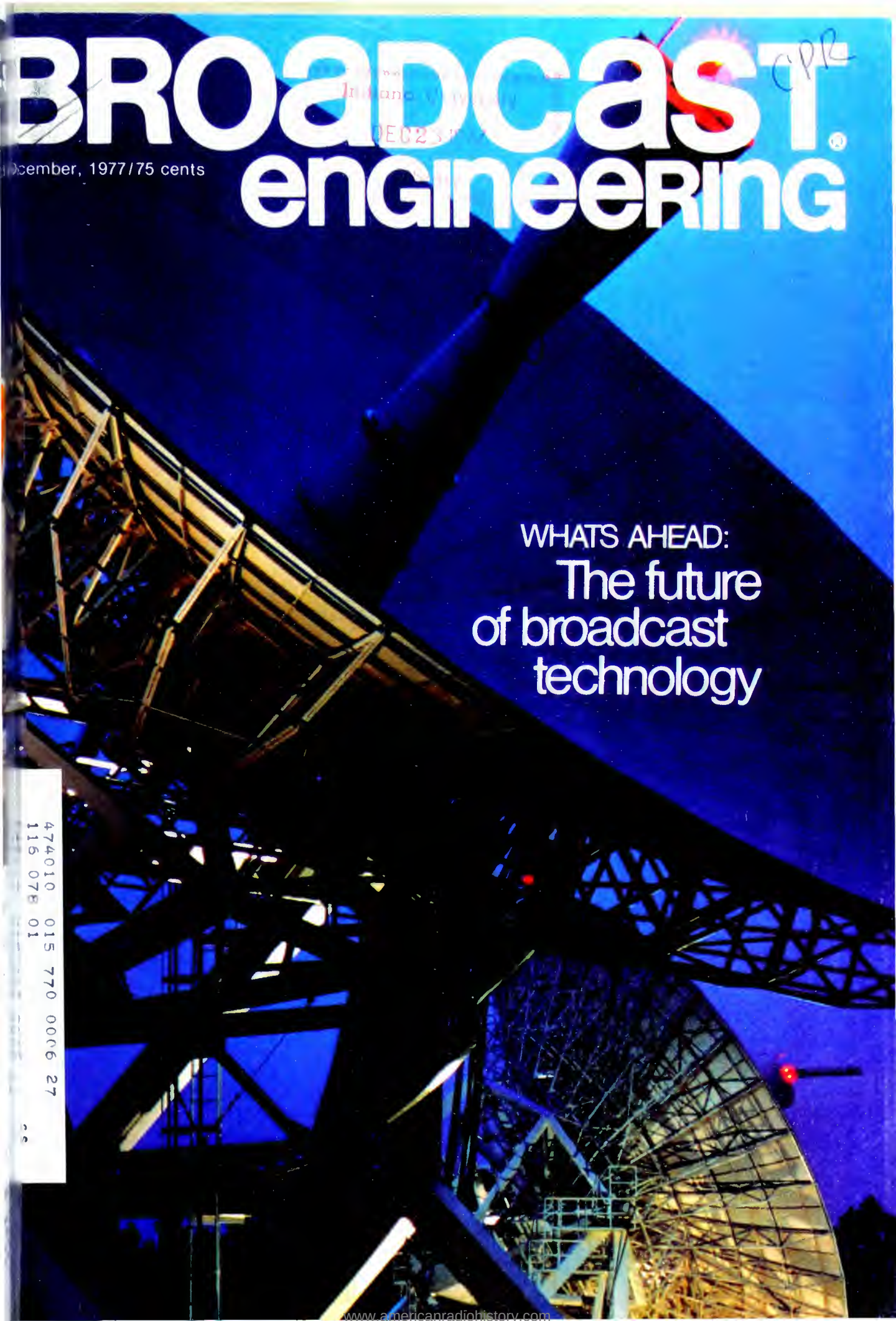
BROADCAST ENGINEERING

December, 1977/75 cents



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December, 1977 ☐ Volume 19 ☐ No. 12

BROADCAST ENGINEERING

The journal of the broadcast-communications industry

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About the cover

Our cover photo shows tw large-diameter antennas at East Coast earth station, d signed and built by Harris Corporation. Our lead artic on domestic communicatio satellites begins on page 3 (*Photo courtesy of Harris Corp.*)

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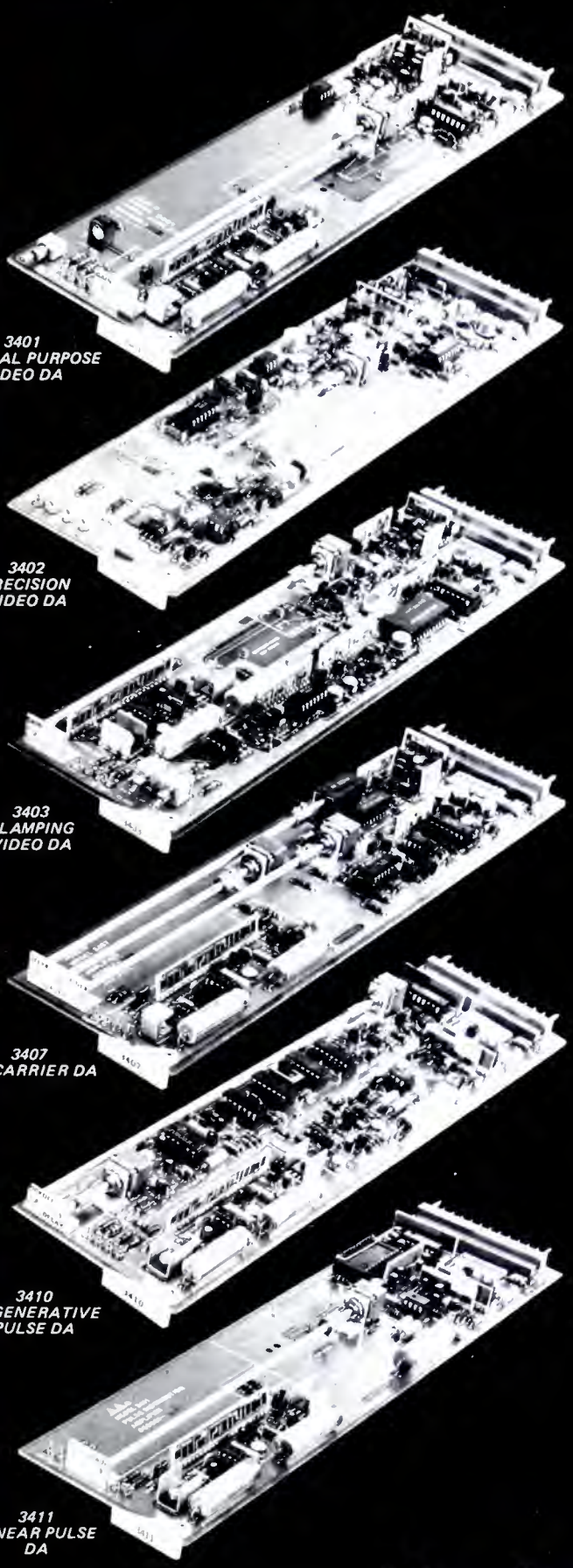

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DIRECT CURRENT FROM D.C.

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 pa

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DIRECT CURRENT FROM D. C.

continued from page 4

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 deni 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 con ducting 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 inte because rumors imply that the receiver would make it possible to a sign adjacent TV channels in the same city. It also is suggested that land-mobile channels could be squeeeezed closer together.

Long Distance AM Interference

In response to complaints originating with the telecommunications authorities of New Zealand (New Zealand?), the commission is now m ing plans to investigate possible interference between clear-chann stations on the West Coast of the U.S. and AM stations in New Zea- land. 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 fr 640 kHz to 641 Khz and the New Zealand station from 1070 kHz to 10 kHz. The theory is that the 1 kHz beat note will have the potentia for greatly increased interference. Attenuation of the skywave ov these long paths is expected to be much less than typical skywave attenuation since the reflections from the earth's surface on whic long distance skywave propagation depends will occur at regions of high conductivity, namely, the surface of the ocean.

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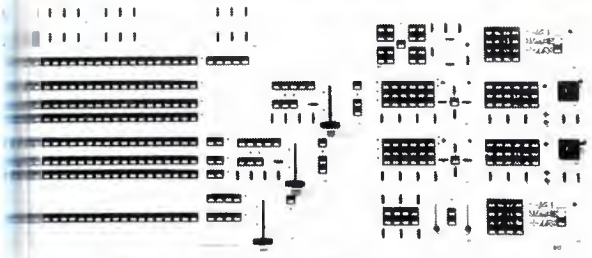

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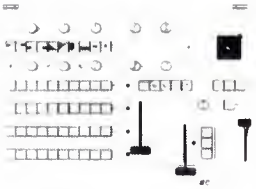

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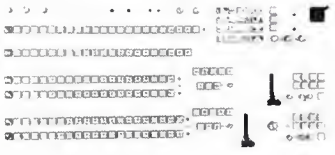

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industry news

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-in 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 9150

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 indentification 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, by 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 or 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 nitor, from Sony?

It sounds too good to be true.

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

And all in a screen size asured diagonally) that will ke a sizable impression on n a king-size audience.

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

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®

registered trademark of Sony Corp
PVM-2550 Trinitron Color Video Monitor

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Why you should continu
Plumbicon® TV tubes i

The future for ENG grows brighter and more exciting with each passing day. The same can be said about the ⅔-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 ⅔-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 ⅔-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 cr parameter in ENG. the field, where you have no control over ligh you need the Plumbicon tube's greater sensi to maintain an acceptable signal-to-noise ra your final edited news story. Even in those ne impossible lighting situations, you are more a sured of producing a useable picture with a Plumbicon-equipped ENG camera than with same camera equipped with the Saticon.

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

Resolution specifications are a good exan this principle. Plumbicon tube sensitivity give enough latitude for aperture correction with little loss in S/N ratio, to achieve the require 100% modulation depth at 5 MHz, but the re tion of most ENG *systems* is limited by the vi tape equipment used. From the systems perf ance point of view, therefore, a pick-up tube chosen solely for its resolution specification have no positive effect at all on picture qualit

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

specify ⅔-inch our ENG cameras.

mperature Stability

he Plumbicon's photoconductive layer is sed at temperatures in excess of 175°F, lumbicon tube can tolerate temperature rions that may take the photoconductor to The Plumbicon tube tolerates 160°F am- ithout damage of any kind. The Saticon, er, will experience partial or complete layer ction at these temperature levels after a few lt is totally conceivable that your ENG will experience temperatures which will he Saticon tube in your camera to ch a critical life condition.

e Based upon actual operating experience with the Plumbicon, rather than on sta- f accelerated life testing, you can expect o 5 years of service, depending upon ang practice.

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

gistration The Plumbicon tube incorporates a n gun assembly for controlled geometry istration. Our final testing includes a com- ed registration check which matches each erformance with a data base which in- readings on previously tested tubes. Should e fail to match up to this data base, it is d. This is added insurance that your camera ntain precise registration even after you your original Plumbicon tubes. Needless you *do not* have to replace the Plumbicon "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:
Amperex Electronic Corporation,
Slatersville Division, Slatersville,
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Telephone: 401-762-3800.

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TOMORROW'S THINKING IN TODAY'S PRODUCTS

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continued from page 8

jority 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 shapin of the radiation pattern in th vertical plane of a transmittin antenna by electrical means so tha maximum radiation occurs at a angle below the horizontal plan *Mechanical beam tilt* is the inten tional installation of a transmittin antenna so that its axis is no vertical, in order to change th normal angle of maximum radiatio in the vertical plane.)

The FCC explained that vertica radiation pattern control accom plished by beam tilt was achieve through either electrical or mechan ical means or a combination of both

The Commission noted that b controlling the angle of radiation i this manner, a station's servic area may be optimized witho causing harmful interference t other stations.

Current rules require that th maximum effective power radiate in any direction above the horizon tal plane be as low as the state o the art permits and not exceed th effective power radiated in a hor zontal direction in the same vertica plane.

