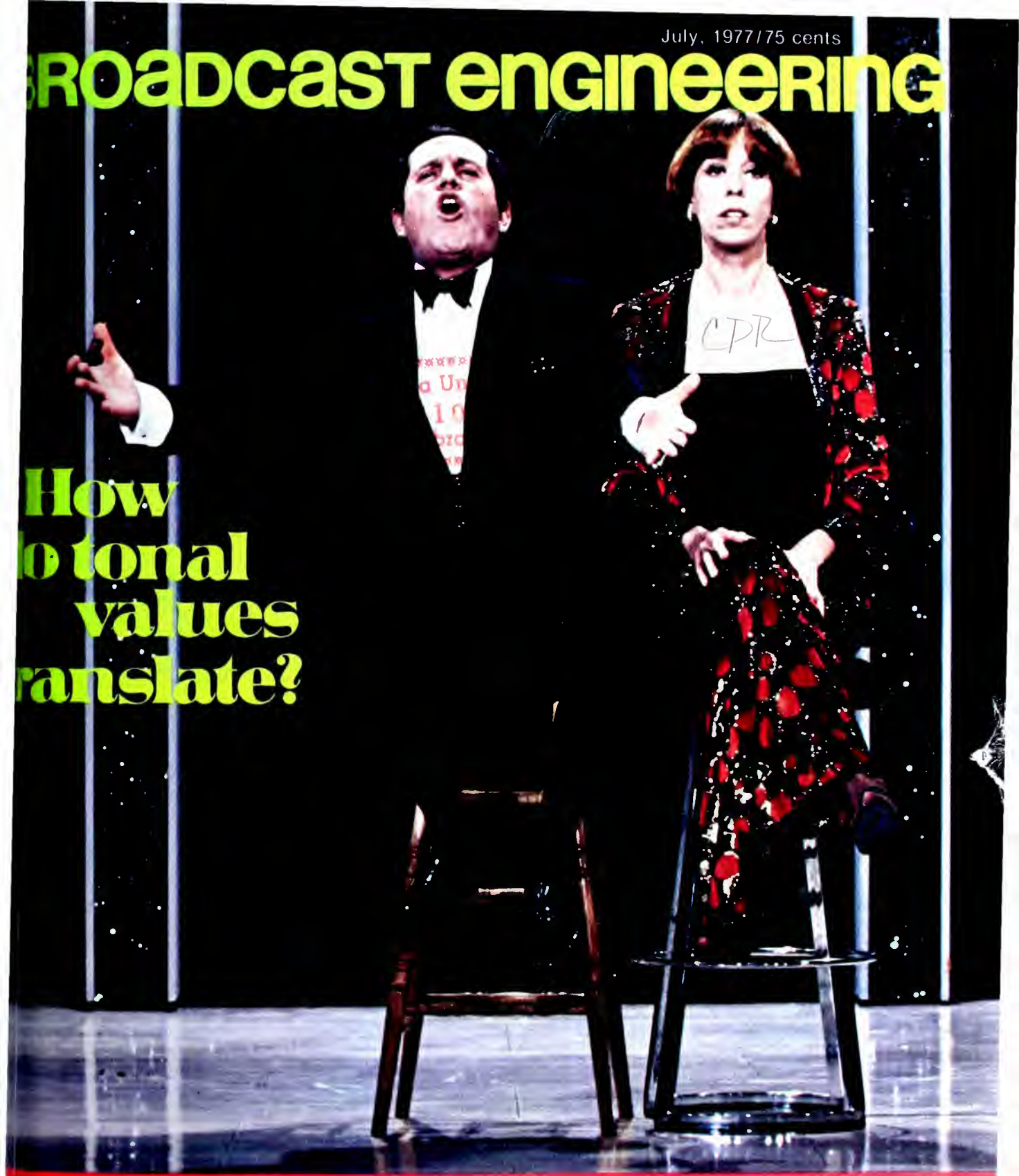
July, 1977/75 cents

BROADCAST ENGINEERING



How
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ranslate?

Directional antennas

Stereo phasing

The FM proof

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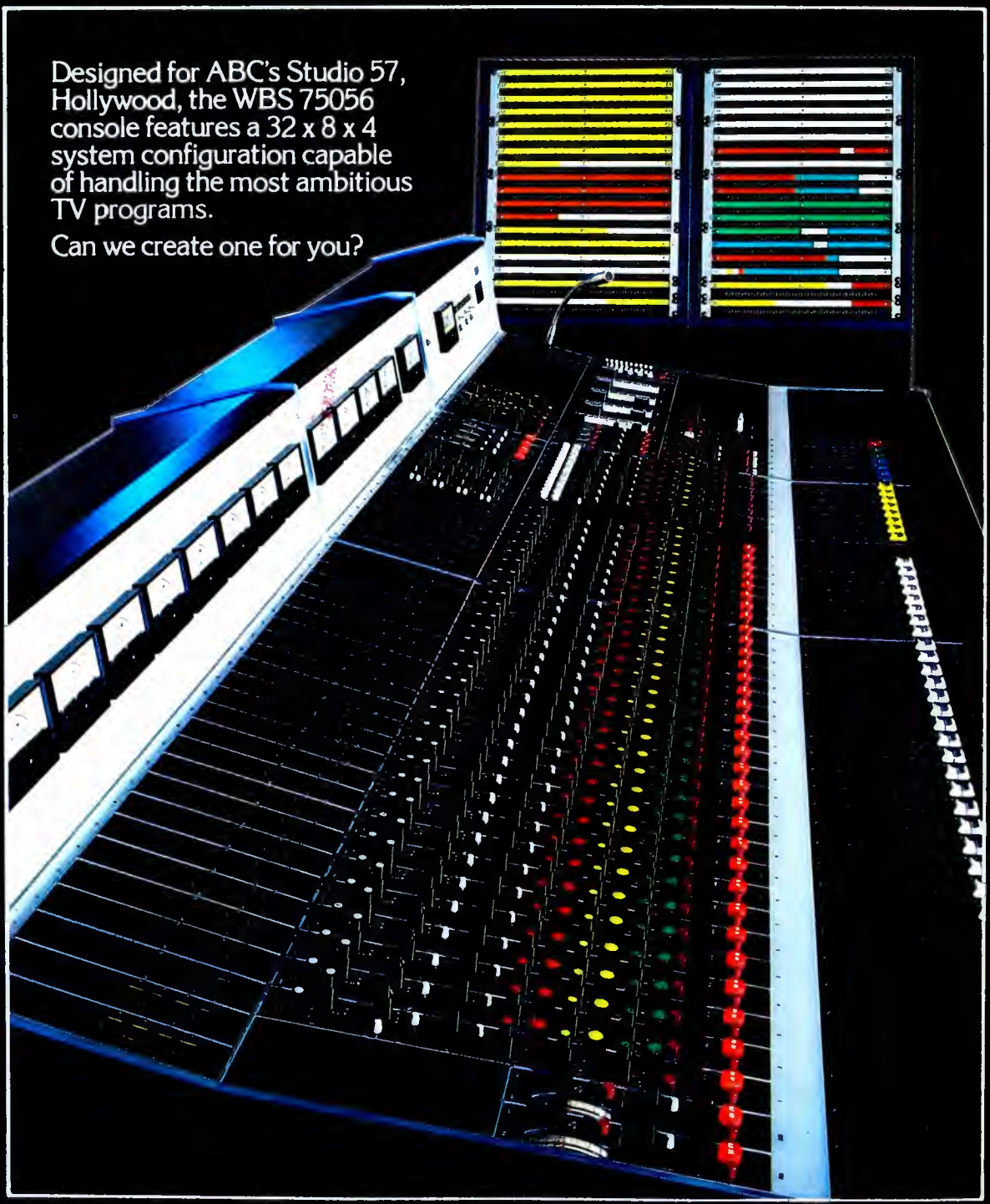

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BROADCAST engineering®

The journal of the broadcast-communications industry — *July, 1977 Volume 19, No.*

About The Cover

If you want to be sure how your colors will translate, see our opening article on page 18. (*The cover picture is supplied courtesy of CBS Television Network.*)

Departments

Editorial, advertising and circulation correspondence should be addressed to: 9221 Quivira Road, P.O. Box 12901, Overland Park, Kansas 66212 (a suburb of Kansas City, Missouri) (913) 888-4664

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DIRECT CURRENT FROM D.C.

July, 1977/By Howard T. Head and Harold L. Kasse

NAB Proposes Revised Audio Performance Rules

The National Association of Broadcasters (NAB) has asked the Commi- sion to open an inquiry into the Rules governing the audio perfor- mance of AM and FM radio facilities and the measurements of audio performance. The new Rules will govern the Proof of Performance nw required to be made on an annual basis.

Noting that the present performance requirements were developed may years ago, NAB points to the radical changes in audio processing ac control techniques employed by radio broadcasters to enhance the characteristics of the audio signal. A wide range of topics is pr posed for consideration, including the behavior of limiting and other processing amplifiers, equalization techniques, pre-emphasis load characteristics and noise-reduction methods. In addition, th study would include analysis of techniques used in modulation moni tors with emphasis on modulation limits and the definition and mea surement of "peaks of frequent recurrence."

NAB asks that the Commission inquire into such topics as the type f audio performance data required and method of measurement for all radio stations. All interested parties, including manufacturers, broadcast licensees, and individuals are urged to provide the Com- mission with information to permit the development of Rules reflec ing the current state of the art.

New Class of AM Radio Station Established

The Commission has amended the Rules governing AM radio stations to extend the AM band to include carrier frequencies at 10 kHz intervals from 530 kHz to 1610 kHz. Previously, the lowest AM frequency was 540 kHz and the uppermost 1600 kHz.

The two new established frequencies--530 kHz and 1610 kHz--are to be restricted to a new class of noncommercial radio stations known as a Travelers Information Station(TIS). These stations are to be used to transmit information to motorists and other travelers which would include warnings of road hazards, airport

Continued on pag

CETEC Jampro's FM Antennas are especially worth listening to.

Hearing a Cetec Broadcast Group antenna specialist explain FM antennas is clearly rewarding. It can result in more listeners and *more revenue* for your station. ☐ Jampro uses the best of modern computer technology. But nothing replaces actual field tests, right? So we do that, too. Another Jampro specialty is optional Pattern Optimization, with field tests for guaranteed ±4dB, ±3dB, and even ±2dB circularity! ☐ From the new JWCP with 4MHz bandwidth for two or more stations common use, down to the elliptically polarized JLCP, Jampro exclusive knowhow goes into every design, manufacturing and testing step. ☐ The JSCP 'Penetrator' is perhaps the most famous FM antenna in use today. Doesn't that tell the story? If not, our world-wide users' list from every climate and continent surely will. ☐ Think about it. Wouldn't you, as a *professional broadcaster,* prefer to talk to a *broadcast professional*? . . . about the very special antennas of CETEC Jampro? ☐ And the entire good group of products from Jampro, Schafer, and Sparta.

Cetec Broadcast Group

The Broadcast Divisions of Cetec Corporation

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Telephone (805) 968-1561

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DIRECT CURRENT FROM D. C.

Continued from page 4

directions, and availability of lodging, food and gasoline. Licensees will be restricted to local and federal governmental agencies.

These stations will be restricted to the immediate vicinity of air, train and bus terminals, public parks, historical sites, interstate highway interchanges, bridges and tunnels. The operation will be secondary to services sharing these two frequencies and must accept interference from the primary service.

Some Changes in CATV Technical Standards

The Commission has made minor changes in the CATV technical standa The revised standards are now based on the physical configuration f a cable system rather than the identities of the various communitis served.

Frequency standards for cable carriage are revised for the carriag to UHF translators to require no more accuracy than that of the translator signal. The frequency accuracy requirement for CATV se top converters is replaced by a frequency stability requirement, a a video signal-to-noise ratio is applied for the first time to direct video feeds.

There was general agreement among both cable and broadcast interes as to the desirability of these changes. Several parties, however urged the Commission to go further and adopt more comprehensive CA technical standards to supplement the rather meager standards now established by the Commission's Rules. The Commission agreed that this should be done and stated that it would do so promptly. It's hard to quarrel with that position--it's just as true today as whe the Commission said the same thing five years ago.

