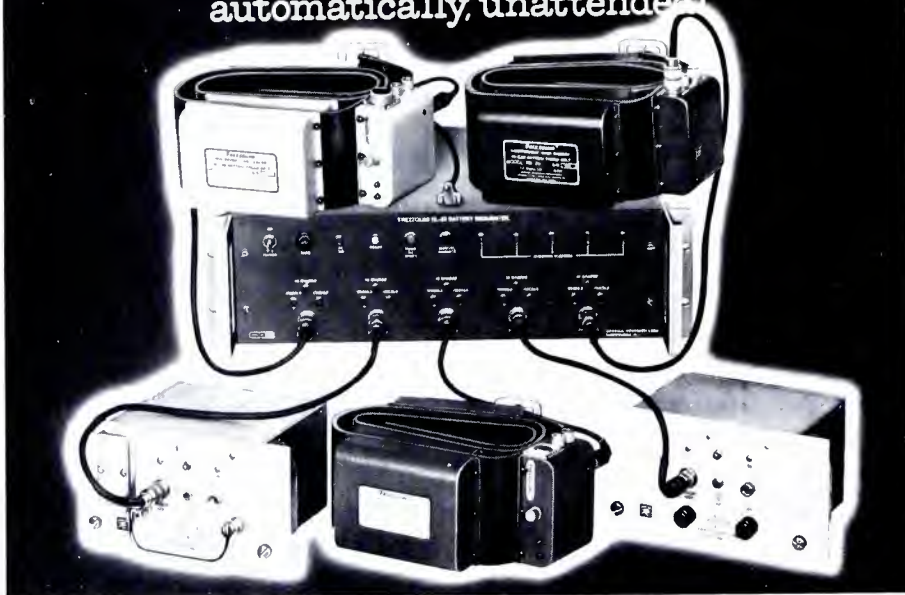
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**new
products**

continued from page 79

Audio consoles

The Ramko Research, Inc. DC-series is a remote-controlled console with rack mount electronics and low-profile main frame. The unit DC controlled and features two inputs for each of the 12 long-linear faders. Two 19-inch rack cabinets hold all output switching, mixing, attenuation and power circuitry.

Ramko's DC38 series consoles feature 4 inputs per mixer with interchangeable lighted input legend. The program, audition and cue LED readouts show input and output status at all times. Each input may be made to operate from mix through high level and all muting functions easily programmed with internal switches. The DC38 series consoles are DC controlled and are available in 5, 8 and 10 channel mono or stereo versions. Two solid state "VU" meters are standard on mono consoles and the stereo versions are standard with 3.

For More Details Circle (88) on Reply Card

ENG camera

The MNC-71/CP ENG camera manufactured by NEC and distributed by Cinema Products Corporation represents a technological breakthrough in the use of advanced integrated circuitry techniques.

The number of individual circuit components is reduced through the use of large-scale integrated (LSI) circuits. This results in stable performance and more reliable circuit operation.

For More Details Circle (89) on Reply Card

technical data

Telemet—The "Transmitter Performance Test Manual" is a 32-page booklet describing methods for checking visual transmitter performance. Proof-of-performance tests required by the FCC are discussed, as well as procedures on how to use the Telemet "Transmitter Test Package."

The manual is divided into several subject categories, including: checking your equipment; sideband response, with tips and precautions; envelope delay; transfer effects; incidental phase modulation; and spectrum analysis. In addition, charts are provided to plot response curves with the outside limits indicated.

For More Details Circle (90) on Reply Card

IEEE Press—Digital Signal Computers and Processors, edited by Andres C. Salazar of Bell Laboratories, is an up-to-date compilation of carefully selected papers dealing with the hardware aspects of digital signal processing. The book's emphasis is on the architecture and applications of high-speed computers and processors that implement digital signal algorithms.

The 44 reprinted papers are organized into architecture; economics; comparisons, trends; elements of a digital signal processor; and, applications.

This 352-page volume, sponsored by the IEEE Computer Society and the Acoustics, Speech and Signal Processing Society, is priced at \$12.00 for the paperbound member edition. A clothbound edition is available for \$25.95 (\$19.95 for IEEE members).

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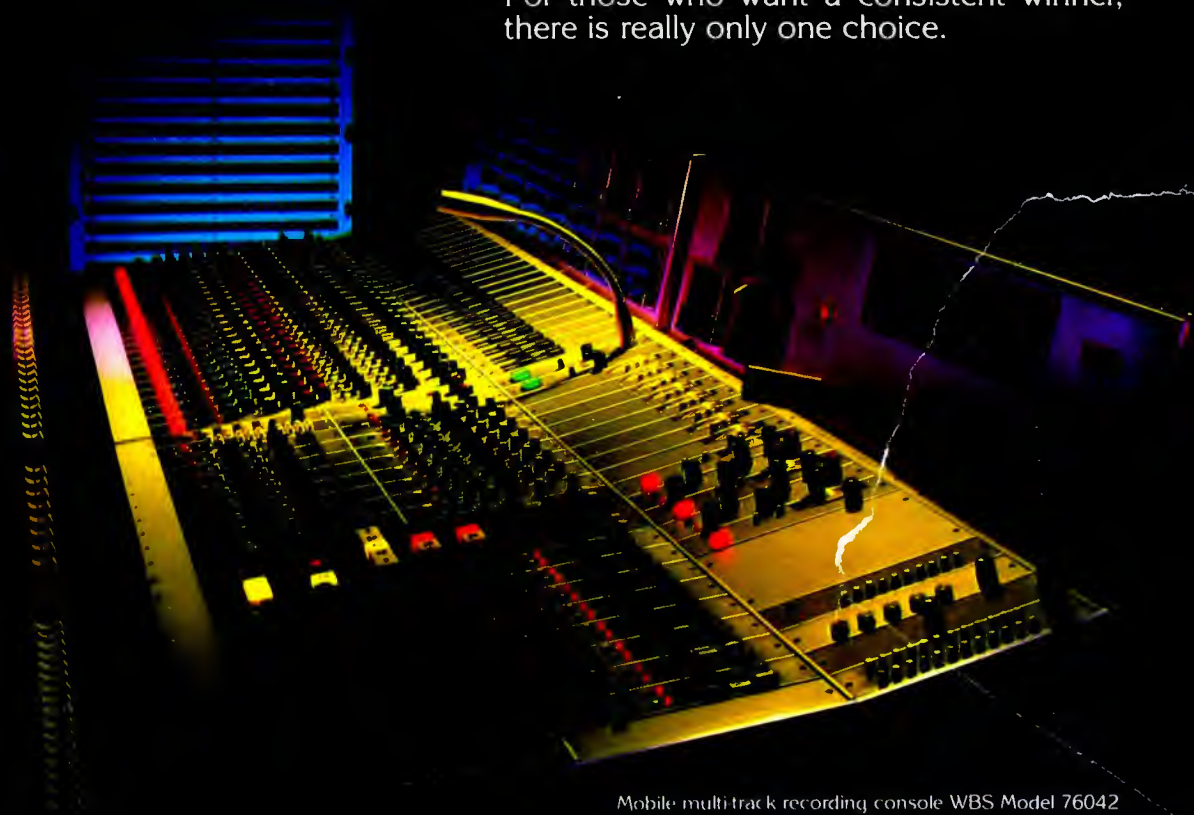
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