The Commission said this requir ment, written before high-gain an

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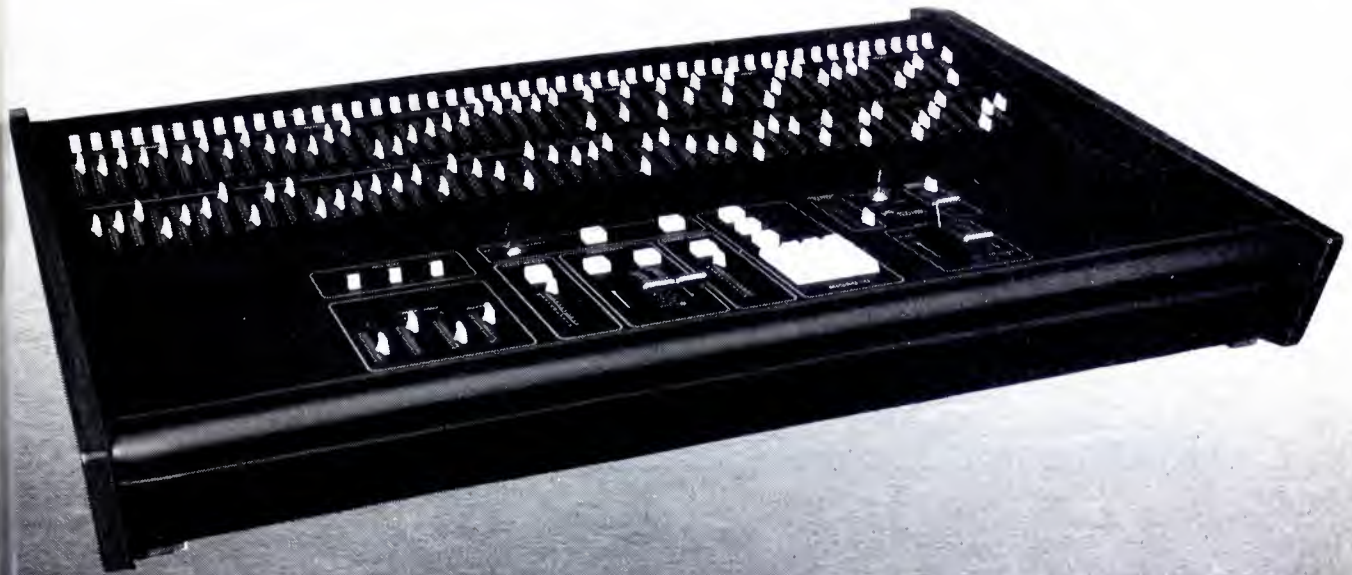
A memory lighting control system complete with 2 scene preset capability.



Strand Century's new Micro-Q is economical, compact, portable and designed to grow with you. You can buy Micro-Q with memory or, if your budget doesn't allow for it now, install the memory later by plugging it in. All it takes is a screwdriver. Micro-Q — the new modular scene preset system with independent Master, Grand Master and split dipless Crossfader, with a 200 preset memory, micro processor 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.

Strand Century leads in memory lighting control systems for the broadcast industry. At Strand Century we speak your language.

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news

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 inform a system designer of t degree to which a proposed terr trial communications system mig interfere with existing satellite s tems has been developed by t Office of Telecommunications (OT

Eldon Haakinson and David Sk ner, engineers at OT's Institute Telecommunication Sciences, c vised the program, called ORB CHECK.

Program ORBITCHECK is a sponse to domestic and internatio regulations limiting the power a antenna beam pointing of terrestr system transmitters towards t geostationary orbit. Output for P gram ORBITCHECK consists of tailed summaries of how close planned system's antenna bea points toward the geostationa orbit for various atmospheric fraction conditions. In addition, t program's output shows whether t planned system is in complian with regulations; ORBITCHECK therefore of potential value spectrum managers.

A report entitled "Power a Beam Pointing Restrictions for G stationary Orbit Avoidance: P gram ORBITCHECK User's Manu describes the program, its limi tions, and its use. The report (Report 77-119) is available from t National Technical Information S vice, 5285 Port Royal Road, Spri field, VA 22161. The cost is $6.

Ground terminal semina scheduled for Kansas Ci

A three-day seminar on satel earth terminal technology is sch uled for Kansas City, Missouri fr January 16-18, 1978.

The seminar, conducted by Hug Aircraft Company's microwave c munications products, is one o series on ground stations used CATV system operators to rece satellite-transmitted television grams. It will be held at the Holi Inn, Kansas City International port.

Technical management perso from both broadcast stations CATV systems will be briefed on theory and practice entailed in use of satellite receiving termina

The seminars are tuition-fr registrations are accepted o first-come/first-served basis. further information, contact Re trar, Hughes Microwave Comm cations, Products, Building 237, Box 2999, Torrance, CA 90509.

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For More Details Circle (12) on Reply Card

news briefs

Videodisc study group formed

About 30 people attended th organizational meeting of SMPTE videodisc study group, according t *VideoNews*. Representatives fro RCA, MCA, Thomson-CSF, sever government agencies, broadcaste and software producers agreed the need for SMPTE to look in videodisc technology.

The group is looking into th possibility of SMPTE acting a arbiter in videodisc standardizatio procedures (as it has been in th 1-inch helical standards discu sions). A major report is due April 1978.

New digital effects device used for World Series

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

Features include variable redu tion or compression from full fran down to the size of a postage stam variable picture positioning, pictu freeze, and automatic noise redu tion.

Ampex updates helical recorders

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

Station totals released

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

NRB convention scheduled

The 35th annual convention of t National Religious Broadcasters scheduled for January 22-25, 1978 the Washington Hilton Hotel Washington, D.C. Speakers inclu Abe C. Van Der Puy, NRB pre dent; Malcolm Muggeridge, Brit author and television personali and author Marabel Morgan.

continued on page

Exclusive from cinema products

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.

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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 North America. For further information, please write to:

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Log entries

January

5-8—Electronics Industries Association/Consu er Electronics Group 1978 Winter Consum Electronics Show. Las Vegas Convention Cente Hilton Hotel, Las Vegas.

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

16-18—Satellite earth terminal technology ser nar, conducted by Hughes Aircraft Compan Holiday Inn, Kansas City International Airpo Kansas City, Missouri.

16-20—National Association of Broadcaste joint board meeting. Cerromar Hotel, Pue Rico.

16-30—National Association of Farm Broa casters' agricultural seminar at sea. Aboa Queen Elizabeth II sailing from East Coast to L Angeles.

19-20—First US/Southeast Asia Telecommuni tions Seminars Program and Exhibit. Hy Singapore Hotel, Singapore.

23-25—Imero Fiorentino Associates' seventh gional Television Lighting and Staging Semin Workshop. Loyola Marymount University, L Angeles.

22-25—National Religious Broadcasters' 3 annual convention. Washington Hilton Hot Washington, D.C.

29-Feb 1—Association of Independent Te vision Stations' fifth annual convention. Vacati Village, San Diego.

March

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

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

17-19—National convention of Intercolleg Broadcasting Systems. Biltmore Hotel, N York.

April

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

9-12—National Association of Broadcaster's nual convention. Las Vegas.

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

May

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

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

24-27—National Association of Broadcast radio programming college. Hyatt Regency Ho Chicago.

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

ntroducing all the features you'd expect from a graphic and a parametric equalizer. 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.

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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.*

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For More Details Circle (92) on Reply Card

people in the news

Radio/Television

Terrell Metheny is the new president and gene manager of radio stations WRIT and WBCS, Milw kee. Methany will oversee the switch of WRIT from all-news format to country and western. Metheny w vice president-general manager of radio stati KJET/KWIC, Beaumont, Texas.

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

KLUGE

KUNTZ

DELKE

Jack Miller is the new president of the Colora Broadcasters Association. Miller, general manager KCOL-AM/FM in Fort Collins, succeeds **Carl And son**, president of KREX-AM/FM/TV in Grand Junctio

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

Manufacturers/Distributors

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

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

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

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

continued on pag

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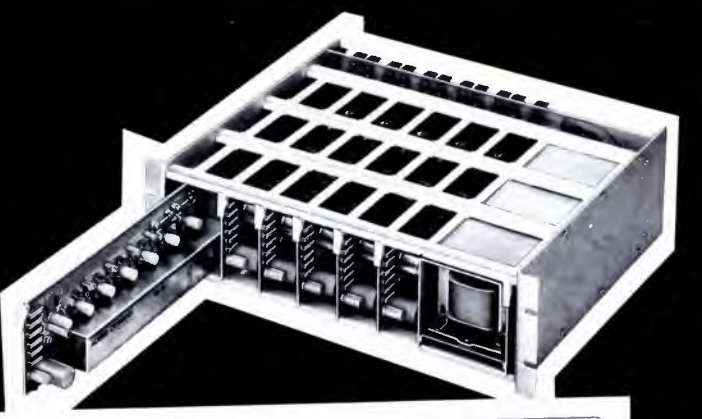

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people in the news

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 p forming arts. Edgren has experience in lighting a stage design, having worked with such performers Lou Rawls, Dionne Warwick, Ben Vereen, Isa Hayes, Tony Bennet and Lena Horne.

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

BUCKMAN

SZEGDA

SCHKOLNICK

Edward W. Watts has rejoined Cetec Corporation corporate vice president, a title he last held from 19 to 1971. Watts was also president of Instrume Specialists Inc., until the firm was acquired by Flu Manufacturing Co. Watts then joined Fluke as weste regional manager.

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

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Joe Roizen (right), BE's video editor, and Ron Merrell (center), editori director, talk with Joe Flaherty at the SMPTE conference in Los Angele (*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 privat interview with Flaherty, and also tour of the Studio City facility set u as a working model of a "film style TV studio. First the interview.*

"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."

BE: *Why a new approach to T program production when it seem that all the hardware has final been perfected for the old way?*

continued on page

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.

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For More Details Circle (24) on Reply Card

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 programs in Hollywood as the f demonstrations of ENG in Washi ton, D.C. ('71) were to the televis broadcasters who saw it then. (interest was to equalize 16mm ne film with portable ENG equipme and we have succeeded. Our pr ent goal is to make these pictures good as 35mm feature film sto and we believe we have dem strated this with our Studio C installation.

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

BE: *The pictures look good, h about the sound?*

Flaherty: The new one-inch heli VTRs that we are using have bet sound than the 35mm film, a there are three full-quality au tracks available. We will give t viewing public better images a better sound with this new systen

BE: *Do you expect the other n works to adopt the CBS methods f future production?*

Flaherty: Actually the networks today make little of their ov entertainment programming; most it is acquired from independent pr ducers. We have built a moc

continued on page

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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 becaus there is less hardware (no contr room, no production switcher, r fixed lighting, etc.) and fewer pe ple needed, reducing both capit cost and operation expenses.

Our analysis shows a substanti saving per episode in a typic sitcom series. We took a few of ou normally filmed programs like Th *Betty White Show* and shifted t tape with equal or better results a considerable savings in time an money. We see the future singl camera arrangement for "fil style" electronic production as a improvement over what we ar showing right now.

The Studio City TV Center

From the outside they look like typical film stages, domed barns clusted 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 com pletes this rudimentary set up.

Adding up the benefits

Flaherty explained some of th benefits while the tour group wa on the shooting stage. First, the se stays on the stage because it' cheaper and the studio isn't special The tri-axial camera cables elimi nate "fire hose" problems wit earlier color cameras. The cinema tographer calls the shot on lightin and f/stops, and there are n changes.

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

Bill Nicholls shepherded the dem onstration of the editing sequence i the van. A section of *The Bett White Show* was used as a example.

The three VTRs running in-fram lock replay what each camera saw A fourth recorder is fed from th switcher and the cuts, fades o dissolves are made on cue. Sinc original takes are always available they can be previewed, altered, o redone at anytime. The heart of thi system is s synchronizer built b CBS to lock the VTRs in constan step.