Short Circuits

The Commission has proposed to prohibit the marketing of external amplifiers capable of operation in the frequency band 24-35 MHz an has instructed its staff to avoid any CB meetings where such ampli fiers are displayed. The Commission has authorized an experimenta license in the 52-74 MHz band to develop both an industrial and consumer video displayer... The Commisison has refused to permit suburban licensee in the midwest to move its main studio nearer th central city, although the licensee insisted that the only alterna tive involved miles of travel to the transmitter site over winding two-lane roads and a narrow wooden bridge often covered by high water... The Commission has issued a new volume of CB Rules and an interference book detailing "home remedies" for CB interference to television receivers and home audio equipment... The Commissio has adopted Notices of Inquiry into FM quadraphonic broadcasting and AM stereo broadcasting; field testing of various AM stereo systems has begun.

DM-1. Part editor, part computer nd 100% post-production magic.

You create the production in your head. EDM-1 brings your ideas to life.

Much more than an editor. EDM-1 is a computerized command and control system for turning out a finished product.

EDM-1 accepts as many as 3,200 scene-by-scene instructions, including entrance codes, exit codes and transition commands. An alphanumeric CRT displays this stored information, along with plain English comments. Only EDM-1 lets you search to a plain English comment, rather than a coded address. Type in "sunset," and you'll see a sunset.

The computer keeps track of everything. Even lets you juggle and restack scenes. And an optional feature "learns" your own special touch with the switcher, duplicating your motions upon command.

Then, when you've told EDM-1 exactly how the finished production is supposed to look, all you have to do is sit back and watch it work.

EDM-1 controls all of your audio and video sources and the master recorder. Finds the scenes. Assembles them with special effects. The whole job. When your EDM-1 says the job is done, the job is done.

That's post-production magic, the Ampex way.

AMPEX

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industry news

SMPTE Conference planned for October

Booth space for SMPTE's 119th Technical Conference Equipment Exhibit is now available, announced SMPTE Conference Vice President Harry Teitelbaum. The Conference and Exhibit, which is scheduled for the Century Plaza Hotel in Los Angeles Oct. 16-21, will feature numerous presentations on different aspects of television and motion picture technology. Among the subjects to be discussed are laboratory practices, film production, televisn production, television sound ad motion picture sound.

SMPTE expects this conferenceo be the largest in their history, wh more than 5,000 professionals e pected to attend. Further inform tion on the Conference and Exhi is available from SMPTE, 862 Sca dale Ave., Scarsdale, NY 10583.

NAEB expands convention format

Plans to expand exhibitor participation in the 53rd annual convention of the National Association of Educational Broadcasters, held in Washington, D.C. November 13-17, were announced by James A. Fellows, president of NAEB. Fellows said that program modifications, allowing delegates more time to visit the exhibit area, have been approved. These changes will create 8½ hours of exibit-only time when business sessions or related activity will not be scheduled.

The new NAEB convention, to be held at the Sheraton-Park Hotel, includes a major group of sessions for engineers who are frequently responsible for recommendations to management regarding the purchase of new equipment. These sessions will provide a forum for exhibitors to make technical presentations n the formal convention agenda ad on the exhibit floor. In addition, n Exhibitors Panel is scheduled as general session to focus on te nology and to encourage exhi attendance.

Fellows emphasized that NAEB convention expects to dr over 3,000 public broadcasting u technical executives as well s representatives from the milit services, local, state and fede government, foreign embassies, le medical profession, business a industry. He noted that an associ membership requirement in association, which has been mand tory, has been waived. For furth information contact Patricia Ki Moran at (202) 223-6274.

New trade show scheduled for Oct.

INTELCOM '77, the first International Telecommunications Exposition to be held in the United States, will take place at the Georgia World Congress Center in Atlanta from October 9-15. A number of major attractions will be bringing all segments of world telecommunications activity together under one roof, including government telecommunications administrations, users, manufacturers, technical experts, agents, distributors, consultants, educators, and communications officials from around the world.

Primary focus of the exposition will be on the needs of developing nations and will include recent developments in the technology, economics, financial policy, regu tory and management aspects o telecommunications.

Also on the agenda are appro mately 14 intensive two-day sh courses covering the most up-to-d treatment of computer networ fiber optics, satellites, digi trends, management of communi tions systems, microprocesso marketing, and finance; and to to major manufacturing plants, te phone operating companies and search facilities.

For further information on INT COM '77, contact Barbara Cof Horizon House International, 6 Washington St., Dedham, Ma 02026.

Continued on page

CETEC Sparta's FM Transmitters are really worth listening to.

3CX3000A7 is an earful.

☐ That's the economical ceramic triode specifically designed for our 3 and 5 kW transmitters. Its 'grounded grid' use eliminates neutralization and continuous fine tuning in the 603 and 605B. ☐ Added stability factors: vacuum variable capacitors in the driver stage. Standard APC. ☐ The 603 and 605B, like all CETEC Sparta transmitters, interface with all makes of ATS. ☐ Reliability? Superior high performance from our solid state direct-FM 680 Exciter. It features advanced concepts such as digital, temperature-compensated AFC. The 680 powers all our FM transmitters from 10 W to 25 kW. ☐ Operations? CETEC Sparta transmitters are a breeze. All important parameters are fully metered. All feature Tally Light fault locators with automatic recycle. All provide easy access to components. ☐ *Interesting fact:* only CETEC Sparta makes AM *and* FM solid state transmitters. ☐ Wouldn't you, as a *professional broadcaster,* prefer to talk to a *broadcast professional?* . . . about the good group of products from Jampro, Schafer, and Sparta? ☐ Contact us. We're ready to listen to you.

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industry news

Continued from page 8

FCC provides public access to radio program log data

The Commission has amended its rules requi radio broadcasters to make their program logs o data available for public inspection, and to make material, as well as public inspection file mate available for machine reproduction. It also continue to require that all radio licensees kee their public files for a period of three years copi all written comments and suggestions concer station operation received from the public.

This action, which amends Parts 1 and 73, bec effective July 5.

The FCC said it would not require commer television and radio broadcasters to retain disclose transcripts or tape or disc recordings of and public affairs programs. The Commission was convinced that the public benefits outweighed costs the proposal would impose on broadcasters.

The FCC's action is the latest in a series documents dealing with public access to broad station program records.

In January 1974, the FCC amended its rule provide for public inspection of television st program logs and to establish the procedures w would apply to inspection requests. The revised r allowed not only access to, but reproduction of program logs of television licensees. On July 17 of year, the FCC amended its rules to permit reproduction of materials maintained locally for pu inspection by television station applicants, permit and licensees, with radio stations to be dealt later.

FCC responds to court rema on educational station rule

The FCC has issued a response to the U.S. Cou Appeals for the District of Columbia Circuit's rem of the FCC action amending its rules requi non-commercial educational stations retain, for days, audio recordings of all public affairs prog that are broadcast. In addition, they must m copies of such recordings available to anyone request and payment of a reasonable copying cost

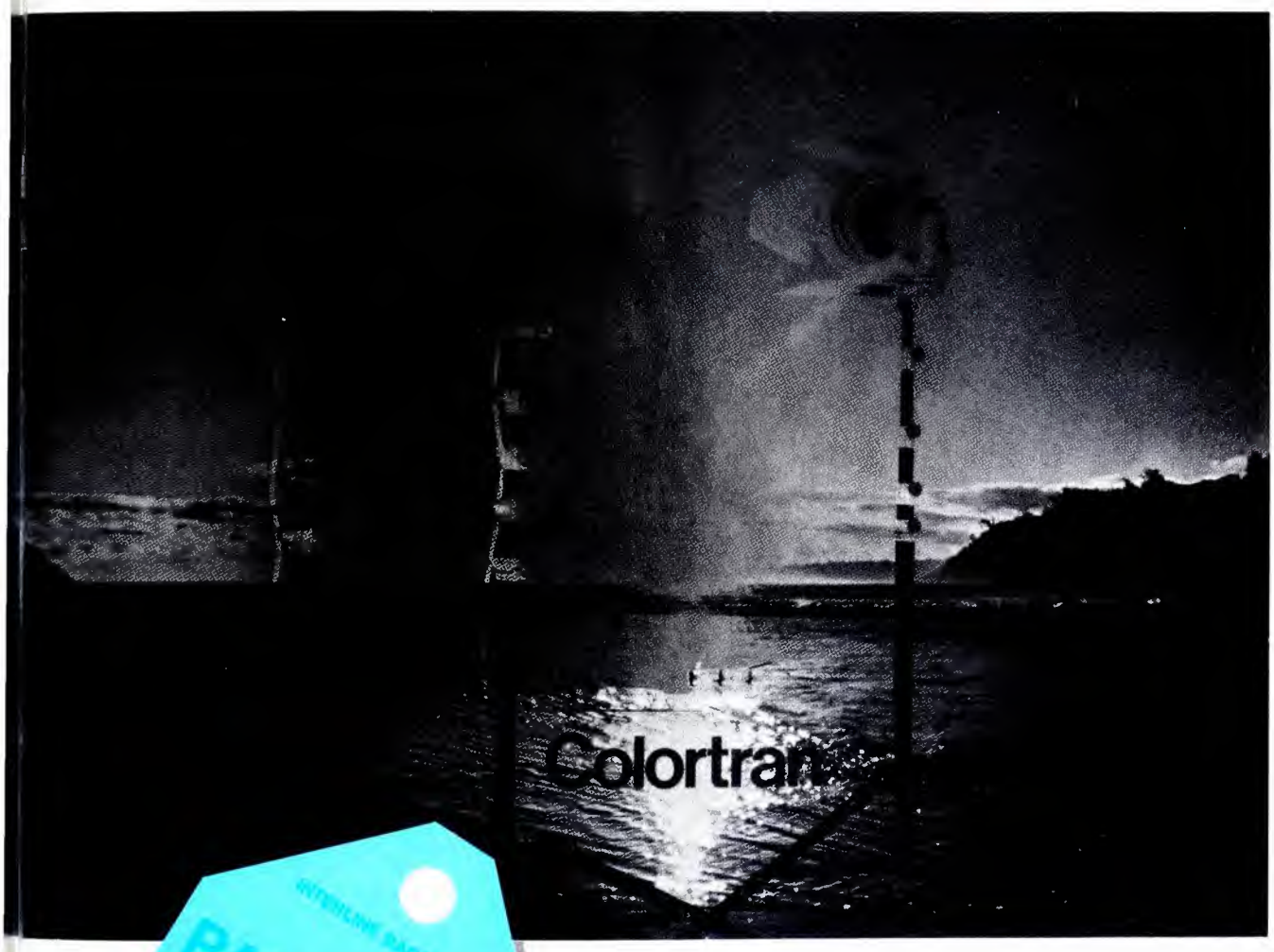
The FCC's action of December 19, 1975, amen Part 73 to implement Section 399(b) of the Commun tions Act. (That section requires non-commer educational stations that receive federal assistanc the form of matching grants or payments to re audio recordings of programs that have been bro cast in which issues of public importance discussed. Copies must be made available on reque

A number of non-commercial educational st licensees sought judicial review of the 1975 act contending that it impinged on their freedom expression in violation of the First Amendment.

Continued on page

uminum carry case for
ni-Pro Kit and Pro-Kit IV.

BERKEY COLORTRAN INTRODUCES NEW LIGHTING KITS FOR WORLDWIDE LOCATION LIGHTING



Lighting Kits must be portable, lightweight, rugged and durable. They are your studio in a suitcase — and must respond to ever-changing location shooting needs, over and over again.

Colortran's new, Mark 2 Kits have been redesigned to respond to today's requirements — worldwide. The Mini-Pro Kit and Pro-Kit IV are now packaged in a rugged aluminum carry case. Both are lighter. Our Flight Kit is streamlined and now includes the lightweight, hi-performance Mini-King with removable barn-doors. These are a few of the changes.