Time code is identical on eac tape for any scene. By calling up particular frame number, all re corders will search that point an

continued on page 3

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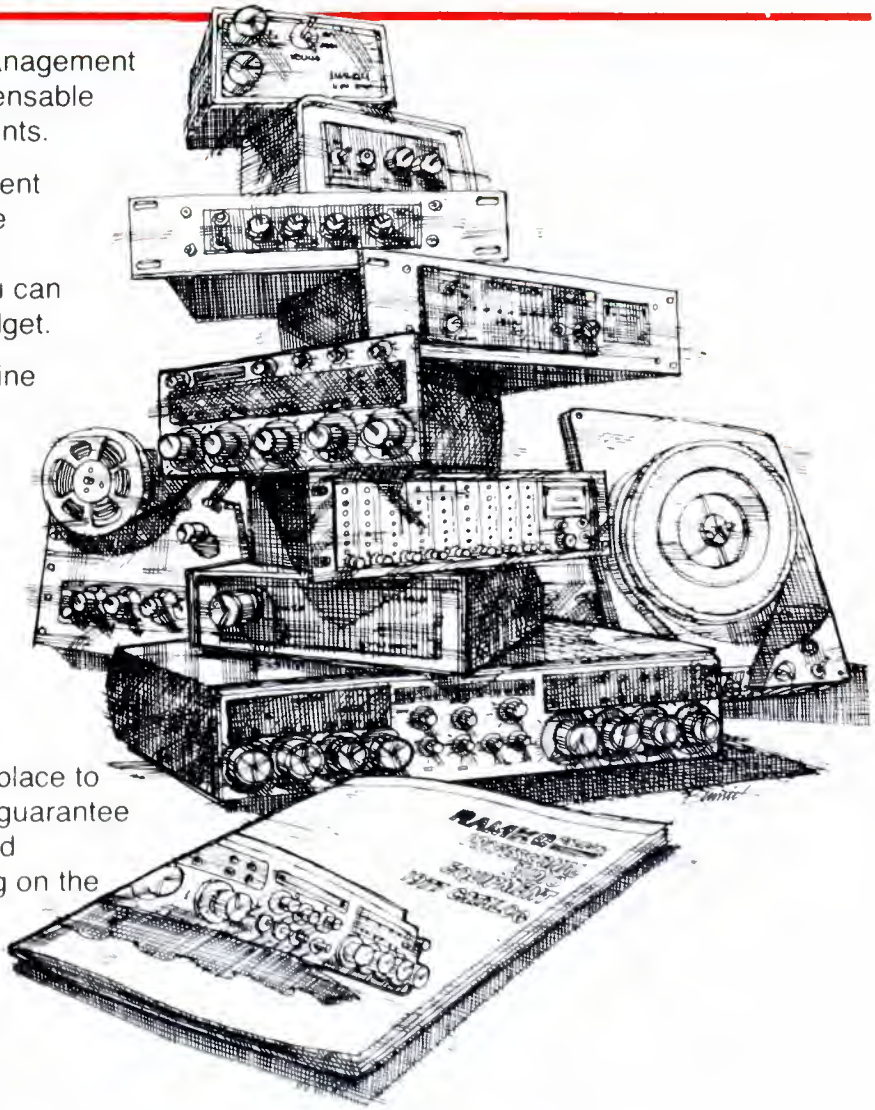

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CBS revolution

continued from page 30

park within a few frames. After play command, the recorders qu ly lock up in absolute frame num synchronization. Warning lights flash to alert the operator in cas any malfunction. The great adv tage is the slow/stop motion ca bility of the helical VTRs and retention of a recognizable image to 30 times normal speed wh searching an edit point.

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

According to Nicholls, the ope tion in the mobile unit comple 80-85% of the show. The rest routine post production, includ titles, credits, bumpers, open a close sequences or freeze fra done with a disc. Currently this done by transferring the mas program tape to quad beca that's what most post-producti facilities are equipped with. C expects to go to full post product with one-inch helicals because th are satisfied with both the mu generation picture quality a sound quality of these new VTRs.

Summary

The demonstration was inde impressive, and if Flaherty's figu are correct, they should certai interest other program producers

Sitting in the control room of t mobile unit and watching the VT on the monitors back up or ra forward to a selected frame numb is conclusive evidence that t system is fast. Parked on s frames with easily readable ti code in the picture makes precise identification of cut poi which can be jogged in and out one frame at a time. The "mov ola" (videola?) approach shou gladden the heart of any dyed-the-wool film editor. The pictu hold color up to 10 times play spe (however the sound goes Mic Mouse!) and stay identifiable black and white up to 30 tim normal, a feature that must celerate selection of scenes by considerable factor.

But most of all, the simplicity the installation and its inher mobility must surely mean th film-style television production us these kinds of electronic packa will have a great impact on 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.

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 domes communications satellites are used only occasiona by major television networks for around-the-wo coverage of major sports events (such as t Olympics) or news coverage of some political hot sp The fact is that direct satellite-to-station progr distribution is just around the corner. If your ra station has a network affiliation, there is a g chance you will see a small-aperture satell receiving antenna mounted on your roof in not-too-distant future.

There are several reasons why radio networks n are planning to use dometic satellites to distrib programming. Namely, satellite distribution is far l expensive than land line services; and, the techni quality is superior. A 15 kHz audio circuit satellite, on a cross-country hop, is no more diffic to achieve than a cross-town hop is for a local-stat STL. Other reasons include increased reliability service and less equipment, resulting in fewer possi sources of problems.

Looking back

In 1963 SYNCOM became the first communicati satellite placed in a synchronous orbit, an orbit wh makes the satellite appear to remain in the sa place in the sky. Since then, other satellites, such EARLY BIRD, ATS, and INTELSAT, have ma satellite communications commonplace for the U government and other users.

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

Western Union placed the first U.S. private indus domestic communications satellite in orbit in 19 Built by Hughes Aircraft Company and dubb WESTAR I, it was placed in a geostation synchronous orbit above the equator (about 22,: miles above the surface of the earth) at 99 degr west longitude. Since that time, others have join WESTAR I to provide communications satellites four to five degree intervals (actually, thousands miles apart at that distance above the earth).

American satellites orbited include ATS-6 in 1974 NASA satellite which is the most powerful commu cations satellite to date. ATS-6 was used to cond broadcasting experiments in the Rocky Mountai Alaska and Appalachia. It is presently positioned o India.

Others are SATCOM satellites, operated by RCA domestic private industry use; INTELSAT IV-A, wit capacity of over 6,000 voice channels and two channels; another WESTAR; and finally in 19 COMSTAR, owned by Comstat and leased to AT&T

Broadcast user satellites

Of all satellites, the ones of most interest to t broadcasters are the WESTAR and SATCOM sa

continued on page

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They're here now

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

Satellite operation

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

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

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

The satellite systems

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

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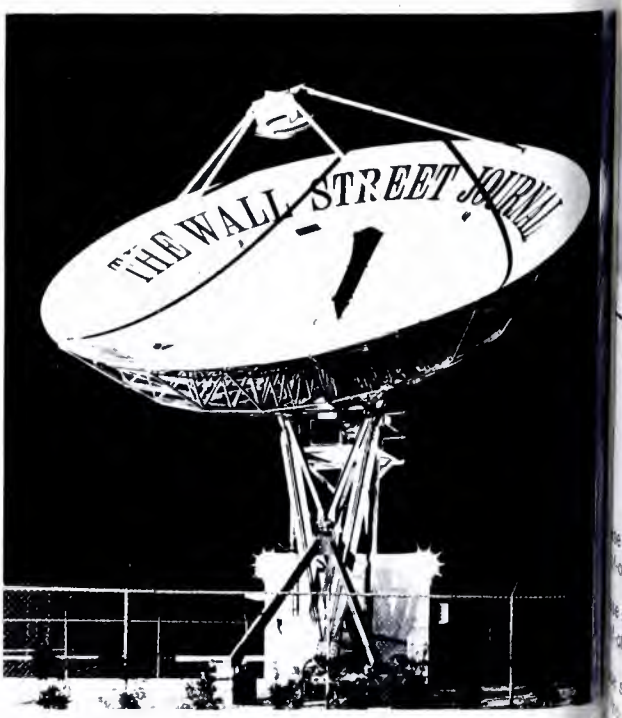

The Wall Street Journal's 4.5-meter (15-foot) receive-earth station located near Kissimmee, Florida. (*P courtesy of Western Union.*)

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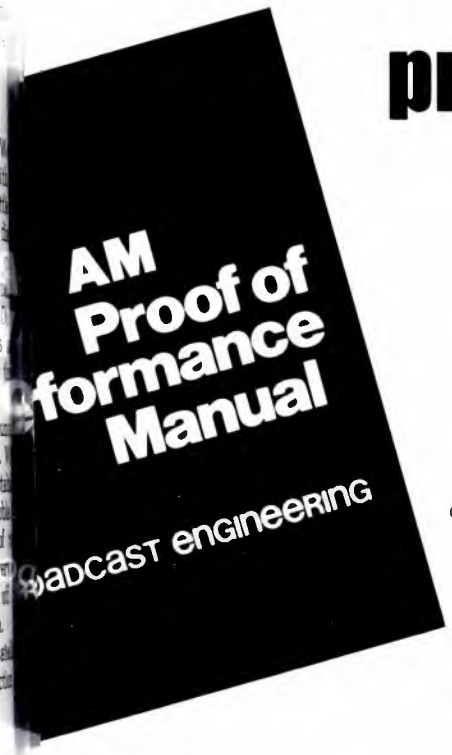

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This domestic communications satellite transmit and receive station in Rayburn, Texas is operated by RCA American Communications, Inc. The dish antenna, 33 feet in diameter, carries private line telephone, facsimile, television and data communications, 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, Wester Union has decided a good trade-off is from eight to te channels per transponder. This depends on the size the receiving earth station antenna, audio bandwidt and noise tolerance of the total system. The aud bandwidths offered by most satellite operators a 4 kHz, 8 kHz and 15 kHz. They also are offering mon stereo and even quadraphonic, if it is requested.

Getting back to earth

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

At an international meeting of the world's commur cations leaders in 1974, technical standards f communications satellite earth stations were pr posed. It was determined that receive-only station in order to allow 4-degree spacing of satellites, shou have antenna specifications that meet a mathematic value of $32-25\log\theta$ (θ = theta). This meant that communications satellites would operate on the san frequencies, with low power transponders, a goo G/T (gain-over-noise temperature, which is similar signal-to-noise ratios), and good side interferen rejection from terrestrial signals.

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

All domestic communications satellite services a handled by the common carrier section of the Feder Communications Commission.

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

However, the common carrier section of the F wrote rules stating that in order to meet F requirements for earth receive-only stations, you h to use a 9-meter (30-foot) dish antenna. It made difference that the physically smaller horns could located in places where a 30-foot dish would not permitted, or because of nearby terrestrial circu on the same frequency, a 30-foot dish could not adequately shielded and the smaller horn could.

As of January 1977, the FCC has issued new ru

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

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

he most recent offering and the one most resting to radio broadcasting is a system devel- by Hughes Aircraft called the Satellite Audio eiving Terminal (model SART-401). This system ists of a three-meter (10-foot) dish on a simple -z (elevation-azimith) mount. Mounted at the focal t of the dish is an air temperature LNA with a e temperature of 240 degrees Kelvin (very noisy by ious systems). All this yields some very high- ity audio signals, and the basic antenna (LNA) converter is expected to market for around 00. This is a dramatic decrease in hardware cost nine-meter systems costing $150,000 each or ot transmit-receive systems running into the ons. It is clear that the equipment has arrived to satellite-to-studio feeds practical right now.

Getting approval to operate

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

ice 15 watts more than 22,300 miles away dn't stand a chance with a 100-watt microwave mitter a few miles away, the FCC is attempting to erve quiet zones used by satellite receivers ed between the webs of present terrestrial its. It also is working to coordinate future nsion of the terrestrial circuits so as not to re the known quiet zones.

ore applying for an earth station permit, a ency coordination study is required. Three lting firms that do this are Comp-u-con of Dallas, s; SAFE (Spectrum Analysis and Frequency eering) of Arlington, Virginia; and Comsearch, of Oakton, Virginia. These firms have all the nt existing terrestrial 4 GHz circuits stored in computers, and they can tell almost immediately r site is sufficiently quiet for good reception.

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

14-foot horns and smaller aperture dishes will equire this step. The next step will be local g. Again, this will apply normally only to the er dishes.

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They're here now

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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:	± dB 50 Hz to 15 kHz
Harmonic distortion:	Less than 1%
Gain stability:	±0.3 dB/Day
	+__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 kH

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

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

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

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

Setting up the antenna

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

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

The only information you need now is the horizontal imuth) and vertical (elevation) angle from your ation on the earth to the satellite. Since you know re north, you can draw the angle from true north the antenna's azimuth with simple measuring tools, n tilt the antenna back to achieve the proper vation angle. Once these course adjustments are de, turn on the receiver and while metering the C voltage, rock the antenna on each axis until a imum signal is received. It is that simple. One w setting up a demo unit did the alignment portion 0 seconds.

System limitations

espite all this improvement regarding the state of broadcast art, you know there must be some wbacks. You're right! There are some. One, of rse, 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.

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 corporate 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 say... he felt more comfortable behin... camera than behind a podi... (Camoin is TD/cameraman; win... of the Peabody award; and, pion... in the use of the minicam ... dramatic productions on-location...

Following the Sony presentati... Mike Madigan, ASTVC vice pr... dent, presented the ASTVC C... munity Service Award to Pe... Tuffo, who accepted on behalf ... WNEW-TV. The award was given ... WNEW for its outstanding 12-p... documentary, "The Cost of Crim... and in-depth series probing ... criminal justice system in New Y... City.

The National Service Award w... given to John Fisher of the Ameri... Security Council for the documen... ry, "The Cost of Peace and Fr... dom." Janet Doka, ASTVC admi... trative assistant, gave the award ...

John Chancellor was inducted i... the ASTVC as an honorary mem... by Bob Zweck, national preside...

AWARD

John Chancellor

Chancellor accepted the honors ... saying that "there is a kins... existing between all members of ... crew and the anchormen" whic... both necessary and important ... the successful production of e... evening's program. He outlined ... important it was to the "on-came... person to know that he could c... on the teamwork of experie... professionals. Chancellor appe... to be getting ready to "turn-tables-around" and "roast" Zw... when Zweck literally ran bac... NBC saying (over his shoulder) ... he had to return for the 11 o'c... news.

Mike Madigan brought the n... ing to a close by wishing everyo... "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 the 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 interfacing, telephone services, and in the aircraft industry. In short, OF communication technology has taken off.

How it works

Figure 1 shows how the OF principle works. The video and audio signals modulate a light emitter—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.

continued on page 44

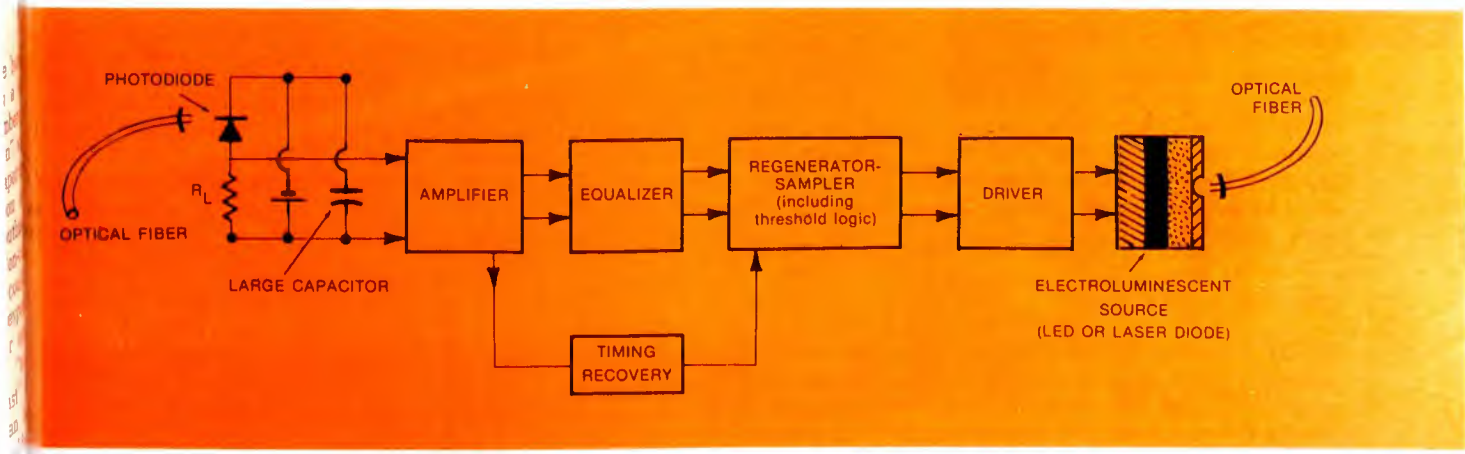

Figure 1 A repeater-amplifier for an optical fiber link would look something like the above, with a photodiode in series with a load circuit and power supply with a large capacitor by-pass. An AC-coupled amplifier is in parallel with a large resistor. The rest of the unit consists of an equalizer and a regenerator, which feeds the driver for either an LED or laser diode. 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 effectiveness, 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.

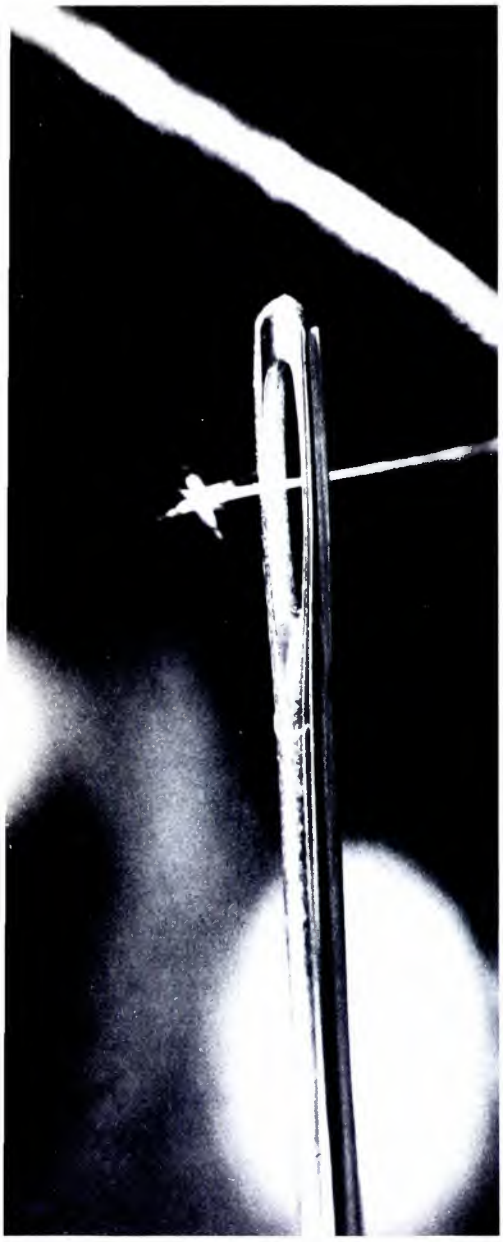

Figure 2 A standard-size sewing needle is used to illustrate the extremely small size of a piece of optical fiber. The fiber is 90 microns thick, which is about the size of a human hair. (*Photo by Ron Whittaker*).

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 include such things as the light-gatherin capacity of the fiber, the specia ratio of the core to cladding o coating, and the exit angle of th light propagated.

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

Low loss

Tremendous progress has bee made in light transmission capabili ties in glass fibers. Although a bean of light normally will be stopped i conventional glass after a few feet the highly purified glass now bein used for OF communication is trans mitting light up to six miles (10. km) without amplification. Wit simple repeater-amplifiers thi distance could be extended almos indefinitely.

By comparison, coax links—de pending upon quality, etc.—requir re-amplification five to ten time more often.

Immune to outside interference

Since light is being conducted in stead of RF energy, the familia problems of RF interference ar eliminated. Even if an OF sheat opens and external light hits the OF most of the light will be absorbed b coatings or cladding. In the unlikel event that outside light would fin its way into an OF, static or nois still wouldn't result, just a gradua attenuation of the signal. This als means that the OF signal couldn be shorted, grounded or affected b moisture.

No problems with leakage

Once again, a troublesome prob lem is eliminated since RF isn involved. Cross-talk, induction an leakage are not a concern. (Th problem of illegal interception als is virtually eliminated.)

Safe

Related to the above are safet from sparks in explosive atmospher and safety from electrical hazards

Insensitive to temperature variations

Unlike copper or aluminum co ductors, OF is not affected b

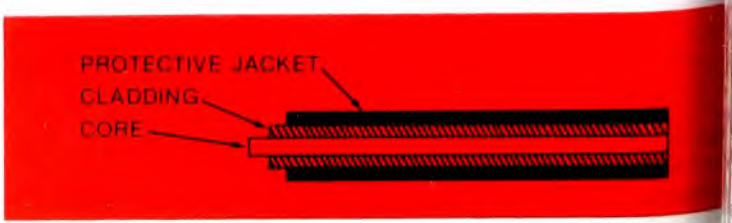

Figure 3 Optical fiber waveguide. Optical fibers typically are fabricated from two compositions of glass. The core, which has a very low absorption coefficient, is surrounded by a second type of glass (cladding) with a slightly lower refractive index. Light is guided down the core by means of total reflection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

...perature variations (up to 1,000°

...remely small size

...he OF is only about 90 microns ...k, which, as stated earlier, is a ...e larger than a human hair. (A ...ron is one-millionth of a meter.) ...ince the extremely small size is a ...e impractical to work with, and ...e the OF strands must be pro-...ted, the fibers are encased in a ...ath which typically brings the ... up to about 1 cm in diameter. ...n, numerous fibers are encased ...ne "cable."

...as fragile as coax

...here might be some argument on ... depending upon criteria, but ...use of an outside coating (such ... Teflon™), the fibers are very ...ble. In fact, in experimenting ... the OF strand used in the ...e-of-the-needle picture," the ...or could loop the OF and pull it ... to the size of a dime. When it ...released, it snapped right back ...straight line, undamaged.

...r cost

...is point also depends upon how ...figured. Since there isn't high-...ne production at the present ... prices are probably as high as ... will ever be. Keep in mind, ...h, that the main ingredient in ...glass fiber is *sand*—something ...there always will be plenty of. ...ontrast, the cost of copper ...ates greatly, and is somewhat ...d U.S. control. In the last 10 ..., over 10 billion pounds of ...r have been used in making ...unication cable. At a billion ...ds of copper per year in ...'s unpredictable world market, ...usly there is a need to look ... closely at alternative media.

... current price for the highest ... of OF is about $1 a foot. ... quality OF runs as low as a ...cents a foot. However, once ...olume production gets off the ...d, OF costs should drop ...atically. This means the cost ... be appreciably below coax ...wisted-pair copper wire.

... with today's costs, some ...vers maintain that OF is ...er than coax when operating ...ses and long-term costs are ... into consideration. But, with ...y variables present this early ... game, bottom-line costs are ... impossible to determine.

...ight

... weight of OF links ends up ... a small fraction of that of ... 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 Manhatten 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. □

SMPTE technical conference features production techniques

By Joe Roizen

The SMPTE's new formula for single annual national conferen once again has proved a maj drawing card for the latest membe ship reunion held in October at L Angeles' Century Plaza Hotel.

There were a good number distinguished visitors from abroa including James Redmond, the BB genial director of engineering; Mic el Oudin, technical director for t SFP, France's national network; a Lord Veda of Outer Space. Ea made presentations to the membe ship.

The technical sessions

The SMPTE ran concurrent tec nical sessions broadly categoriz as film- or television-oriented. Wh this report concerns itself primar with the electronic side, it is int esting to note that the newest te vision production techniques bei instituted or proposed lean towa film methods, but substitute el tronic imaging and recording for t film medium.

Monday's opening session,

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

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

...ch C.B.B. Wood of the BBC ...sented Sir Charles Curran's pa... reflected the director general's ... that film was still the major ...ium in European TV operations. ...ndicated that television services ...ally consume more film than the ...ma industry and that, not with...ding efforts by TV engineers to ... quicker and simpler production ...ods via electronic picture gen...on, there was little probability ...film consumption would dimin...n the near future. He felt that ... though electronic production ...making progress, camera mobil...sensitivity and ease of editing ...gave film the edge.

...ring the Monday afternoon ...ions, chaired by Bill Connolly of ... the gamut of papers reported ... wide range of new techniques. ...ille McMann, speaking for a ... of researchers at the Thomson-...Labs in Stamford, gave some ...ling details about their new ...al noise reducer for NTSC ...led signals. It's the same unit ... shown at NAB earlier this ... 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 ...t.

...G. Newhauser of RCA followed ...a review of the latest in color ...ra pickup devices, the Sati... This tube now going into ... ENG and EFP cameras has a ...f desirable characteristics ... the author described.

...ping 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 quadruplex recorders at the Buttes Chaumont studios in Paris. The authors showed a SECAM-NTSC transcoded ¾-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 know 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-

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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 Vidtronics 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 Metr media) extolled the virtues of tim code editing in small market st tions. He claimed the addition time code in a small station ope ation improved talent, directing an planning. Time code also speeds u non-paying segments and thus free time on the machines for revenu producing activities, he said.

The morning papers were followe by a panel session which include the authors plus Len Lauk, a ne work manager for the CBC. Lauk opening remarks, made with co siderable cheek (with tongue i serted), questioned the need for a this expensive and complex gadget that depletes the CBC's coffer while adding little to program qua ity or content. In closing comment he suggested that the SMPTE pe haps should foster papers explai ing the latest intricacies in electro ics to non-technical types (like hin self) so they can better assess th value of such devices in the operation.

Audience questions to panelis followed no particular theme, but

as noticeable that film-oriented embers wanted to know what it ok to make the transition. Coutel as asked if film editing was erequisite to VTR editing. She plied, "No, but it would not rt."

Joe Flaherty of CBS chaired the ernoon session and got off to a od start by telling the audience t tape was inherently cheaper n film.