Colortran offers 14 different kits in 120 and 240V versions. To select the ones that best fit your requirements, write for our new brochure and price list to Dept. BE777.

These Colortran products are available on a GSA contract

Berkey Colortran®

1015 Chestnut Street, Burbank, California 91502. Tel. 213 843-1200 — Division of Berkey Photo Inc. — P.O. Box 5, Burrell Way, Thetford Norfolk, IP24 3RB, U.K., Tel. Thetford 2484

INNOVISION

...the full lineup of innovative cameras and camera technology that set NAB '77 on its ear and has truly earned Philips the reputation of "the INNOVISION company".*

Since the first decade when Philips creative technology changed color television forever with the Plumbicon™ tube and the Philips Norelco PC-60 camera, it has been one innovation after another.

3-Plumbicon tube design, beam-splitter prism, C.L.U.E. (Color Line Up Equipment) etc., etc., etc. Right into Decade TWO with the world-wide acceptance of LDK and LDH cameras ...the finest, most advanced, most complete family of cameras available anywhere.

Now Philips proudly presents the "INNOVISION family" of television products to meet every need, every budget.

VIDEO 80—NEW...an incredible, broadcast-quality camera/camera system for ENG, Field Production, Studio. Converts to each configuration with just a simple change of slide-on viewfinder and plug-in electronics. Simple to set up...simple to operate because all the test features are built-in with "no compromise" performance. And there are even more automatic features in its ENG configuration, for total mobility. It's compact, rugged and lightweight. Designed to go anywhere, do anything on AC or power pack.

But the greatest innovation is Video 80 economy. Economical to purchase, economical to operate. Its versatility lets you do more with less equipment for true cost/effective operation. And since Video 80 can interface with most of your existing equipment, it saves all around. That's economy three ways.

LDK-25—the finest, state-of-the-art multicore studio and field camera system available today. With *all* critical components Philips designed... Philips made, for optimum performance of the entire camera system. Like computer matched yokes, beam-splitting prism, deflection circuitry, Plumbicon 1" anti-comet tail tubes.

Couple these with innovation C.L.U.E. for ease of color ba electronic temperature control white balance, flexible auto iris ar

trast compression and you have era system unsurpassed in stabil ture quality and performance.

The LDK-25 family also has ally controlled triax version, the for remotes and modernized installation. Its built-in memory maintains settings up to a week automatic cable compensation nates timing and power supply lems to beyond one mile.

The LDK-15 is the LDK-5 in able configuration...the ultimate

PHILIPS

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ity

pduction cam-
field produc-
for use as a compact studio
. Operates in a self-contained
or interfaces with either the
-or 25 CCU in system configura-
th absolutely no compromise in
nance.

**UHF Transmitters—an ad-
l, new television transmitter**
ctured is the 17.5 kW VHF trans-
which can be paralleled for 35
HF transmitters range from 1 to
and may be paralleled to 110 kW.
a unique, common 1-watt I.F.
exciter which can also be ret-
rofitted into earlier competitive
systems. Over 1,000 Philips trans-
mitters have been sold world-wide.

LDH-20S—with increased sensitivity and a wide selection of zoom lenses. It's the acknowledged leader in 3-tube economy broadcast-quality cameras, with over 1600 in use world-wide. Philips patented prism beam-split optics, contours-out-of-green enhancement, C.L.U.E. adaptor for easy color alignment, balance and camera matching make it unmatched in its class.

LDK-11—with exclusive Philips design and performance. The full broadcast camera that started everyone thinking *both* ENG *and* Field Production in a hand-held camera. But LDK-11 does it without compromising quality or operational features. A remarkable battery or AC powered portable camera with full control remotely or at the backpack. And with studio camera features like famed 3-Plumbicon tube picture, beam-split prism, bias light and Philips linear matrix for superb colorimetry, H&V contours, auto iris, auto white balance, genlock sync generator, switchable gain and gamma, built-in color bars, remote VTR and zoom controls and two audio channels. All this and more make the LDK-11 like no comparable broadcast camera in the world.

And check out these other innovative new Philips products:

New LDK-65 Telecine Film Chain with parts commonality and outstanding performance of the LDK-25 camera family.

New BCN 1" helical scan Video Tape Recorders and new compatible 1" cassette version.

They all add up to a complete innovative family of cameras and technology to serve the television industry.

Send for more information (indicating product interest). Or, better still, have your Philips representative set up a demo for you. But do it today. Philips Broadcast Equipment Corp., 91 McKee Drive, Mahwah, N J 07430 (201) 529-3800.

***Innovative Leader in World Television**

PHILIPS®
TM N.V. Philips

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industry news

Continued from page 10

NRBA convention gears up for 125 exhibitors

Exhibit space for the fourth annual National R Broadcasters Conference and Exposition, to be October 9-12 in New Orleans, is 75 percent sold already ahead of the entire amount reserved for 1976 show. According to Al King, executive president for station services of NRBA, "New ex tors and increased space requested by those exhibited last year has already assured a sellou 1977."

The exposition, limited to 125 booths, will be hel the New Hilton Hotel, and will feature the late automation, programming services, engineering radio broadcast equipment.

Legal Guide available— helpful to broadcasters

The Legal Department of the NAB announces publication of a 600-page guide to provide guidanc radio and television stations on FCC-related prob they encounter in their day-to-day operation.

It is available now at a cost of $35 for members and $70 for non-members.

Erwin G. Krasnow, NAB general counsel, said is the first compilation under one cover of mo FCC rules and policies governing programming, c mercial practices, employment, engineering and o aspects of station operation. The *Legal Guide* is result of literally thousands of hours of research analysis.

He said the *Guide* represents a testament to constantly increasing burdens broadcasters must in mind in keeping track of, and complying wit seemingly endless stream of paperwork generate the FCC's regulatory process.

The *Legal Guide*, clearly written in layman's te is intended to be more than a comprehen explanation of hundreds of FCC rules, reports court decisions. It gives practical advice to the st manager on complying with Commission regulati filling out application forms and effectively co with bureaucracy. For example, one of the appendixes provides a listing of telephone numb and addresses of FCC Field Offices, Governm Printing Office Regional Bookstores, and other sou of information.

In 1934, *all* of the FCC's Rules and Regulations w contained in a relatively simple 180-page booklet. T is takes 2,750 pages to print *only* those portions w apply to broadcasters.

In 1934-35, all the Commission's decisions wer the first edition of FCC Reports—388 pages. contrast, it took five volumes containing 7,140 p (with smaller type) to cover just a portion of decisions released by the Commission durin comparable period in 1975-76.

Introducing two new ways to get the lighter side of the news.

Microwave Associates' MA-2CP and MA-2EP.

They're by far the lightest, easiest to carry, simplest to use and maintain portable microwave radios to move onto the market.

Because they're so light, the 2 watt MA-2CP and 8 watt MA-2EP open up a new era of flexibility in news gathering at 2GHz. You can go almost anywhere the news is.

Both models have a unique frequency offset capability that gives you a total of 21 microwave channels. Three times the frequency agility of older models.

If you want, we also offer the 2CP and 2EP in 1-channel and 7-channel versions.

In addition, the MA-2EP provides sophisticated diagnostics, switch-selectable tuning and the opportunity of mounting the RF head up to 30 feet away.

Both the MA-2CP and MA-2EP are engineered with people in mind. And each system is compatible with all our Portable Line accessories.

So if you need two great little portables for ENG remotes, write or call for the complete details.

The MA-2CP. And the MA-2EP.

They're guaranteed to give your news gathering a nice, light touch. Microwave Associates, Communications Equipment Group, Burlington, MA 01803. 617-272-3100.

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The Sony BVT-1000. Consider the logic.

A time base corrector is part of a system. A system that includes a video tape recorder.

Isn't it logical that a company which manufactures video tape recorders would have an inside track on what it takes to correct time base error in a VTR signal?

We're talking, of course, about Sony Broadcast.

The company that pioneered professional U-matic video recorders. And introduced the BVH-1000 1" High Band Video Recorder, that has the whole broadcast industry moving in a new direction.

Sony Broadcast has matched these impressive video recorders with an equally impressive digital time base corrector. The BVT-1000.

And before you face up to the difficult decision of which TBC is best for you, consider the logic of the BVT-1000.

1. The economy of a complete package. Sony Broadcast knows that line-by-line velocity compensation, complete video processing with advance sync, drop-out compensation, and the ability to handle both direct and heterodyne color are not just options."

They're requirements. Requirements that broadcasters need and use in day-to-day operations.

So we make all these so-called options standard built-in features of the BVT-1000. And you save dollars in our greater production efficiency.

2. The advantage of superior technology. The economy of the BVT-1000 doesn't mean you sacrifice quality.

Far from it.

The BVT-1000 incorporates unparalleled technological excellence. Excellence demonstrated by a unique A/D converter that expands the effective number of bits per word, resulting in a higher signal-to-noise ratio than theoretically expected in an 8-bit system. Which leads to transparent picture quality.

With the Sony Broadcast BVH-1000 1" recorder, the BVT-1000 provides locked recognizable color pictures from still-frame to seven times normal speed. And to greater than thirty times normal speed in monochrome. So your editing techniques are faster and more critically accurate than ever before possible.

And for use with U-matic format recorders, the BVT-1000 offers special advantages. A wide 4H window and special anti-gyro circuitry compensate for wide errors and maintain both color and luminance stability.

Advance sync control allows phase correction using LED indicators at the TBC, for system integration. And the video level can be monitored by LEDs that show at a glance high or low level relative to one volt peak-to-peak.

3. The logic of a systems approach. If you are into electronic news gathering, or if you're part of the new revolution in 1" high band machines, the chances are very good that you're already using Sony recorders.

The BVT-1000 gives you an opportunity to add new logic to your broadcast equipment. The logic of an all-Sony system.

For full information about the BVT-1000 or any of the other professional video products in the Sony Broadcast family, call your nearest Sony Broadcast office.

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New York: (212) 371-5800 Chicago: (312) 792-3600 Los Angeles: (213) 537-4300 Canada: (416) 252-3581

What you see isn't always what you get

Part 2 of a 2-part series

By Ron Whittaker and Jacqueline Tornberg

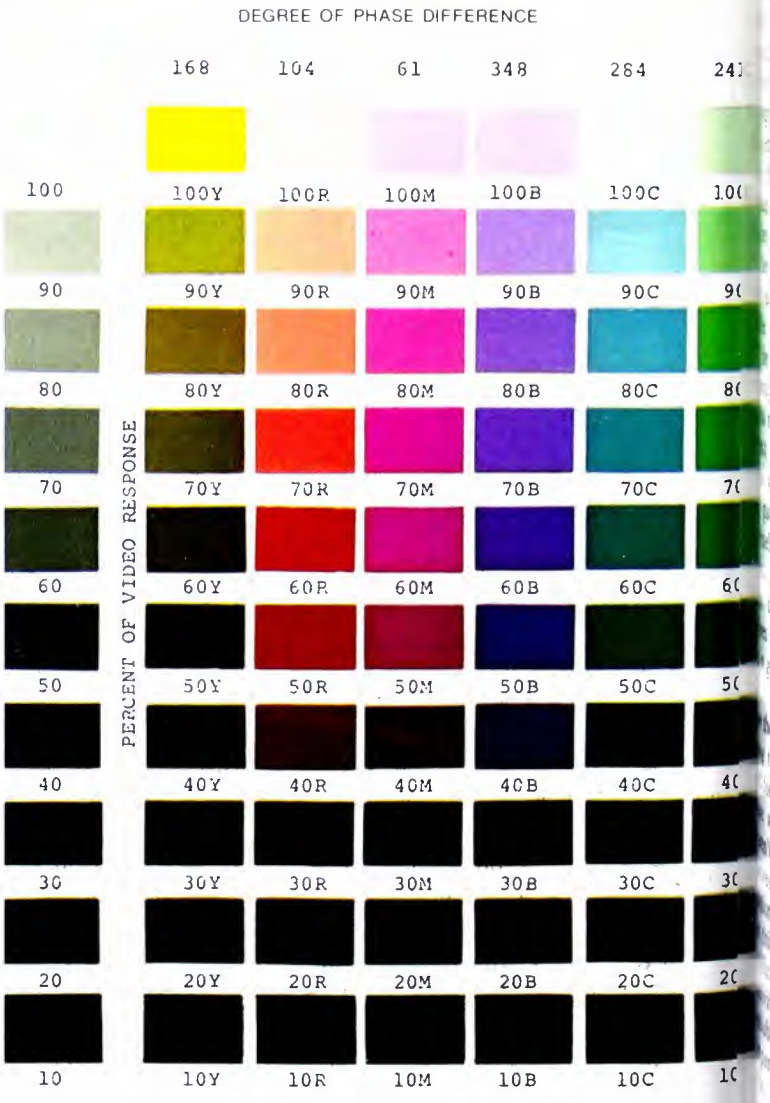

Figure 1.
Color classification system and 10-step gray scale.