Bernard Laramee of Milestone oductions described the Holly-od Editors Guild view of the ure. Laramee explained that the ld has recognized the need for training their members to handle e editing. They have installed a X System 50 and contracted for on-time code editing set up.

Blair Benson gave George Gould's er on post production at Tele-nics. Benson's major point was t the editing system of the future ld be a modernized version of random access, light pen actu-d CMX 600 of which only a few e ever built. (Teletronics has that Benson swears by.) He cribed a few modern color rection techniques by electronic ns which provide high quality great flexibility.

Audio post production came un-the scrutiny of Tom Keller of BH in Boston. He described the io pitfalls of a quad VTR and many of them could be avoided good design and better tapes. ir own tests have shown that the penetration of the video head cts audio quality. By the time back out the head so the ure disappears, the audio is t. He predicted that the 1-inch hines will be better in this rd.

The last paper was given by Bob ankuch of Bell and Howell, who ewed the expanding market for production hours in the future. ording to Pfannkuch, the future leproduction is an assured one large growth areas in feeding appetites of not only the ex-ded broadcast operations, but the new markets such as trical, educational, government, consumer.

The afternoon panel convened Al Malang of TAV joining the p and made a short state-t. The questions again leaned ard Laramee's presentation on future role of film editors in There also were questions

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ONE THING ABOUT THE NEWS BUSINESS: YOU NEVER GET A SECOND TAKE.

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"Scotch" MBU Videocassettes.

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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 st dominates TV prime time by a 70: ratio, but this would continue shrink as the techniques they a instituting become more widesprea

Flaherty's major point was th with this kind of equipment, fil companies can get into TV ele tronic image generation witho discarding the creative talents a ready on hand. MTM, which w completely film-oriented, now using this system for two curre sitcoms, *We've Got Each Other* an *The Betty White Show*.

James Redmond of the BBC the showed the current production tec niques used by his organizatio Some of his statistics were interes ing since they affirmed that ele tronic production yields the mo program hours in their operatio According to Redmond, the lio share of new programming (67%) i done with TV cameras, 31% is don on film, and a mere 2% comes i via satellite.

The BBC also has taken gre care to color-match film and elec tronic images so they can b inserted into each other witho objectionable color shifts. (Author' note: the color matching unit i called TARIF, which stands fo Technical Apparatus for the Rectifi cation of Inferior Films.)

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

Michel Oudin of the SFP gave a ilar summary of television in nch network studios. The SFP is organization of more than 3,000 ployees with studios in Paris and ewhere. Oudin also declared t film was still better adapted for ma production, but he showed w the SFP is employing a single- nera production technique with tronic equipment to cut cost. y are experimenting with port- e cameras such as the Microcam 1-inch helical VTRs like the N. They still edit on 2-inch quad, eventually that will change, lin said.

his year the SFP will produce e than 2,000 hours of programs ch feed the three national net- k channels, TF1, A2 and FR3. in expects the single camera in style" production with EFP pment to provide good program lity at considerable savings in future.

lenry Zahn of Fernseh provided omprehensive description of his pany's Type B helical recorder, BCN series. Zahn stressed that format already was ratified by SMPTE Working Group and that ral hundred machines are in cation, the bulk in Europe, with in North America.

s paper covered the existing

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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 ¾-inch cassette equipment.

Advanced technology session

The Friday morning sessi chaired by Charles Ginsburg Ampex dealt with the latest in technology and got off to a go start with a paper on fiber optics A. Tenne-Sens of Canada. He d ferentiated the system response 10 Hz to 16 MHz from the DC to 2 MHz response of the optical fib themselves. The major limits are t transducers and electronic syste which encode and decode the sign Non-linear distortions increase w the modulation factor of the L and it's hard to get straight li response overall.

Joseph Roizen of Telegen follow with a report on teletext technolo now in use in about five countr around the world. Roizen describ the well-established CEEFAX syst used by the BBC for their 100-pa "magazine of the air" service viewers, and the IBA counterpa known as ORACLE.

He also showed typical servic provided by French TV with a te text system known as ANTIOP Developed by their research facil in Rennes, this system perm allocating everything from a f lines in the vertical interval to t full set of picture lines for digi data transmission.

Robert McKenzie of Ampex plained the Hilbert transform ch ma processing in his compan Electronic Still Store. Using a subcarrier sampling for digital c version and comb filtering of chroma information, McKenzie scribed various optimization te niques for best picture quality. It difficult to fully separate luminar and chrominance signals when th is vertical movement in the ima but the technique of rocking subcarrier phases can help.

Gene Leonard of Da Vinci Syste was next with an electronic p posal which, if adopted, should place carpenters and scene paint in TV studios.

Leonard pointed out that the n element in TV image manipulatio the access to every picture elem in a digital frame store.

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

Revitalizing the Emergency Broadcast System

By Joseph J. Conte
EBS Program Manager National Weather Service

Since the early days of CONELRAD (Control of Electromagnetic Radiation), the broadcasters have been hearing muffled federal platitudes about organizing the local and state broadcast stations into cooperative warning dissemination networks. Even as recently as today, some broadcasters are playing the doubting Thomas role, where seeing is believing.

Oddly enough, the many voices of the past that rebuked attempts to formulate 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, and state and local officials in 38 locations. (Figure 1 shows the states where seminars and workshops have been held and where future ones are scheduled.) The multi-organizational coordination involved to schedule a program of this magnitude is unbelievable. An important factor, however, is that this was 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 six 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 of 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?

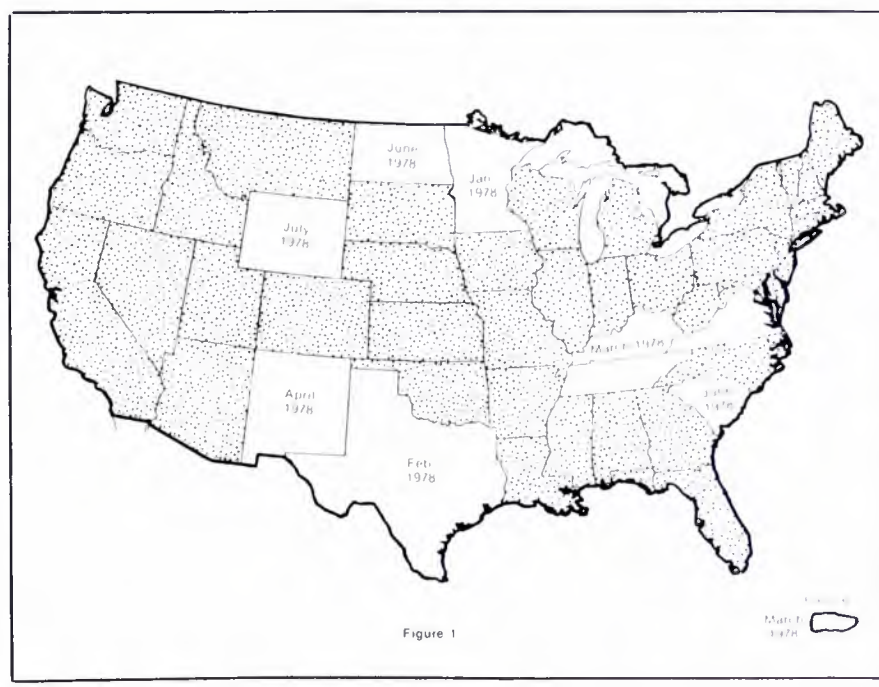

Figure 1

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 engine stands on top of the Motor Co to align the laser system during remote broadcast.

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

asier to install than telephone lines nd was capable of transmitting up 2,000 feet. The station then ntacted Lake Systems Corporaon, a local distributor, which rnished the system (model 761) for e special remote broadcast.

The 761 uses an infrared optical rrier, thereby avoiding FCC lisnsing requirements to transmit y one volt composite video signal m sources such as TV cameras, Rs, or demodulated microwave sebands, plus multi-channel highality audio.

According to Howard, the system very portable, and eliminates the ed for installing cables. More portantly, it transmits studioality sound under all weather nditions, except extreme fog.

Although Howard does not believe IB will use the laser system on a ular basis, he did say the station ght use it for future remotes nducted during special events.

While it has been known for some e that video signals could be t over short hops, not much ention has been given to audio nals on optical carrier systems. nfact, the bandwidth capabilities similiar to that of optical fibers. ndreds of audio signals could e been sent on the same beam. here is a problem, it's that the adwidth is so wide that other nals may hop a ride and arrive nvited. This, of course, can be ninated by special filters.

Beautiful music

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

Governor Michael Dukakis proimed September "WJIB Month" Massachusetts. And Boston's yor, Keven H. White, declared tember 15, 1977 as "WJIB-FM dio Day" for "providing New land listeners with fine quality sic, news, and public service grams from its location on hisic Commercial Wharf since 7." Commercial Wharf was reed "WJIB Wharf" for the event.

The station also received contulatory telegrams and letters m throughout the state, and from congressional delegation. WJIB d these, as well as taped ssages of congratulations from eral public officials, during its r-day celebration. □

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-designe console has auxiliary equalizers, and controller and group functions, giving the engineer more control and flexibilit (*Photo by Ray Garcia.*)

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

When new recordings arrive at e broadcast studio, many of us nd to take for granted the vast nprovement these offerings provide i audio quality over their predecesrs of a few years ago.

How often do we stop to consider at the success of today's "sounds" i often the result of a continuing rvolution in recording techniques H by a relatively small group of reative engineers, manufacturers, ad sound studios who continually rive to improve the "state-of-the-t"?

One example of this effort is iladelphia's Sigma Sound Studios. unded in 1968 by Joseph D. rsia, former Philco research-chnician turned audio engineer, gma Sound has energed in the 0's as the producer of the "Philly und," a distinctive blend of hythm & Blues with strings, horns, d other instruments usually asso-ated with classical music.

The current star of the electronic ow at Sigma is a combination of 2-track recording with automated gital memory and readout.

The console was designed by the gma engineering staff and custom anufactured by MCI in collabora-n with Allison Research of Nash-ille. The audio chain was intention-y kept as straight forward as ssible; it contains only four oper-ional amplifiers from mike to odule output, and is transformer-s at all high-level points. It has

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

veral engineering conveniences signed to allow quick set-up ring live sessions, including: an tomatic cue system with manual erride; automatic level presets for ack bouncing and doubling; cus-m equalizer, including a 12-fre-ency, two-slope high-pass filter; odule status LEDs cluster grouped; odule mode switching facilities on master or individual basis; depth mension held to within limits hich permits reaching the top of e 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.

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Mixing Down

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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 be replaced with an easy-going inter ty and self-assurance. The ability break down a composition into component groups, even single struments and vocals, then recc bine them into final form, h released the artistic side of t engineer.

The result of the Sigma-M Allison collaboration is that mo options have been given to t operator, without exceeding l capabilities.

Simple comparison with recor ings made only a few years ago sufficient to illustrate the vas improved potential of today's e gineering technology.

The storage/retrieval possibiliti of automated audio cut the tir needed to produce the desired e result; however, instead of getti down and going home earlier, t

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

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

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

According to Tarsia, the interp between user and maker has p duced most of the advance in t field, and while larger compan have the money and people in-depth R & D, the little person h an offsetting virtue of being a bet listener.

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

Tarsia, who still spends at le three days a week "at the boar and functions as both president a chairman of the board, heads team of 32 technicians and spec ists now located in two studios Philadelphia and one in New Yor

In charge of the technical side 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. □

eering, who also helps in the sign of oncoming generations of uipment that will help maintain ma Sound's competitive edge. rry Chipetz, general manager, rsees business in both Philadel- la and New York, while New k's day-to-day operation is han- ld by Gerald Block and Barbara isi.

igma has six studios, numbered the order of their development: nbers 1 through 3 have two 4-track layouts with capacity for ing and dubbing; studio 4 has r automated 24-track layout; num- e 5 is the newest studio, and is ated in New York; 6 is a small ing and copy studio. And, con- uction has just begun on a enth studio.

sked how broadcast stations ld 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."

ordings, the following comments faced:

'Every mono station should get a patible Stereo Generator to inate the 3 dB center channel ld-up which happens when ster- is directly summed to mono."

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

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 som members of the press).

The result was front-page pub licity in the evening *Examiner* an incoming newspaper clippings fro around the country for a month. A grinning, but chagrined Frank Fre had pulled off the station's greates publicity stunt—but unfortunately i wasn't in a rating period! *Peter V Taylor, KFOG.*

Gulf region is warm and moist

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

Maybe you had to be there tha hot, humid June day this year whe our weather girl was giving he usual concise national summary She read it this way:

"...and there is a region o warm, moist, *hair* around the gul region..."