s mentioned in Part One of this
tle, one of the big problems in
ision has always been the area
npredictability associated with
way things appear to the
an eye and how they sub-
ently appear on a TV screen.
y colors and tonal values are
ficantly changed by the tele-
n process. As a producer,
tor, engineer, or art director,
need to know what to expect
the television system, or you
experience some disappointing
costly) surprises.

his two-part article reports on
of the most extensive studies
done on the subject. In all,
500 colors were carefully and
matically analyzed. The find-
which ran over 90 pages in
original form, are summarized
his series.

nce there are many thousands
ades of paint available to the
ision artist and set designer, it
d be a hopeless task to try to
ify each of them. It is not even
ible to analyze one "royal
," for example, and expect any
istency among manufacturers.

was the authors' opinion that
best way to approach this
nma was to select a relatively
e" paint medium which would
itself to a very accurate
ysis. Then, after extensive
ysis, certain conclusions and
elines about color and tonal
s in general could be made.

low the study was conducted

ang tempra pigments were
ted for this study, not because
are widely used in television
aren't) but because they lend
nselves to the very precise
ulations necessary in a study
as this.

ecifically, the color samples
individually mixed from Prang
r-soluble, powdered, matte-fin-
empera pigments, manufac-
l by The American Crayon
pany. The pigments used were
g yellow (No. 1550), orange (No. 1551), red (No. 1552), turquoise (No. 1553), violet (No. 1555), blue (No. 1556), green (No. 1557), magenta (No. 1558), black (No. 1559) and white (No. 1560).

The equipment used for electronic analysis of the colors in this study consisted of one E.M.I. 2001/C color camera with three one-inch lead oxide vidicon Plumbicon™ tubes, a Tektronix 520 NTSC vectorscope, and a Tektronix 529 waveform monitor, all of which were from the studios of WUFT, Channel 5, in Gainesville, Fla.

Procedure

The same vectorscope and waveform monitor were used for each analysis, and the same engineer recorded the readings. The equipment used was carefully adjusted to conform to FCC/NTSC guidelines.

The color samples were placed on an easel directly in front of, and at a consistent distance from, the E.M.I. camera. The easel was lit with one 2,000-watt tungsten-halogen scoop, and color temperature was carefully maintained at 3,200 degrees Kelvin.

Although a great amount of data was generated from this study, the authors have selected for discussion only the parts which they feel will be of the most immediate value to television personnel.

Figure 1 summarizes much of the information. It is difficult to accurately mass produce a chart such as this, even with the highest-quality printing equipment. The "television gray" squares (left column) should be totally "colorless"; that is, they should have no magenta, cyan, or yellow cast. The chart should be viewed by daylight. Fluorescent lights should be avoided. Tables 1 and 2 summarize the pigment formulas used.

Shades of gray

First of all, note that the television gray scale shown in Figure 1 appears more compressed between

Continued on page 20

Table 1. Mixing formulas for steps of television gray scale matched in pigment

Percent of paint in sample	Percent of video response
95.5W-4.5B	100
88W-12B	90
78W-22B	80
63W-37B	70
50W-50B	60
35W-65B	50
21W-79B	40
8W-92B	30
100B on blotter paper	20
black velvet material	10

Continued from page 19

Table 2. Mixing formulas for 60 colors in color classification system

Hue	Percent of Paint in Mixture
100 Yellow	84Y-1G-15W
90 Yellow	98.5Y-1.5B
80 Yellow	92.5Y-4/0-3.5B
70 Yellow	86Y-6/0-8B
60 Yellow	76Y-9/0-15B
50 Yellow	64Y-12/0-24B
40 Yellow	45Y-16/0-39B
30 Yellow	16/0-16R-68B
20 Yellow	100B on blotter paper
10 Yellow	black velvet material
100 Red	1R-4/0-95W
90 Red	5R-11/0-84W
80 Red	11R-16/0-73W
70 Red	21R-26/0-53W
60 Red	35R-34/0-31W
50 Red	72R-14/0-14W
40 Red	89R-4M-7B
30 Red	31R-21/0-48B
20 Red	100B on blotter paper
10 Red	black velvet material
100 Magenta	3.5M-96.5W
90 Magenta	18M-82W
80 Magenta	37M-63W
70 Magenta	54.5M-.5R-45W
60 Magenta	74M-1R-25W
50 Magenta	93M-2R-5W
40 Magenta	85M-4R-11B
30 Magenta	35M-15R-50B
20 Magenta	100B on blotter paper
10 Magenta	black velvet material
100 Blue	1.5M-1.5V-97W
90 Blue	8M-5V-87W
80 Blue	14M-11V-75W
70 Blue	18M-17V-65W
60 Blue	31M-23V.46W
50 Blue	43M-32V-25W
40 Blue	56M-38V-6W
30 Blue	33M-22V-45B
20 Blue	100B on blotter paper
10 Blue	black velvet material
100 Cyan	4C-1G-95W
90 Cyan	15C-2G-83W
80 Cyan	34C-3G-63W
70 Cyan	53C-5G-42W
60 Cyan	75.5C-8.5G-16W
50 Cyan	85C-12G-3B
40 Cyan	66C-7G-27B
30 Cyan	31C-4G-65B
20 Cyan	100B on blotter paper
10 Cyan	black velvet material
100 Green	5G-1Y-94W
90 Green	16G-4Y-80W
80 Green	37G-9Y-54W
70 Green	57G-13Y-30W
60 Green	80G-18Y-2W
50 Green	64G-19Y-17B
40 Green	41G-14Y-45B
30 Green	7G-13Y-80B
20 Green	100B on blotter paper
10 Green	black velvet material

video levels 10 through 50 than between video levels 50 through 100. That is, to the eye, the steps from video levels 10 through 50 appear less tonally separated or less visibly distinct than the steps from 50 to 100. Step 100, or "television white," appears not white, but gray. Steps 10 and 20 could not be matched in pigment, since 100 percent Prang black tempera was too reflective. Step 10 is made of a strip of black velvet material, and step 20 is made of 100 percent Prang black tempera, painted on a strip of blotter paper.

An equal mixture of white and black tempera yields a video response reading of 60 percent. Between steps 30 and 80, each step is approximately 15 pigment-mixture percentage units away from its neighbor. At the extremities of the scale, the steps are only 8 to 10 units apart.

A careful examination of the data shows that there is no linear relationship between pigment mixture formulas (percentages of black and white tempera) and video response readings. All that can be concluded is that the addition of more black will yield a lower video response reading, and the addition of more white will yield a higher video response reading. The "shades of gray" aspect of the study constituted "Phase I" of the research.

The dimension of hue

Phase II dealt primarily with the dimension of hue. Fully saturated paints were mixed in an attempt to match the six fully saturated colors of the standard TV color-bar waveform.

The mixing procedures were somewhat similar to those of Phase I. Eight Prang colors were arranged in a circular scale corresponding to their spectral distribution: red, orange, yellow, green, turquoise, blue, violet, and magenta. Between any two adjacent colors, red and orange for example, 10 pigment samples were prepared, ranging from 100 percent red to 100 percent orange. The powdered paints were mixed with water, measured by syringe in cubic centimeters, and then mixed together in varying percentage proportions, such a percent red and 85 percent ora or 15 cc red and 85 cc ora There were 10 or more diff mixtures for each of the e adjacent pairs of colors on circular scale, making a total mixtures. These 97 color sam were then placed one by one o easel in front of the E.M.I. ca and phase difference and level readings were recorded.

Also recorded were phase ference and video level reading the six colors of a specially pared alignment chart, so that chart could be used again to se equipment at exactly the s levels for the following experim

An obvious hue compression found between degrees 100 and (red) and between degrees 330 350 (violet). Much like the pression of the gray scale bet steps 10 and 50, these compre areas indicate an inability of television system to make as hue distinctions in these areas.

This particular finding is surprising when one examines hue distribution of the visible spectrum. The range of the band (80 nanometers) and range of the violet band nanometers) are two of the w spectra, the others averaging proximately 30 to 40 nanomete width.

This information suggests the compression by the televi system in these two areas of spectrum may be caused b failure of the system to compen for the comparatively wide ra of these two spectral bands.

This would simply mean colors between red-orange and genta and between violet and will not reproduce with as nuances in hue as will other a of the spectrum. So, if you wis highlight (shade) a red area apple for instance—with orange, the findings from this s indicate that the red-orange sh would be indistinguishable; will reproduce as identical hues a color television set, as wel identical gray values on a black white television set. There app to be no need to stock diffe

Continued on pag

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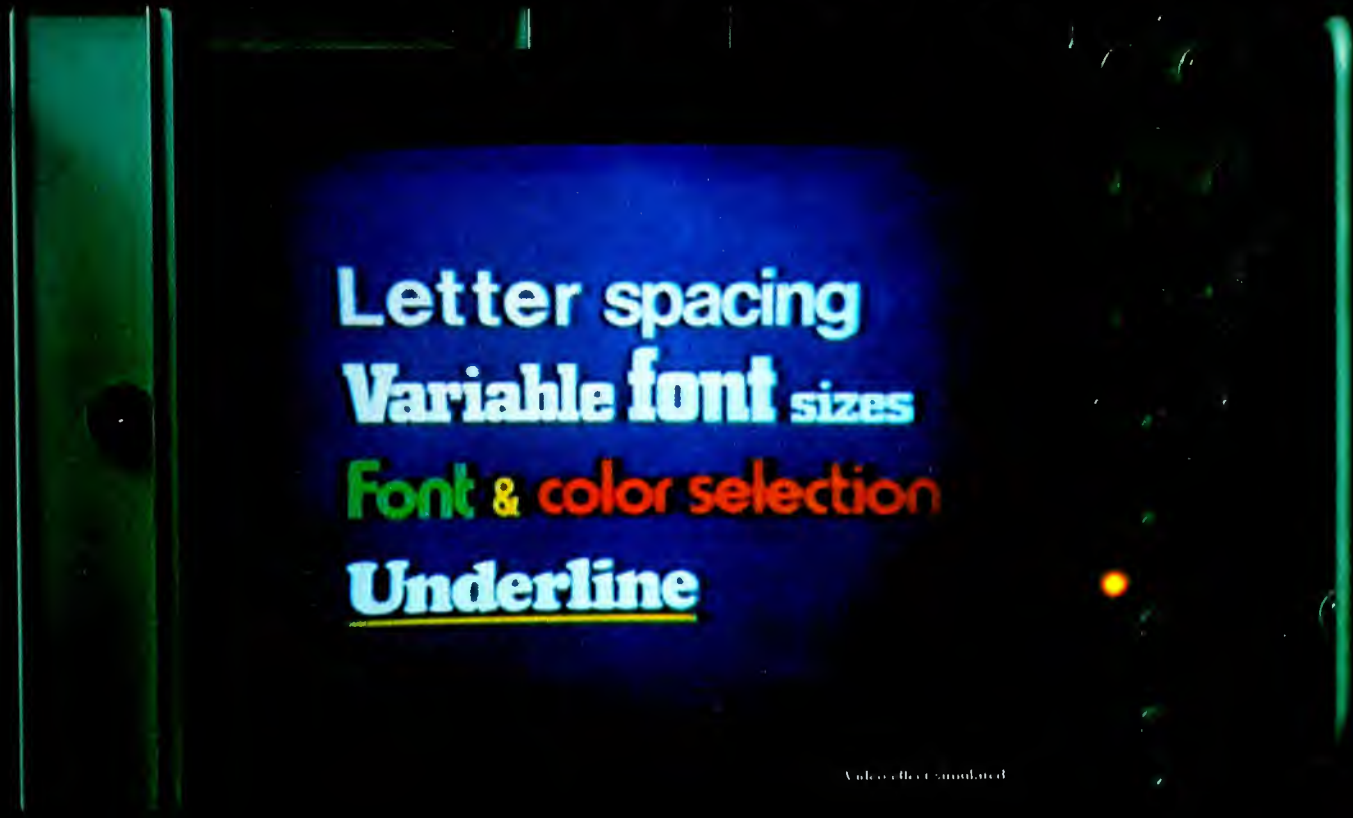

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paints and papers in various red-orange and red hues, since they all will reproduce alike.