She knew what she said, but tru to the calling, she forged ahea with nary a break in tempo whil the rest of us enjoyed to the fulles the only weathercast I can remem ber to feature its own SAG TAIL *Anonymous, Midwest gospel station*

Disco "Lucey"

A few weeks ago Governor Lucey of Wisconsin was to have a state wide telephone talk show which wa aired on many of the radio station 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 statio was having some trouble with the feed.

In a panic he grabbed the firs record in sight and put it on the air To his surprise, the record he ha grabbed was "Disco Lucy," a se lection he will long remember. *Tom Lewis, WNFL Radio.*

Lend us your bananas

Slipped on any blue banana lately? If the answer is yes, send us the peel for a laugh or two. If blue bananas aren't in your diet, and sag tails don't wiggle down your street get with it. Mail your bananas t Blue Bananas Editor, Broadcas Engineering, P.O. Box 12901, Over land Park, KS 66212.

news briefs

ntinued from page 16

sers measure satellite range

GTE Sylvania Incorporated has ivered high-accuracy laser sys- is to measure the distance be- ween earth and an orbiting satellite the National Aeronautics and ace Administration (NASA). Pre- ie measurements help scientists cument and compare motions of n earth's crust over a period of ars. These data and other stud- may result in a model that could lw the prediction of a global thquake pattern by 1985 and al earthquake forecasts by 1995.

ltec Lansing forms adian subsidiary

ltec Corporation's new Canadian sidiary, Altec Lansing of Canada .., will be headquartered in conto. Headed by Ron Marsh, the n will provide centralized ware- sing for national distribution and al inventory for immediate pro- t availability.

lajor advantages of an in- ntry subsidiary are that it allows lers to be invoiced and pay in adian dollars, eliminating cus- s restrictions and distance bar- rs, according to a company kesman.

ian receives Emmy award

arian Associates received a Ci- on of Outstanding Achievement Engineering Development at the evision Academy of Arts and ences' Third Annual Emmy ards Luncheon honoring creative s in television.

he award cites Varian for im- ving the efficiency of UHF kly- n tubes so that they use about o less electric power, thereby ucing a TV station's energy sumption, while still producing same transmission output.

&T orders satellite earth terminal

10-meter diameter satellite th terminal has been ordered m Scientific-Atlanta Inc. by &T Long Lines. The model 8002 meter earth station antenna has ecial reuse feed to operate with satellite; this feed provides ultaneous transmit and receive ability on the same polarization. ncluded with the antenna is a lter assembly containing fully undant high power amplifiers, 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.

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 wa high on the "wish list" for 1977. A promised, the commission delivere an ATS package which allowed FM and nondirectional AM stations t install a "magic black box." Severe manufacturers rushed to have hard ware available in time for th

Figure 1

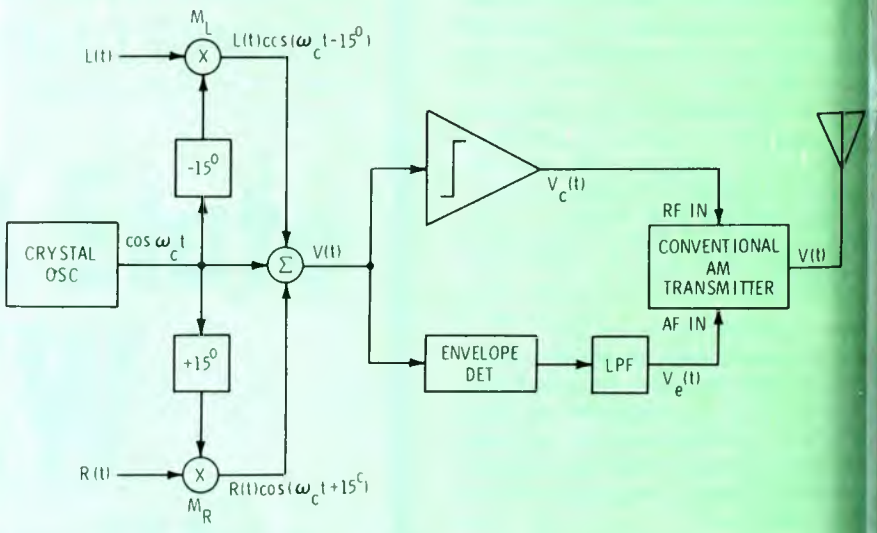
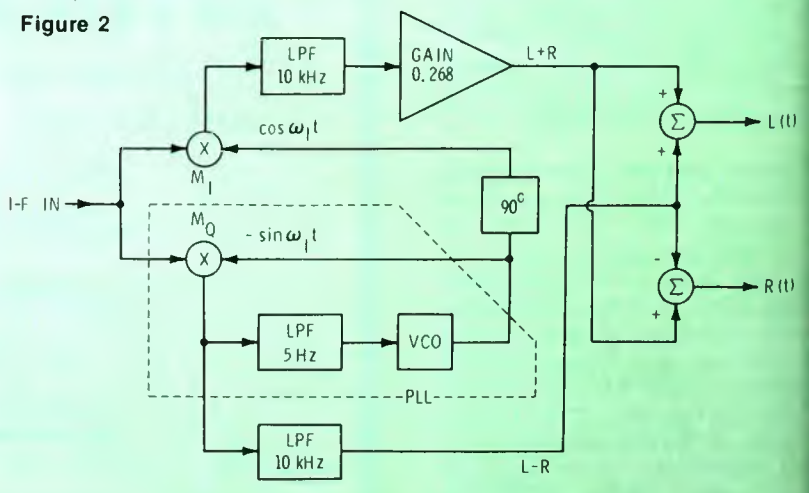


Figure 2



shington NAB. Most contenders monstrated imaginary systems t *might* be produced. In fact, the z word at the show was "ATS patible," whatever that meant. n reality, few dollars were spent broadcasters on ATS systems. A cloud labeled "let's wait and " seems to be hanging over the ble concept. Rules to permit AM ectionals and TV stations to rate under ATS were projected late 1977. If broadcasters are ing the floor in anticipation, v are doing it very quietly.

Finding the missing channels

ast year, we wrote in these es that results of the commis-'s tests on FM quadraphonic ld be out by mid-1977. A report ow out, but the journey will still a long one for quadraphonic ponents. The new deadline for ments is December 16, 1977 reply comments due January 1978.

M stereo, on the other hand, gained momentum. Several of proposed systems have changed ds during this year, and perhaps other subject has caused so y voices to be raised at various ventions and seminars across country. The National Am eo Radio Committee has com-d tests on the systems sub-ted to them. Several others are g submitted directly to the com-sion.

Harris Corporation, the johnny-e-lately in the AM stereo com-tion, has added another three-r acronym to our vocabulary: M. That's Harris-ese for Com-ble Phase Multiplex. Let's take a at how this system works.

Compatible phase multiplex

he basis of the CPM system is a of amplitude modulated signals arated in phase by 30 degrees. left-channel modulation is ap-d to a carrier lagging the ltant by 15 degrees, and the t channel to a carrier leading by degrees. The sum of these two is transmitted signal.

he received signal is broken n into two parts. Information earing equally on both left and t channels arrives in phase and ns the L+R signal. The differ-e channel information (L-R) does contribute as much to the L+R nnels since it is rotated by 30 rees.

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

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AM stereo

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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

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 plethera 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.

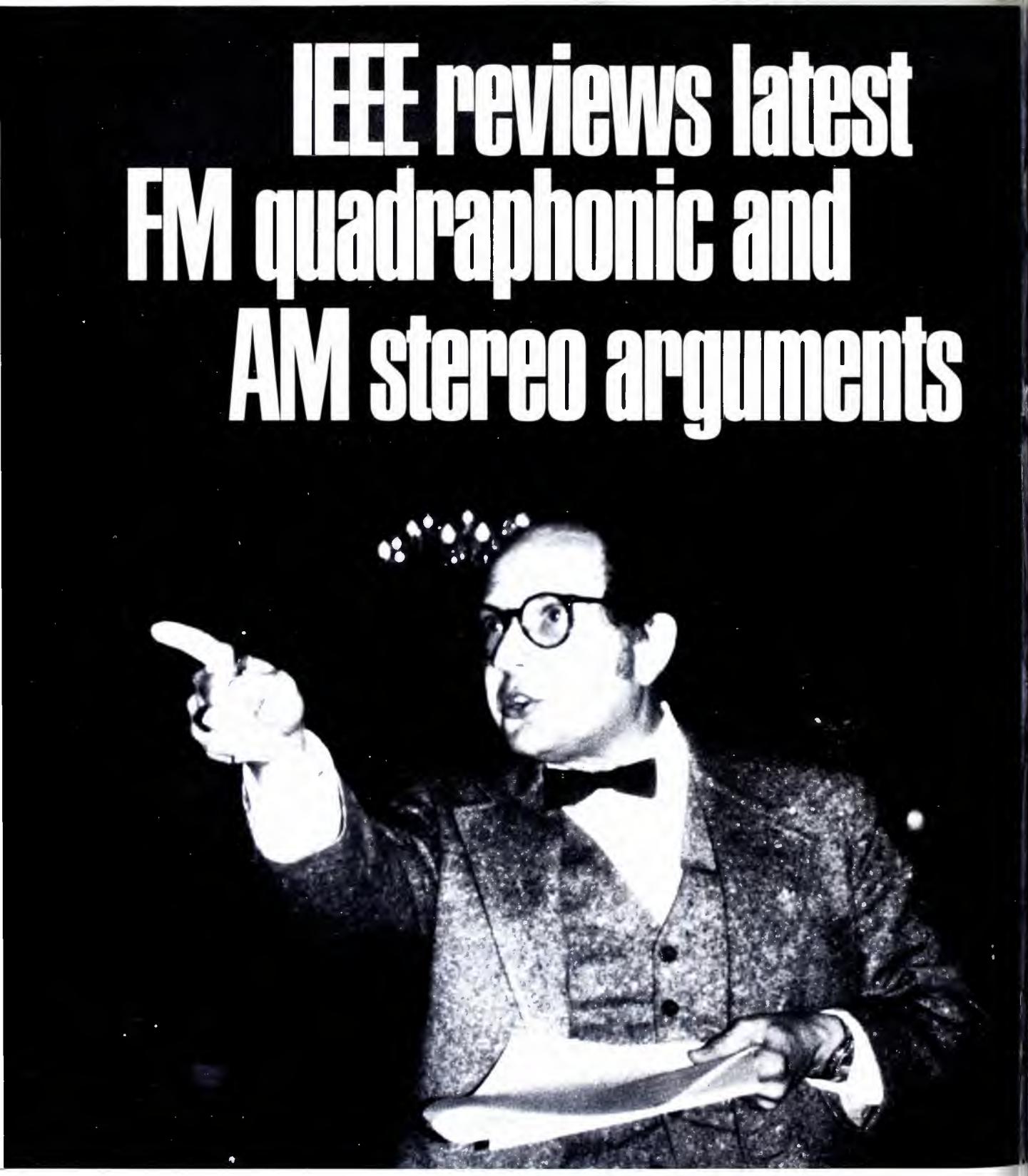
We have a choice to make: Either cater to the $10 portables or produce a high-quality sound for the sake of the expensive wideband receivers. We can't do both. Let's make this decision carefully. □

...reo systems. Under the right ...ditions, they all work and they ... sound good. Listening to a ...ording of an off-the-air stereo ...gal, or listening to a demonstra... with a low-power transmitter, ... audio is amazingly clean and the ...earation is good.

...What is difficult to evaluate is the ...formance of the entire system, ...luding receivers. Listening to a ...200 modulation monitor and lis...ng to a $20 table radio are two ...ferent animals. Of far greater ...portance (at least in the begin...ig) is the system's *monaural* ...formance. Many FM stereo sta...ns have failed to take mono ...eption into account, as is evi...ced by the phase cancellation ...ard on mono receivers. (All of the ...tion's employees listen in stereo ...d forget that a large part of the ...dience is listening in mono.)

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

IEEE reviews latest FM quadraphonic 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 quadraphonic and AM stereo, featured such well-known industry leaders as Emil Torick, Eric Small, Louis Doren, Leonard Kahn, and Norman Parker.

FM quadraphonic 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 quadraphoni and one AM stereo system will b selected by the FCC.

Quadraphonic discussion

The FM quadraphonic discussio opened with Louis Doren describin the ins and outs of the QSI discre system. Doren traced the history

SI quadraphonic to when it was st introduced as the Doren Quadplex System and described the 95 z SCA that could be transmitted ong with the quadraphonic signal. set of spectrum analyzer photoaphs demonstrating the system's mpliance with FCC-occupied ndwidth regulations was passed while Doren explained how the crete quadraphonic system actuy would take up less spectrum ace than a simple mono signal.

He also pointed out that all the -4 quadraphonic systems are ssing cousins" in that the methds of generating the rear-channel rmation are very similar, except modulation details and how the A is handled.

n reviewing recent activities of National Quadraphonic Radio mmittee, Doren explained that the o major matrix quadraphonic ponents, SQ and QS (referred to "pseudo quadraphonic"),dropped of the proceedings. We later ed Emil Torick of CBS Technolo- Center, representing SQ, why B dropped out of the NQRC. He d since the matrix quadraphonic tems could be transmitted under ting rules, there was little point participating in a committee to ommend a change in technical ndards. As you might expect, ick does not consider the SQ em to be "pseudo quadraphonic." ric Small, representing the ipon/Columbia System, followed en and surprisingly, spent little e on the details of that system. ead he presented an interesting es of slides describing some of work done by the NQRC, uding photographs of some of installations at broadcast sta- s. In the end, Small and Doren peared to work well together moting the concept of discrete draphonic, with Doren explainhow it is done and Small wing how it was tested.

lthough Gerald LeBow was a eduled panel memeber, repreting Sansui QS, he could not end due to illness in the family. t meant Emil Torick was left to end the matrix concept. After king a case for the superiority the CBS SQ approach over the er matrix systems, Torick pre- ted some charts showing how erage area based on signal-to- se ratio for discrete quadranic stations would be reduced atly. Doren and Small were not ressed, to say the least, with ren suggesting that CBS must ve used the worst of the discrete adraphonic systems for comparison. 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 speak-

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IFEE

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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 quadraphonic imagery than 4-2-4, but without as much signal-to-noise deterioration as 4-4-4. Torick once again mentioned that the only quadraphonic program meterial 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 quadraphonic 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 hav been hampered if there were limit tions in multi-track recording. Sma said anything but 4-4-4 could musically inhibiting.

The quadraphonic discussio ended with the basic arguments st unresolved, but everybody's positi was a little clearer. Any unbiase observor would have to admit eac system proponent had some goo points, and the best system depen upon one's priorities.

AM stereo

Chris Payne, NAB vice presiden presented a review of current A stereo systems which participated i the National AM Stereo Radi Committee. The data he presente demonstrated typical performanc for the AM stereo system as a grou rather than as individual system According to the data, if AM stere finally becomes a reality, the pe formance will be impressive. Pe haps renewed interest in AM audi quality will make it economicall feasible for receiver manufacturer to produce better quality units tha will make the broadcasters' audi efforts more effective.

Leonard Kahn, who made a independent presentation describin his own AM stereo system, su prised everyone when he announce that Hazeltine Corp. has entere into an agreement with him t develop Kahn system receivers, thu imparting important prestige to th Kahn effort. In a discussion of th relative merits of this system, Kah drew questions from the audienc as well as some heated respons from Norm Parker of Motorola.

Parker found his way to the stag and told the group in no uncertai terms that the Motorola stereo sy tem did not "split" under heav modulation as Kahn suggested. Kah inquired about the accuracy o Motorola's block diagram for th system, maintaining that analysis the diagram would prove his poin Parker pointed out that actual fiel tests, witnessed by Chris Payne showed no evidence of the phenom ena Kahn described.

A member of the audience ha commented previously about th "emotionalism" of the morning quadraphonic and AM stereo dis cussions, and Richard Cassidy sensing an amicable resolution wa not at hand, finally adjourned th session. Cassidy, National Publi Radio director of engineering an session chairman, had opened th morning activities looking forwar to a lively discussion, but at th close was probably grateful tha everyone walked away alive.

SOCIETY OF
BROADCAST ENGINEERS, INC.
P.O. Box 50844, Indianapolis, Indiana 46250

Why SBE?

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 the 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.

SBE forming chapters

MISSISSIPPI, JACKSON—Charlie Pearson, WMAU-TV, Route 1, Box 64A, Smithdale, MS 39664; (601) 567-2612.

MISSOURI, COLUMBIA—Robert Brockman, KOMU-TV, Highway 63 South, Columbia, MO 65201; (314) 442-1122.

NEW YORK, ROCHESTER—Frank Romeo, c/o NTID, Rochester Institute of Technology, 1 Lomb Memorial Drive, Rochester, NY 14623; (716) 464-6436.

NORTH CAROLINA, ASHEVILLE—Lee Davis, WLOS-FM/TV, Box 2150, Asheville, NC 28802; (704) 255-0013.

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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 water from a ruptured boot finding its way down through the magnet windings to the porcelain cap at the base 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 coral side of the TTU-55B Mill, but the unit activated giving the operator time to kill the high-voltage before disaster could occur.

The 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-

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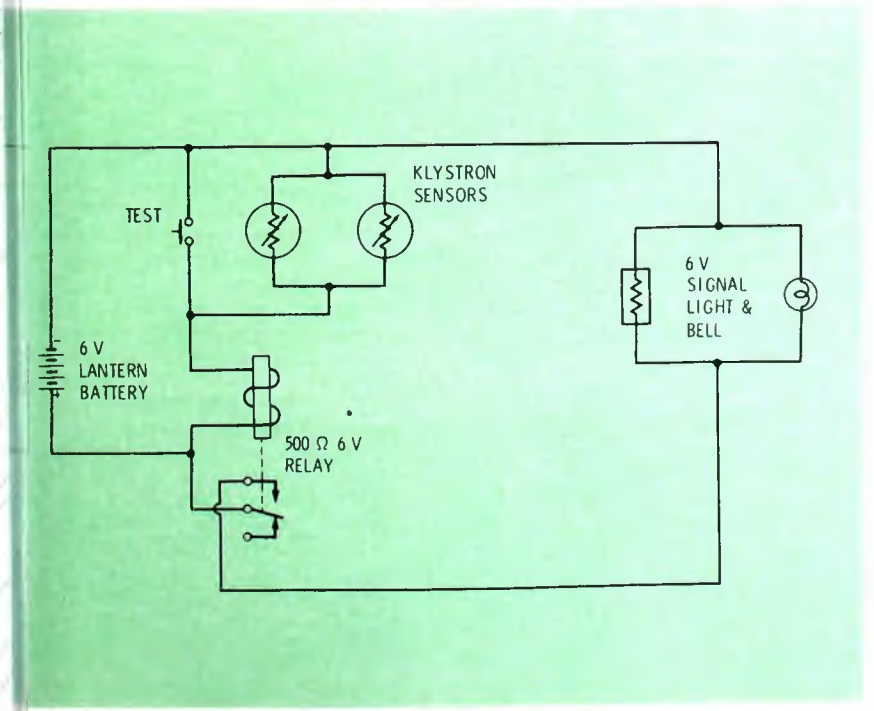

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tion takes place and a current in excess of 15 ma. trips the relay. Tests showed that approximately one tablespoon of water is sufficient to trigger the alarm.

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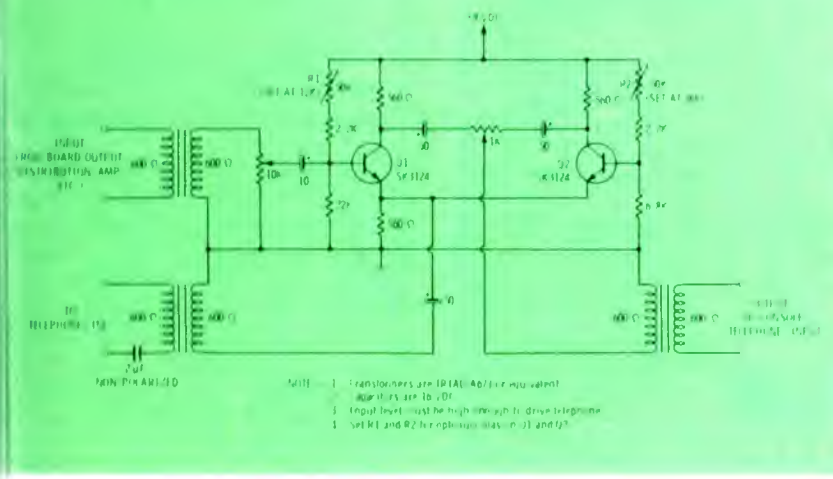
The *Handbook* can also be purchased directly from the NAB at $30 a copy for NAB members and $45 a copy for non-members. Write to: Station Services Dept., NAB, 1771 N Street, N.W., Washington, D.C. 20036.

tput, thus eliminating the feedck patch from DJ mike input to ard out back to the telephone ut. The DJ audio appears on the ard only at his mike mixer.

The telephone caller's audio feeds h Q1 and Q2 emitters and pears at the output in-phase, ding the board's telephone input. h 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



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 exciters. 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 Novembe issue of **Broadcast Engineering**, pr gram automation is coming o strong again. At NAB (now set fo April 9-12 in Las Vegas) a wal through the automation exhibits wi be well worth your time. State-o the-art systems are much mor flexible, and some feature CR readouts of what has been pr grammed, including availabilitie One manufacturer is using colo coded lines and showing the en tries in English.

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

Applause for the guests

FCC Chairman Richard E. Wile and House Communications Sub committee Chairman Lionel Va Deerlin were applauded during an after their addresses before th convention, but for different rea sons. Wiley was departing from th FCC after a job well done.

As for Van Deerlin, it wa appreciation for his comments o deregulation of radio and the ex tension of the license period tha drew a thankful applause. Va Deerlin suggested that the licens period run more than five year perhaps as much as 10 years! The turning to personnel changes at th FCC, he said, "We might see trend toward sharper regulation your industry. Our subcommitte may be the only voice left i government for deregulation."

New products

On the opposite page we a kicking off the New Products colum with a few of the products bein shown for the first time. Addition products shown at NRBA will b 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 preprogramming 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 R3000 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 calibrator for uniform fader settings; illuminated momentary action, silent channel on control pushbutton; cue function operable both by fader

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new products

continued from page 77

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

For More Details Circle (81) on Reply Card

Tape recorders

The model designation of the n generation of *Otari* machines Otari Mark II. Its features incl separate transport and electron to allow mounting versatility in ra or console, DC capstan servo w standard ±7% pitch control, plug-in electronics for ease of s vice, complete accessibility on fr and rear panels to electronics justments, and an interface jack coupling a dbx or Dolby nois reduction system.

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

For More Details Circle (82) on Reply Card

Slow motion machine

Arvin Echo drew crowds at SMPTE Los Angles convention wh they unveiled their professional v eo slow motion machine, the SL MO-1.

Aside from its electronic attri tions the SLO/MO-1 will be on market for under $50,000, a f that should draw a lot of attenti The unit is transportable by t men, since its weight is about pounds. When used in the fie Arvin Echo says the unit should immune to vibration.

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

For More Details Circle (83) on Reply Card

12 kW VHF transmitter

A new data and specificat sheet on a 12 kW transmitter, mo TT-447, utilizing two hybrid c bined but totally independent tra mitter assemblies to achieve 12 output is available from *Acrod Industries*.

The data sheet describes h low-level IF modulation is utilize insure performance stability at highest levels of program quality description of automatic fail sensing and optional modula switching features along with inherent broadcast service quali

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/simulcast, 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 models, switchable mike preamp pattern 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 reproducer with all three playback decks driven by a single motor and power transformer.

The "Triple Decker" includes three completely independent circuits: 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, repairable digital logic control and keyed, 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 plugs 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

new products

continued from page 79

Audio consoles

The *Ramko Research, Inc.* DC- series is a remote-controlled conso with rack mount electronics and low-profile main frame. The unit DC controlled and features tw inputs for each of the 12 long-lif linear faders. Two 19-inch rac cabinets hold all output switchin mixing, attenuation and power ci cuitry.

Ramko's DC38 series consoles fe ture 4 inputs per mixer with inte changeable lighted input legend The program, audition and cue LE readouts show input and outp status at all times. Each input ma be made to operate from mik through high level and all mutin functions easily programmed wit internal switches. The DC38 serie consoles are DC controlled and ar available in 5, 8 and 10 chann mono or stereo versions. Two soli state "VU" meters are standard c mono consoles and the stereo ve sions are standard with 3.

For More Details Circle (88) on Reply Card

ENG camera

The MNC-71/CP ENG came manufacturered by NEC and di tributed by *Cinema Products Corp ration* represents a technologic breakthrough in the use of a vanced integrated circuitry tec niques.

The number of individual circu components is reduced through t use of large-scale integrated (LS circuits. This results in stable pe formance and more reliable circu operation.