In Figure 2, which deals with hue only, the pigment mixing formulas for each sample are shown. In this figure, it can be seen quite clearly where there are large gaps in the phase difference continuum: between 20 and 60 degrees phase; between 140 and 165 degrees phase; and between 165 and 205 degrees phase. The compression in the red and violet ranges can also be clearly seen.

Perhaps the most startling and significant information shown by this figure is that what appears to be violet to the eye actually registers on a vectorscope as "television blue." A mixture of 60 percent Prang magenta and 40 percent Prang violet yields a phase difference reading of 348 degrees, identical with the blue of the standard color-bar waveform. (The video response of this mixture, however, is 33 percent, 13 percent brighter than the blue of the waveform.) This discrepancy between the eye and television reproduction is probably caused by compression in the violet ranges of the television system.

For the television artist this would mean that if a vibrant blue is desired on the screen, a mixture of violet and magenta should be used instead of blue. If blue is used, the result will be a bluish-green, as 100 percent Prang blue registers as 332 degrees phase, or between the ranges of blue and cyan.

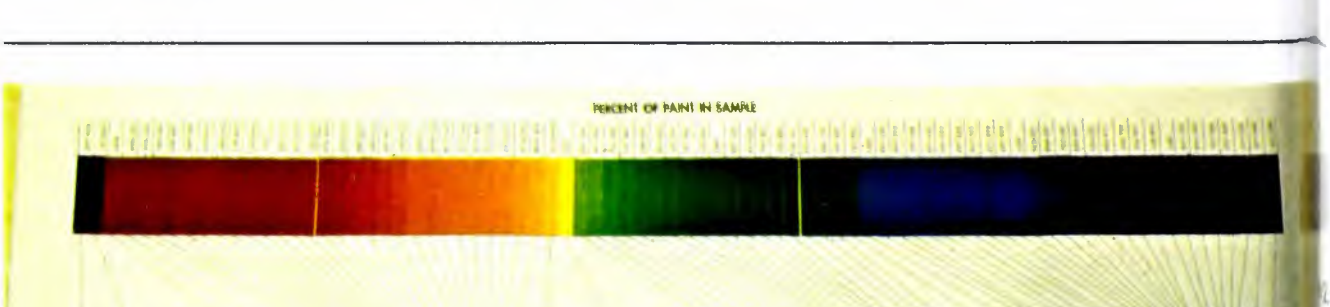
It should again be noted that no mathematical relationship was found between the mixing formulas and phase difference of video response in Phase II of the research. As formulas were changed, changes occurred in both phase difference and video response, but these changes were not equal to, nor consistent with, the formula changes. The findings and adjustment factors discovered in Phase II were incorporated into the creation of the color chart (Figure 1).

Hue and brightness

Phase III of the research for this study was concerned primarily with the dimension of brightness; but since brightness and hue are l characteristics of color and interrelated to some extent, hue also of major concern in Phase

The object of the third phas research was to create six saturated hue scales that w match in brightness, step by s the television gray scale. That i was planned that 54 desatur hues would be isolated in Phase which would match the bright of the 10 steps of the television scale.

For each of the six hues, ex yellow (for which only 10 sam were prepared), 19 pigment sam were prepared, making a tota 105 samples. The color sam were placed one by one on an e in front of the camera, an double reading, both phase ference and video level, was corded by the same engineer o each sample. (Because the obtained were of an unexpe nature, Phase IV was added to research as a double-check on findings for the first three ph and as a conclusive means isolating the 60 colors of



sm.) Therefore, six fully satu- l hues were isolated, and their ng formulas were kept constant : they were desaturated uni- ly with white and black paint. uld be expected that all of the samples would have identical e difference readings, and only video response readings would . This premise was proven rect. Both hue and brightness shown to be dependent vari- .

is dependency can be seen in re 3. By examining the red scale it can be seen that as e paint is added to the fully rated red, the phase difference d shifts from 102 degrees to egrees, and then again to 305 ees, past magenta and towards .

l of the six isolated colors ed in one direction or another desaturation. When black was d, yellow shifted 116 degrees rd green. (Yellow was not turated with white as it had a o response reading of 100 ent when fully saturated.) n white was added, magenta ed 135 degrees toward cyan. Blue shifted 46 degrees towards cyan when black was added. Cyan shifted 8 degrees toward blue when black was added. And green shifted 37 degrees toward cyan when black was added.

In order to compensate for these shifts in phase, appropriate hues were added to prepare the colors presented in Figure 1 as the final classification system. Orange was added to yellow and red, red was added to magenta, magenta to blue, green to cyan, and yellow to green. Since brightness is conversely dependent upon hue, proportional desaturation changes were made, depending upon the characteristic brightness of the colors added. (See Table 2).

To the television artist these shifts in phase can be a help or a hindrance. In either case, it should be noted that the addition of white will cause red to reproduce more like red. Also, the addition of black greatly alters any hue, especially yellow which becomes green.

Figure 3 shows a consistent "wandering" of hues which have been heavily desaturated with black. That is, hues which register at 40 percent video or below tend to stray significantly from their appropriate hue grouping. For example, some of the heavily desaturated magenta samples register as blue, while others register in the cyan range. This "wandering" was found in all six hue groupings.

The hue samples presented in Figure 1 have also been adjusted for "wandering." Each sample in a particular hue scale registers at its appropriate phase. Those samples registering at 100 percent video and at 40 percent video or below were difficult to read accurately on a vectorscope and appeared colorless on a television screen.

In light of this finding, it appears that if color is desired on the screen at all, television personnel should use only those hues which register between 50 and 90 percent video. All brighter and darker hues appear neutral, so white, grays and blacks may be substituted if desired. The final color classification system for the television artist (Figure 1 and Table 2), then, consists of 30 actual hues and 30 apparently neutral values.

ure 2. Phase difference upings of 80 fully rated color samples.

ure 3. Phase difference upings of six aturated hue scales.

Use of the system by television personnel

The color classification system presented in Figure 1 can solve many of the problems set forth in Part One of this article. The problem of too many colors can be significantly reduced, for example, since only hues registering between 50 and 90 percent video appear to have an identifiable color on the television screen. By studying the system shown in Figure 1, as well as the body of incidental findings, television personnel will be able to generate their own guidelines on how colors will reproduce electronically.

Theoretically, the findings can be applied accurately only to Prang tempera colors. In reality, however, much of the guesswork can be eliminated from color decisions that must be made with other artists' media having a matte finish, by using Figures 1, 2 and 3 as a guide for color decisions. Remember that each of the 60 color samples in the system corresponds to a specific gray value from 10 to 100.

Since the system contains the six fully saturated colors of the color-bar waveform, the system can also be used by television engineers for aligning color cameras.

In summary...

This rather extensive study produced some unexpected findings on the response characteristics of standard broadcast equipment to specific hue and brightness combinations. It is difficult to summarize 90 pages of data that took almost one year to compile in two short *Broadcast Engineering* installments. Color reproduction is a highly complex and sometimes highly subjective phenomenon. (Part One of this article dealt with some of the very important subjective elements.)

However, by studying the summarized data contained in these two articles, broadcast producers, directors, artists, set designers and engineers should be able to remove much of the "surprise element" from color television production. □

Kevin O'Connell, WQXI, Atlanta says:

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"Fastest editing machine I've ev used! I can use a grease pencil split gate opens for perfect visibi without lifting the tape"

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ecause the calibrated level
ol 'clicks' when I move it out and
into position I can always return
calibrated setting. Easily."

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marker. Or, I can crease-mark the
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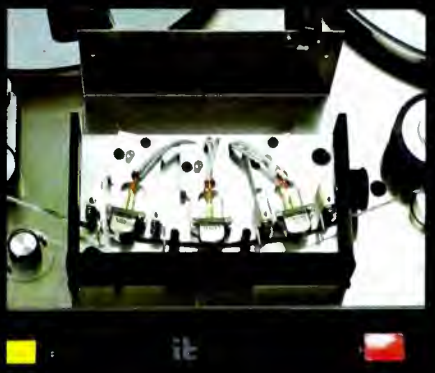

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STEREO PHASING: The untold story

By Dennis Ciapura

The effects of phasing errors on a station's mono FM signal are well-known and certainly much has been written on the subject in recent years. The mono degradation has always been a hot topic because up until just two or three years ago, many radio markets were known to exhibit 80 to 90 percent mono listening statistics. This was true despite stereo market penetration figures of nearly 100 percent on the broadcast end and 80 percent or better on the consumer end of the chain. In other words, we were transmitting stereo signals and most potential listeners had at least one stereo receiver of some sort, but most of the *time spent listening* was in mono.

The time spent listening is a very important factor, because it gives us an opportunity to either turn the listener on or off, depending upon how we do what we do when he listens most. Obviously then, a muddy, swishing mono air sound was what the listeners heard most of the time they listened, if the station's tape gear had a phasing problem.

As you've probably noticed, we are talking about this mono problem in the past tense, but now there is good news and there is bad news. The good news is that some of the factors that resulted in such a large portion of the time spent listening to mono are changing and we can look forward to a reversal in the trend. Most FM automobile installations are stereo and production cost reductions have made inexpensive stereo table model receivers a reality. This is not to say that mono compatibility is no longer a problem, because most of the time spent listening in most radio markets is still mono, but the trend is going the other way.

The bad news is that as most of the listening time is converted to stereo, our phasing problems will not be alleviated, because the same phasing errors that resulted in deterioration of the mono signal, also result in similar alteration of the stereo signal. The stereo losses often go unnoticed at the broadcast station, however, because the stereo degradation usually cannot be heard until the signal has been transmitted and received. A strange story? Yes, but unfortunately true. And that is the un-talked-about part of the stereo phasing story.

Can't be heard until transmitted?

When a stereo tape is auditioned in the studio, the left and right audio channels are fed independently through the audio system and out the speaker to the listener, just as the radio listener would hear the tape if he had the tape at home to play on his audio gear. Now let's assume that the station has absolutely perfect fidelity. Should the listener still hear the tape exactly as it would sound on his own equipment? Unfortunately, No. There's just one hitch. The FM broadcast transmission system does not really transmit discrete audio channels. The left and right audio channels are broken down into left plus right and left minus right components when transmitted, and it is the eventual decoding of this sum and difference information that the receiver delivers to the audio system in the home. While there are dozens of stereo generation schemes and demodulating circuits in use (... of which are switching techniq... the odds are that most st... listeners hear an audio signal ... has undergone at least one ... version where the left and ... audio channels have been ... trically added. And this is ... "Catch-22," but first, let's tal... look at the mono.

Stuck in the middle

Although we usually think of ... left plus right component of a st... transmission as the mono signal ... must not forget that the L+R is ... a component of the stereo info... tion. In fact, with most conte... rary music, it's a large part of ...

A solo performer, whether v... or instrumental, is usually plac... the center channel position ... stereo recording. This was ... always true though. In the ... days of stereo, the easiest wa... remix a master to make a st... release was to put each of the a... tracks on either the left or ... channel. It wasn't long, how... until the pan pot ruled supreme ... recordings with a more nat... stereo image began to make ... way out of most studios.