For More Details Circle (89) on Reply Card

technical data

elemet—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 object 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. for the paperbound member edition. A clothbound edition is available for $25.95 ($19.95 for IEEE members).

For More Details Circle (91) on Reply Card

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EQPT. FOR SALE (Cont.)

IGM 500 STEREO AUTOMATION. Four years old, excellent condition with spare parts. Available immediately. Consists of five rollouts, ten voice and music channels, one mono 48 tray Instacart, 500 step DA MOS memory with battery backup, remote control, 364J logger, SMC 382A time announcer, two SMC 250 sequential carousels, logger encoder, ten step music sequencer, silence sensor, three racks, 500 system control unit. $12,500 or best offer. **MUST SELL!** Original price $36,000. Contact Robert Royster, CE, KiFM, San Diego, (714) 560-9836. Went Live. 12-77-1t

BTS-IB RCA stereo generator, two years old in excellent condition. Two 400-foot rolls of Belden 6 pair shielded direct burial audio cable. Susan Brown, WEOS-FM, St. Clair Street, Geneva, N.Y. 14456, 315-789-5500. 12-77-1t

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HELP WANTED

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EXPERIENCED ENGINEER with first phone for southwestern VHF. Some operations, including remote controlled transmitter, but emphasis is on maintenance of studio and ENG equipment with minimum supervision. Duties could involve some light travel involving microwave maintenance plus maintenance and development of extensive translator system. A current airman's certificate would be helpful. Qualified applicants please send resume with references and salary requirements to Chief Engineer, KOAT-TV, P.O. Box 4156, Albuquerque, NM 87106. EOE. 12-77-1t

UNIT SUPERVISOR. Major west coast video production facility needs experienced mobile unit supervisor. Complete responsibility for equipment and crew performance as well as client interface on location shoots. State of the art cameras and video tape equipment. Send resume and salary requirements to Dept. 405, Broadcast Engineering, Box 12901, Overland Park, KS 66212. 12-77-2t

TV ENGINEER—EE or Electronics graduate (or equivalent military). Experienced all phases. Start as Assistant Engineer. Consideration for chief in future. 3-5 years experience. Career opportunity. Excellent benefits. Contact C. A. Perkins, Box 8887, Jackson, MS 39204. Phone 601-372-6311. Equal Opportunity Employer. 12-77-1t

TV ENGINEER (2 positions) immediately available at upper midwest university. Install, maintain, and operate broadcast and closed-circuit equipment. Award-winning, full-color operation. FCC 1st class license. Salary approximately $10,000, depending on experience. Equal Opportunity Employer. Send resume to Broadcast Engineering, Dept. 403, P.O. Box 12901, Overland Park, Kansas 66212. 12-77-1t

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INSTRUCTIONAL TELEVISION ENGINEER: Assume responsibility for completing conversion of monochrome system to color, including design and modifications, etc. Well-versed in maintenance of quad, helical and small format VTRs and familiar with Norelco color camera system. EE Associate Degree or equivalent. Three years related experience necessary. First class FCC license preferred. Norelco schooling opportunity, 22 days vacation, excellent benefits, competitive salary. Send resume to Personnel Department, St. Louis Community College, 5801 Wilson, St. Louis, MO 63110. An Affirmative Action/Equal Opportunity Employer. 12-77-1t

WE ARE LOOKING FOR A FIRST RATE EXPERIENCED TECHNICIAN capable of caring for a wide range of modern equipment in a large network affiliate. Must have a solid technical background and be heave on **EXPERIENCE** in most of the following: cameras, switchers and production facilities; transmission equipment and microwave; quad and helical VTR; audio mixing and recording equipment; digital devices; E.N.G., etc. First Phone required. Swing and some night shifts. Send full resume to Bob Plummer, KOMO-TV, 100-4th Ave. No., Seattle, Wa. 98109., (206) 223-4027. Equal Employment Opportunity Employer. 12-77-3t

POSITION AVAILABLE—Chief TV Engineer position available at Northern Illinois University. Responsibilities include direct supervision of technical staff involving; daily studio productions, remotes, campus R-F distribution system, equipment maintenance, videotape playbacks and television systems design and technical guidance. Phone((815) 753-0171, Ext. 80. 12-77-1t

WE ARE PRESENTLY SEEKING a competant maintenance technician to occupy a supervisory position at our remote controlled transmitter. Studio experience helpful; professionalism necessary. Call 304/525-7661. Equal Opportunity Employer. 12-77-tf

CHIEF ENGINEER—needed for AM-FM-Musak operation. Good salary for a good engineer. Near Detroit. Send resume to Engineering Dept., WHLS Radio, Box 807, Port Huron, MI 48060. 12-77-1t

CHIEF ENGINEER wanted for Fayetteville, Arkansas. Call 501-783-4105 or write KFPW-TV, Box 4150, Fort Smith, AR 72914. Attn: Don Vest. 12-77-1t

CHIEF ENGINEER, 5 KW AM, 10 KW automated Stereo FM. Western Colorado. Must have experience with directional antenna, remote control, STL, and automation. Salary open. Contact Robert Hale, Woodland Broadcasting Company. 303-249-4546. An Equal Opportunity Employer. 12-77-1t

HELP WANTED (Cont.)

TELEVISION—CCTV Video Maintenance Te nicians. Full Benefits. Greater New York, Suff County or New Jersey Area. Send resume VPC, P.O. Box 268, New Hyde Park, N.Y. 110 6-77

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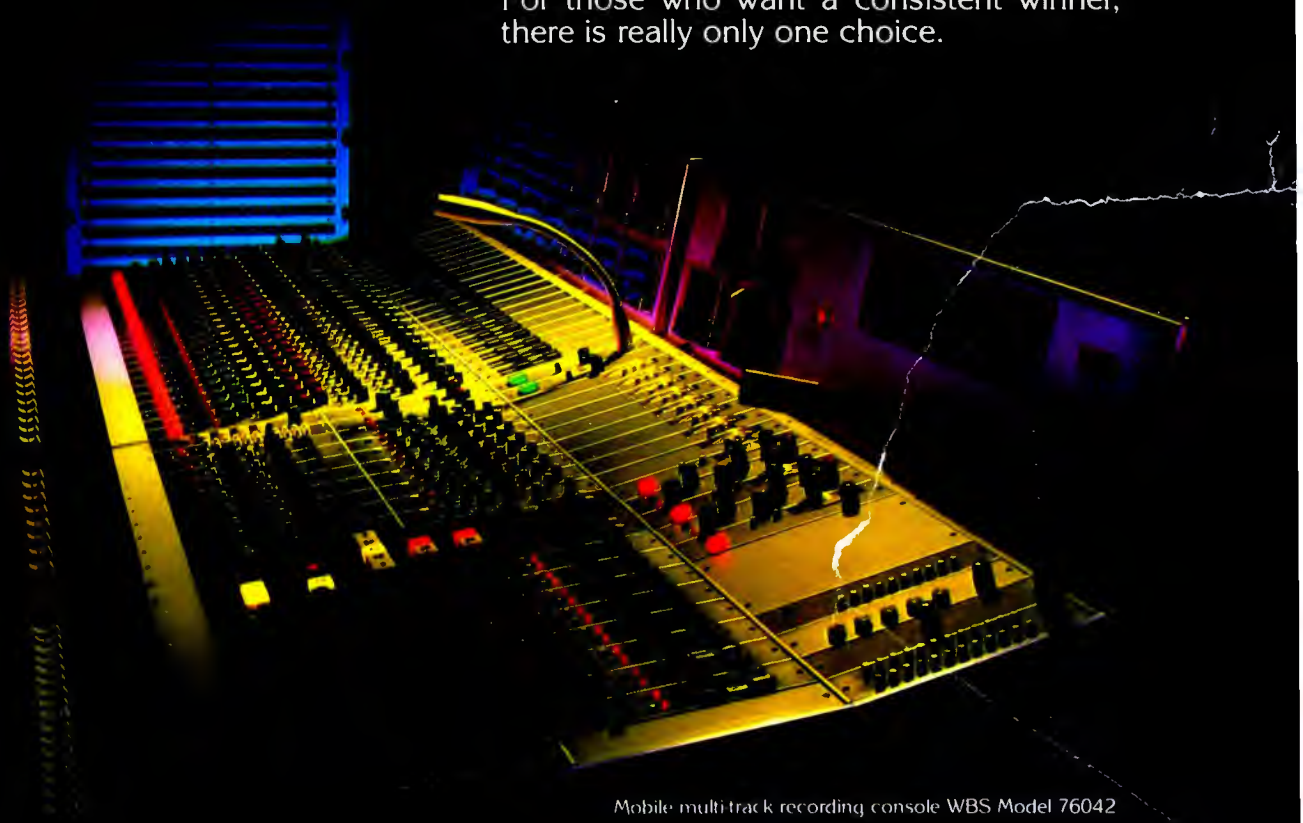

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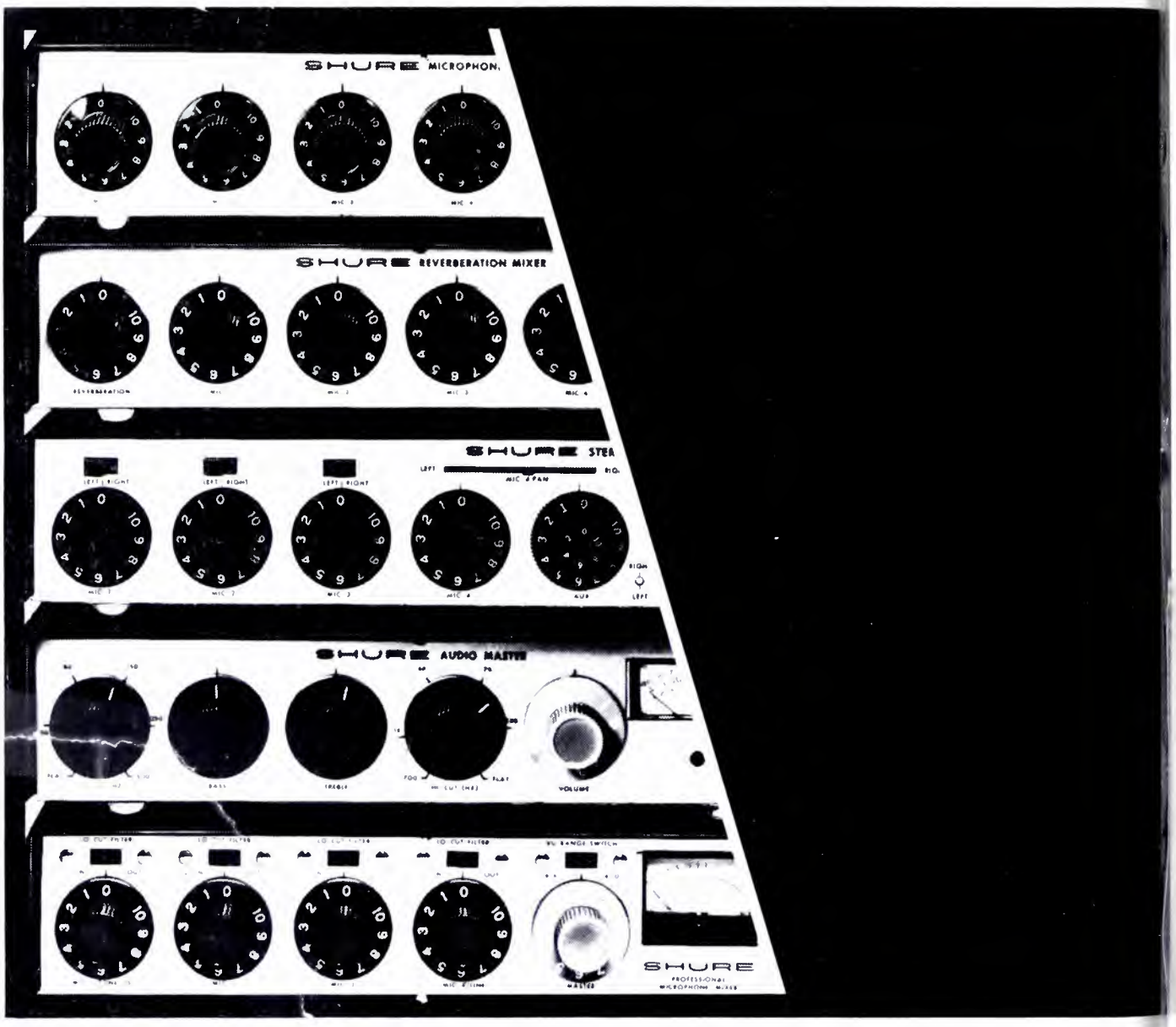

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