Common studio practice for ... years now has been to place sol... in the center channel, which is ... L-R or L+R transmission cha... that we customarily think of as ... mono signal. Recording engi... usually use one of two methods ... maintaining the desired mix v... cutting a record featuring a ... vocalist. Either the recordin... supplied to radio stations wit... separate mono side having a sp... mix to avoid a phenomenon k... as center channel build-up, w...

Continued on pag...

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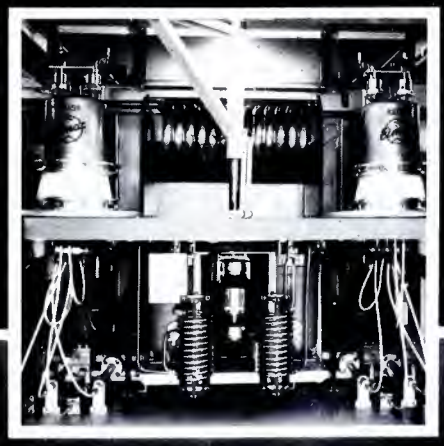

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STEREO PHASING

Continued from page 26

occurs when a stereo recording is played monaurally, or a special phasing device is used to cause about a 3 dB loss in the center channel when the left and right signals are added for mono play.

So, as you can see, our simple and seemingly straightforward stereo recording is not so simple after all. It's stereo, but it's also partly mono...in most cases, primarily mono. At this point you may begin to see how our sloppy-phase tape can sound different off the air than off the tape. When we listened to it in the studio, there was no addition of the left and right channels that would result in a loss of center channel high frequency response as the channel-to-channel phase difference increased with frequency. At the listener's receiver in the home, that solo vocalist would not be reproduced with the same crispness that we heard in the studio, even if the frequency response of the individual transmission and reception channels was perfectly flat. Any addition of the left and right audio channels, anywhere, would cause a loss of highs.

Phase shift losses

Refer to Figure 1, which shows how much loss we can expect from various degrees of phase shift. As you can see from the data, appreciable losses are suffered as the shift approaches 90 degrees. The loss of rise time in the mid-range is probably more significant than the actual dB loss of response, which accounts for that occasional loss of crispness or bite that poor transient response is notorious for.

Now, let's take a look at what the mono frequency response would be like when a stereo tape is transmitted with phase errors. Figure 2 shows an example of what the frequency response versus stereo position would be for a mono receiver with perfect frequency response. As you can see, components of the stereo program material that appear at far left or far right in the stereo recording suffer far less treble loss than the center channel information. The reason is simple: a left-only or right-only signal will not be subject to any cancellation in the L+R baseband, while the same audio positioned at stage center will appear equally in both left and right and any phase cancellation will result in maximum loss. This results in a rather interesting phenomenon.

The *mono* frequency response will vary as a function of the *stereo* position, even though the signa is being reproduced on a mono ceiver. Figure 2 is based o typical tape system with a 90 de phase shift at 5 kHz due to azi error.

How about the stereo?

Figure 3 is a simplified schen of a typical matrix circuit use many FM transmitters in opera today. Basically, what the ci does is to add the left and channels in phase to generat L+R and add then out of phase subtract them if you like) to erate the L-R.

Let's assume for a moment we are feeding the system wi stereo tape input with the phasing characteristics that Fi 2 is based on; 90 degrees at 5 The output at the L+R term would cancel more and more a frequency and corresponding p shift increased until finally at degrees, total cancellation w result in 0 L+R output. On the side of the matrix, however, the and right signals, which had cancelling at low frequenci produce 0 L-R output, now beg uncancel as the frequency phase shift increase until fin 180 degrees inverts the signals into phase and the mono signal shifted from the L+R main ch into the L-R subchannel!

So, now we know where t lost-out-of-phase components gone to; out of the main cha and into the subchannel. Since transition is taking place function of audio frequency, stereo frequency response wi center channel input with cha to-channel phasing error dep heavily upon very accurate p tracking of the main and channels in both the transmitte receiver.

For a stereo generator to be to achieve 30 dB of channel sep tion, the phase tracking has t very close, within 3 degrees, s transmitting end of the chain usually pass a phase shifted s signal without audible loss of c channel highs. This is why mo tion monitor audio output can s fine as long as the head azi error and equalization setting bined don't result in loss of vidual audio channel high frequ response. *Continued on pag*

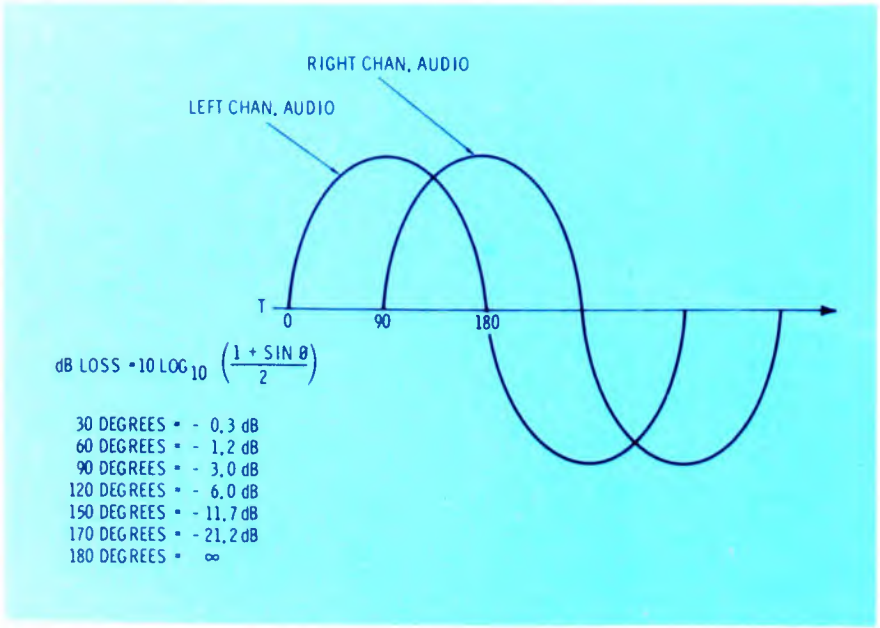

Figure 1. Losses that can be expected at a given frequency at various degrees of phase error between the left and right audio channels. As audio frequency increases, the wavelength decreases and the phase shift increases proportionately. The losses increase rapidly as the shift approaches 180 degrees, however.

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Robert O. Southard
General Manager, WFRV-TV

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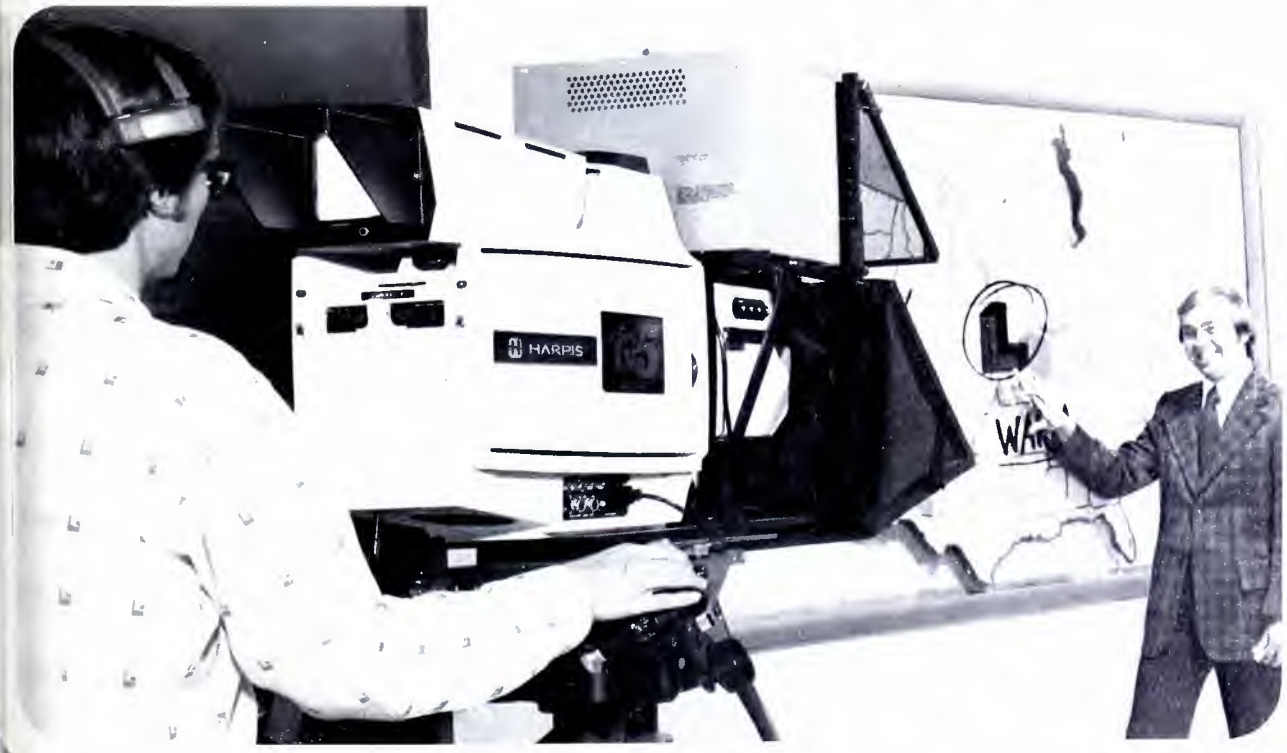


For More Details Circle (25) on Reply Card

Miami Newsfilm Update:

The two largest TV network affiliates in this competitive "Top 20" market choose to upgrade their newsfilm equipment rather than switch to All-ENG, recognizing the indispensable role of 16mm newsfilm in a balanced newsgathering operation.

Despite the continuing "All-ENG" hysteria, the majority of affiliate and independent TV stations across the country have opted for a balanced newsgathering operation — a healthy mix of modern, one-man-band newsfilm cameras and a limited number of ENG units with live transmission capabilities.

What's happening in a "Top 20" market like Miami is typical of current trends in gathering news for television.

Basically a flat narrow strip along the coast, with the Atlantic Ocean on one side and the Everglades on the other, Miami is considered among the fastest growing markets in the country. Long fav as a major convention town, Mia also a gateway for South Ameri Central America, and one-stop s vice to Europe. Since 1960 Miam been the third-ranked city in the country in terms of datelines, w more hard news stories in one c than any other market this size.

"Our cost analysis left it very much up in the air as to whether ENG saves you money in the long run."

WCKT-TV, the NBC affiliate in Miami, has won numerous awards in recent years for its outstanding news coverage and investigative reports.

"We have two ENG units with live and tape capabilities," says Gene Strul, News Director, WCKT-TV. "The time had come to decide whether to go All-ENG or to retain film cameras.

"Our cost analysis left it very much up in the air as to whether ENG saves you money in the long run.

"We have also found that, contrary to reports, ENG units still do not serve as replacements for film cameras. We still cannot edit tape with any great speed. And the support equipment for ENG is bulky and difficult to maneuver. We use helicopters frequently to cover stories. (We also use them to rush material to us.) On occasion, we also shoot film from boats. ENG could be a problem when a helicopter or boat is needed. We also do a lot of investigative reporting where ENG would be difficult to use because the amount of equipment required would let everyone know what we're doing.

"As far as the public is concerned, it doesn't make much difference whether we use tape or film. The audience isn't interested in the difference — unless it's live. Of course, the public isn't gaining anything if a story is put on live just to use the live capability. That's just a promotional gimmick, and the public gets blasé after a while. After all, they have already seen a *moon walk* live, and they see golf games and other events live. After a while they say 'so what.' Why bring in a feature story live when it could have been done better on film?

"The question was: should w invest in modern newsfilm camera more ENG? We felt that our two E units were enough to supplement t and serve our purposes at this poi And so, as our old newsfilm came have gone out, we're replacing the with new CP-16 units."

Dave Seeger, Newsfilm Reporter, WCKT-TV, loading his CP-16 into the news car. "VNF 7240 gives us a lot more latitude," says Seeger. "Working on various investigative series and shooting frequently at low light levels, I've probably 'forced' more film than any photographer around here." (Eastman Kodak has recently developed a new, remarkably fast stock, VNF 7250, with an ASA rating of 400, which permits shooting at light levels as low as two footcandles without requiring any forced developing! If needed, the new VNF 7250 can be pushed three stops to an ASA of 3200!)

Gene Strul (right), News Director, WCKT-TV, Choate, Assistant News Director, in conferen about an upcoming investigative series. "W found that, contrary to reports, ENG units sti not serve as replacements for film cameras, says Gene Strul.

Frank Broughton, Lab and Photographic Equ Manager, WCKT-TV, accepts delivery of eigh CP-16's from Charles Sutyak of Photomart (t regional CP-16 dealer headquartered in Orla Florida). WCKT-TV purchased two CP-16's in two in 1975, and in the winter of 1976-77 — twelve additional CP-16's!

"I don't think our equipment inventory should lie exclusively with ENG or film," says Ralph Renick, Vice President for News, Wometco stations. The WTVJ-TV news department equipment inventory includes two ENG vans, five ENG cameras, and nine of the station's CP-16's.

...don't think a station should ...All-ENG primarily because, ...ith present ENG technology, ...ur coverage would be limited."

...-TV, the CBS affiliate, is the oldest ...n in Miami. And the "Ralph Renick ...t" is probably the longest contin... ...ewscast in America. WTVJ-TV ...as the greatest number of ENG units in Miami: five.

"I don't think our equipment inventory should lie exclusively with ENG or film," says Ralph Renick, Vice President for News, Wometco stations. "I don't think a station should go All-ENG primarily because, with present ENG technology, your coverage would be limited.

"Plus, some stories, especially features with a great deal of motion involved, lend themselves better to a newsfilm camera. Stories that are better covered with film include some breaking stories where you have to be able to move rapidly, and out-of-town stringer stories. While film in our shop is becoming a back-up or secondary system of coverage, with ENG being our primary and preferred mode of coverage, it is important that the news manager invest sufficiently in film equipment that is reliable.

"As for film versus ENG cost factors, the extra personnel involved in ENG and other extra expenditures have made the two a financial draw, they break down about evenly."

...enick (left), ...sident for ...Vometco ..., with Jim ...e, News ...ment Editor, ...V. "We see ...part of the ...eration for ...seeable ...says Renick.

Cameraman Jeff Fort, of WTVJ-TV, takes a light meter reading, getting ready for a federal prisoner to come out of the courthouse building. WTVJ-TV acquired twelve new CP-16's in the fall of 1976, of which nine were assigned to the news department.

The leading TV stations in Miami may differ in their general approach to news and newsgathering, in the specific tape/film ratios they use in covering the news, and the extent to which they use ENG live capabilities. Though the competition among the stations is keen and lively, on one subject there's a definite consensus: *16mm newsfilm still remains the backbone of a balanced TV newsgathering operation.*

STEREO PHASING

Continued from page 28

The average stereo receiver is another story though. Many of the less sophisticated sets have very poor main and subchannel phase linearity at the high end which doesn't make the stereo separation sound subjectively bad because the mid-range channel separation is usually quite good. But since the high end tends to go mono, the inevitable high end response losses begin to dull the center channel. The most audible effect is not so much the loss of treble response, which might only be a few dB at 10 kHz on a stereo receiver, but the degradation of midrange transient response that results from lowering the high end cutoff frequency for center channel information. It's that same dulling effect that blurred the mono signal, except that the stereo losses are more subtle.

Some of the better stereo tuners have a "high blend" circuit that can be switched in to help reduce hiss on weak stations by reducing the separation at high audio frequencies. The audio frequency response of the tuner is not affected by this function and circuit designers like to provide this feature because most listeners would be less annoyed by a loss of stereo at the high end than a constant hiss. If you have access to a tuner with this feature, tune around the band with the switch in and out and you'll be able to tell the

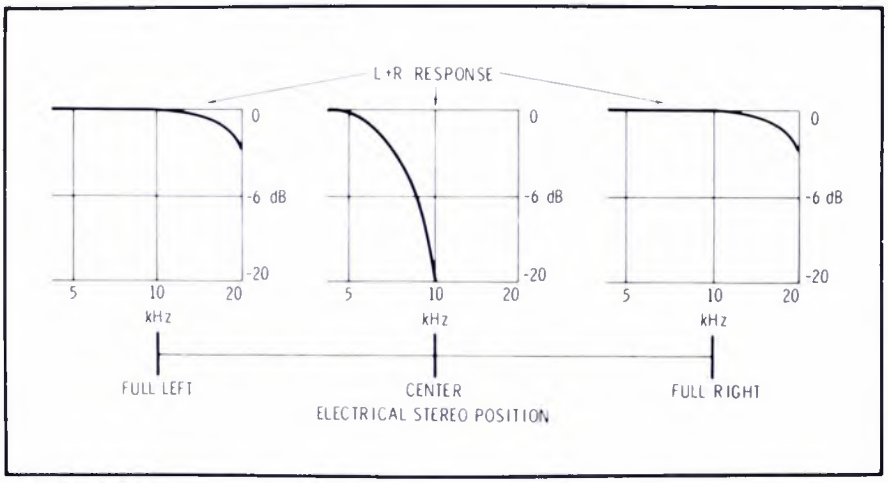


Figure 2. Mono frequency response vs. position for a typical tape deck with a head azimuth error producing a left to right phase shift of 90 degrees at 5 kHz.

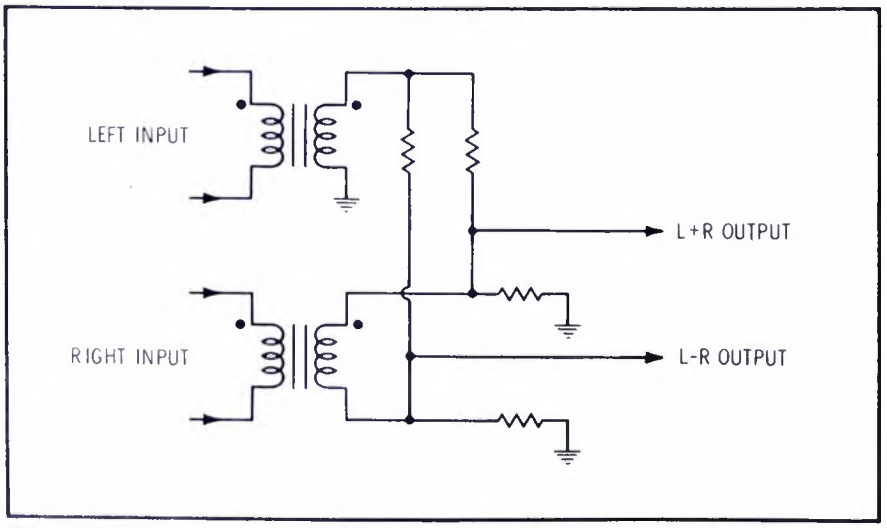


Figure 3. A simplified schematic of a typical stereo generator matrix.

tape-formatted stations by the of some high end when the ble switched in, unless of course station's tape gear is in top s or the music doesn't have a h center channel at the moment.

This is not to say that ta necessarily a deficient si source, for certainly the me offers programmers an opport to fine tune the format ahea broadcast, but the engineering partment must keep the tape tuned up if optimum audio r duction, both mono and stereo, be attained.

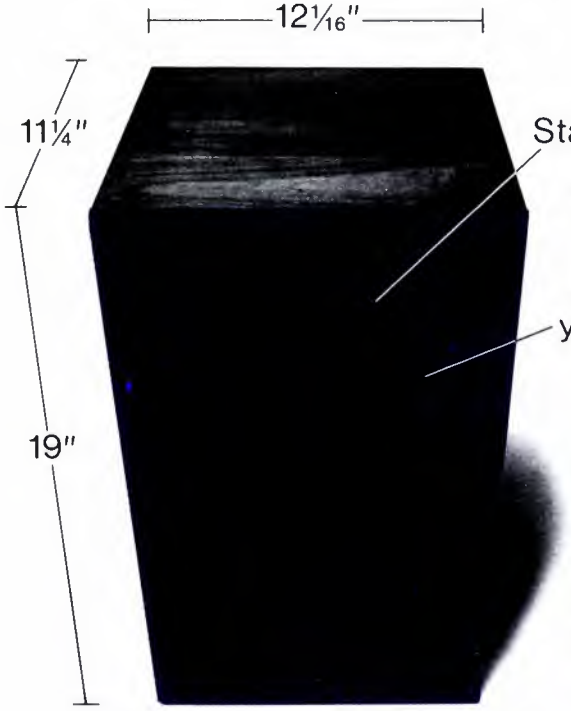
Shifting tape load

Realizing what subtle inner v ings are acting upon our s transmission, it is easier to u stand why we hear some of things on the air that we do. you ever noticed that some stat which you know are automate running a tape format of some sound audibly duller on the compared to stations playing ords "live," even though the is reported to be flat and you the station isn't overproces How about the carted announ that don't sound exactly like live voices even though the corders and playback decks ar as can be.

If you think about it for aw you'll see there is a very reason to keep the channel channel phase within 30 degree to 15 kHz, a goal that a maintained, professional deck attain and maintain with fre spot checks. **Tape decks shou checked at the start, center and of reel because the phasing varies as the shifting tape changes tensions and a compro setting of the head azimuth ma required for best reproduction the entire length of the tape.**

Many engineering and prog ming people listen for pha errors on the air, but limit attention to the familiar ske effects common to gross undul phase shifts. Less obvious ph ills can render the station's audio efforts ineffective. If you believe it, bridge the left and channels of your favorite tape through a resistive adder and p mono test tape. You may see unpleasant view of your ce channel.

Now there's a JBL monitor specially designed for broadcast studios.



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BE

Directional Antenna Basics

Part 3 of a series

By Robert A. Jones,
Consulting Engineer, La Grange, Ill., and Facilities Editor for BE.

This is Part III of our continuing series on the design of directional antenna systems. In Part III, I will expand upon the basic two-tower concept as studied in April.

Two-Tower Addition Formula

There are two basic ways to calculate our two-tower radiation pattern. These are referred to as the addition method and the multiplication method. Equation 1 is that of the addition form:

$$E=Kf(\Theta)\cdot(E_1+E_2/\Psi+S\cos\Theta\cos\varnothing)$$

As explained in Part II of this series, these terms represent the tower vectors, (E_1 & E_2), the phase angle relationship between the two towers (Ψ), and physical spacing in degrees (S). This formula can be re-written as shown in Equation 2, by separating out the sine and cosine terms:

$$E=Kf(\Theta\cdot[(E_1+E_2\cos(\Psi+S\cos\Theta\cos\varnothing))^2+(E_2\sin(\Psi+S\cos\Theta\cos\varnothing))^2]^{1/2}$$

Using this formula the reader can compute the results shown in Table I. In this example I have calculated the horizontal plate pattern, thus F(Θ) and cos Θ can be assumed to be 1.0. The constant "K" was computed, as shown in Formula 4 of Chapter II.

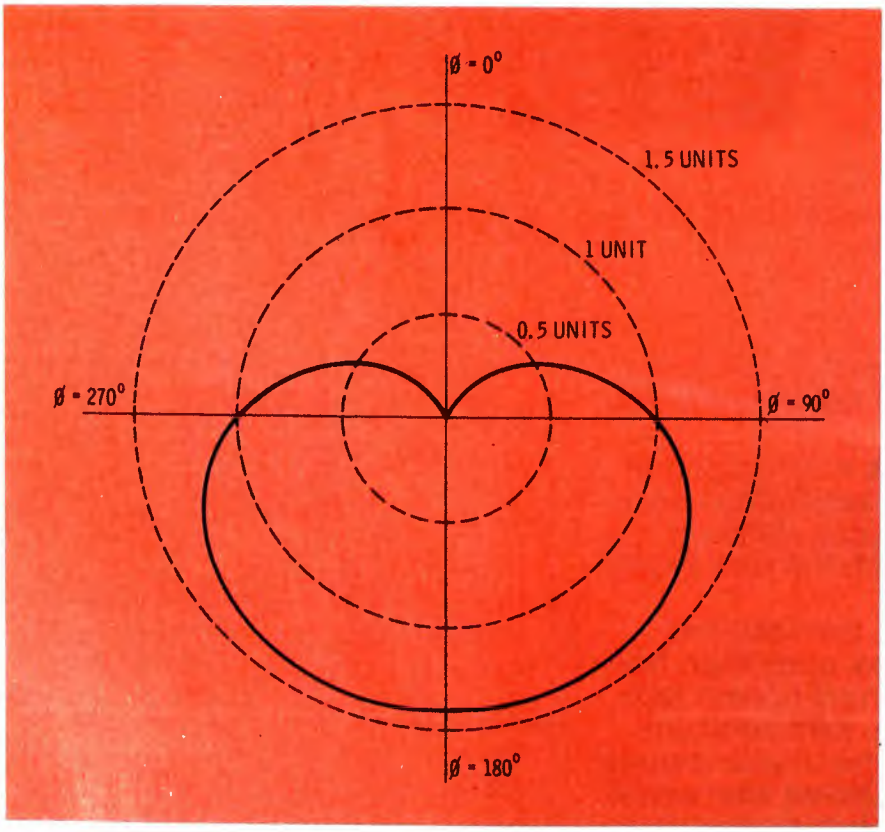

Figure 1

Two-Tower Multiplication Formula

Now let me show you how I develop the same identical pat with the multiplication meth using the formula in Equation

$$E=Kf(\Theta)\cdot\sqrt{\frac{1+M^2}{2M}+\cos(\Psi+S\cos\varnothing\cos$$

In this formula, all terms are the same as in the addition form except for term "M". This re sents the ratio of tower num two's vector divided by tower ve vector =

$$\frac{E_2f_2(\Theta)}{E_1f_1(\Theta)}$$

In Table II, I have tabulated the data used to compute the patt *Note that the final column in T I is identical with the last col in Table II* except it is 141 per larger. Figure 1 represents the p graph of this pattern.

At this point you may say th all great, but where did Equati come from? Also, why are there sine terms? The reason for this point is that in this formula I written the equation around mid-point between the two tow In such a step, the sine terms f each tower will have oppo polarity, hence will cancel other at each and every bea calculated. I have outlined method used to develop Equatio Let the expression (Ψ+S cos Ø Θ) be represented by the term "X We can then let E_1=1.0 and write it in Equation 4 as:

$$E=Kf(\Theta)\cdot\sqrt{(1.0+E_2\cos\text{“X”})^2+(E_2\sin\text{“}$$

Multiplying out we get:

$$E=Kf(\Theta)\sqrt{1.0+2E_2\cos\text{“X”}+E_2^2}$$

$$\sqrt{\cos^2\text{“X”}+E_2^2\sin^2}$$

Since $\sin^2+\cos^2=1.0$ (from sim trig) we can substitute:

$$E=Kf(\Theta)\sqrt{1.0+2E_2\cos\text{“X”}+}$$

By substituting for X and divi out the $2E_2$ term we get:

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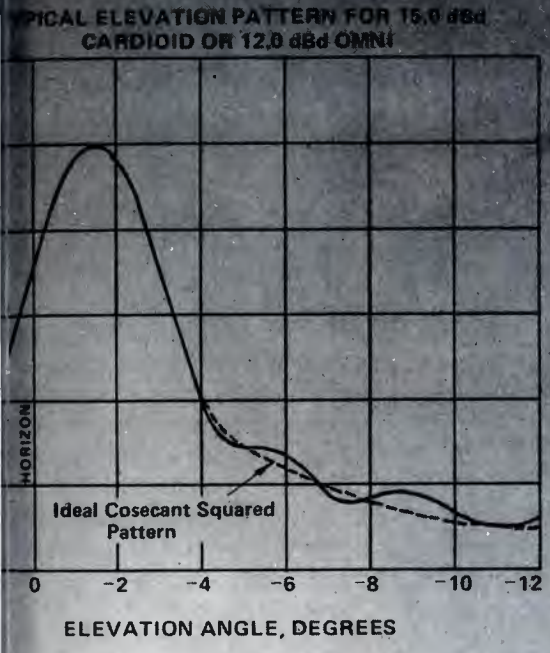
UHF-TV TRANSMITTING ANTENNA
PROVIDES CUSTOM-OPTIMIZED RADIATION PATTERNS



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- Pressurizable radome eliminates problems caused by corrosion and ice formation. Powered radome heaters are not required.
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Continued from page 34

$$E=Kf(\Theta)\sqrt{2E_2}$$

$$\sqrt{\frac{1.0+E_2^2+\cos(\Psi+S\cos\varnothing\cos\Theta)}{2E_2}}$$

The $2E_2^2$ term outside the radical is a constant (for any given design), so it can be included in the K term. Thus we can write Equation 4A as:

$$E=Kf(\Theta)$$

$$\sqrt{\frac{1+E_2^2+\cos(\Psi+S\cos\varnothing\cos\Theta)}{2E_2}}$$

I want to point out that Equation 3 is the most practical, the least time consuming, and results in the least chance for error. This is no doubt the most widely used method among engineers. Equation 3 is of course identical to Equation 4A, except it is more common to substitute M for E_2.

Rarely Used Method

There is one other step or method that is rarely used in calculating two-tower patterns. I show it here in Equation 5 mostly for its historic value, and not as a common or generally accepted method of developing patterns. This is referred to as the "half-angle formula." It can only be used when the fields of each tower are equal. For this the reference point is assumed to be ½ way between the two towers.

$$E=Kf(\Theta)\left[\cos\left(\frac{\Psi}{2}+\frac{S}{2}\cos\varnothing\cos\Theta\right)\right]$$

This formula is derived from Equation 3 by using the old trig fact that,

$$\cos\frac{A}{2}=\sqrt{\frac{1+\cos A}{2}}$$

All formulas really represent different trig relationships.

Two-Towers By Computers

Most consultants now resort to the aid of a computer in calculating directional patterns. It will be helpful to understand how the computer calculates a basic two-tower, or multi-tower, pattern.[1] In essence this is done by the addition method, similar to formula 1 above. One tower is written as the reference tower ($E_1 \angle 0°$). Then each of the other towers is "added" to the reference tower, one at a time, regardless of the number of other towers. The computer program developed by Don Markley and myself was written to accommodate up to 12 towers. In Equation 6, each of the other towers is added in by:

$$\text{Reference tower} + E_n\angle\Psi_n+S_n\cos\Theta\cos(\varnothing-\delta)$$

The only new term here is the Greek letter δ. This is to acc... for the fact that not all the to... may lie in a straight line. For ... tower, other than the refer... tower, this represents the ... between true north and the r... ence tower. Figure 2 shows how ... angle is determined. For every ... tower, beyond this reading, th... would be a different value. The... exception would occur when ... towers are on a straight line ... such a case δ would be a con... angle.

Phase Angle Determination

At this point it would be he... to show how to calculate the co... value of phase angle (Ψ) to pro... a null at any desired bearing. ... the angle of the tower line ... given two-tower pattern is e... lished, and the spacing betwee... towers is set, the next step ... compute the phase angle. Figu... shows the relationship betwee... tower line, the spacing and ... phase angle needed to produ... null at any desired angle. Ke... mind that when a null occurs ... two-tower pattern it means tha... vectors from each tower are ... out of phase and result ... cancelling of the total signal at ... angle.

Knowing this one fact, we ... write the formula to be used a...

$\pm180°=\Psi+S\cos\beta$ (Equati...

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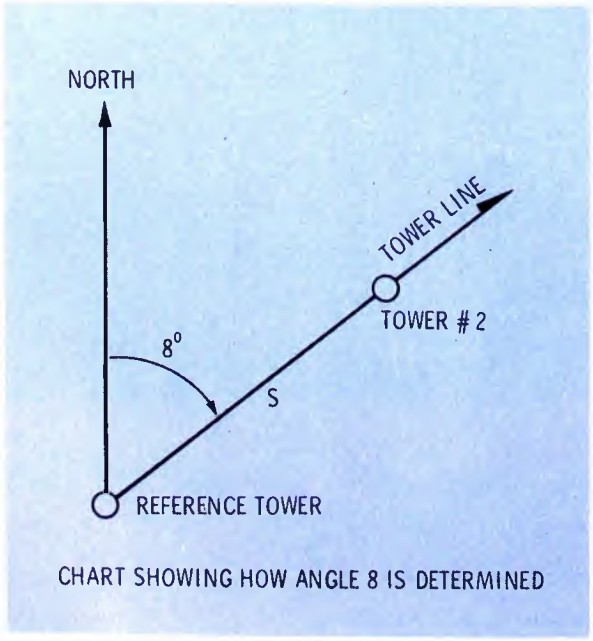

Figure 2

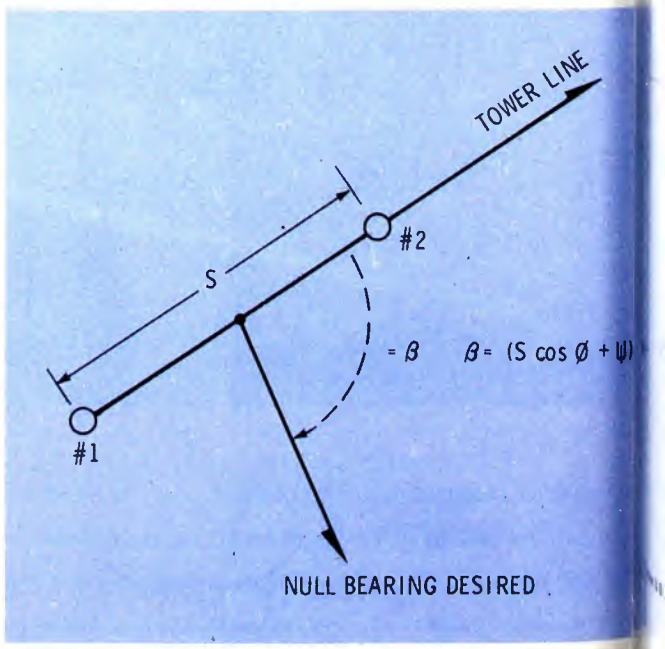

Figure 3

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Focal length	12-216mm	16-288mm
with 1.5x range extender	18-324mm	24-432mm
with 2x range extender	24-432mm	32-576mm
Maximum relative aperture	1.1.6 (f=12-172mm) 1.2.0 (f=216mm)	1.2.1 (f=16-230mm) 1.2.7 (f=288mm)
Zoom ratio	18x	18x
Image format covered	12.8 x 9.6mm, 16.0mm dia	17.1 x 12.8mm, 21.4mm dia
Minimum object distance from front vertex	0.7m (27.6")	0.7m (27.6")
Object dimension at minimum object distance: Wide	103.2 x 77.4cm, 129.0cm diameter	
Tele	5.3 x 4.0cm, 6.7cm diameter	
Back focal distance	62.65mm (in air)	78.08mm (in air)
Glass compensation	69.2mm (BK7)	70.2mm (BK7)
Wavelength range for color correction	400-700nm	400-700nm
Weight	23kg (approx. 50 lbs.)	23kg (approx. 50 lbs.)
Dimensions	466.5mm length x 284mm width x 260.5mm height	
Focus and Zoom control	Manual, with plug-in interchangeable servos	
Range extender control	Plug-in servo/manual	

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CALCULATING UNIT VECTORS

$E = f(\theta)\,(F_1 \angle 0^\circ + F_2 \angle \Psi + S\cos\beta\cos\theta)$

SUBSTITUTING $= 1.0\,(1.0\angle 0 + 1.0 \angle 90^\circ + 90^\circ \cos \beta, 1.0)$

A, B, C, D → J

A θ	B 90 cos A	C 90 + B	D cos C	E 1 + D	F E^2	G SinC	H G^2	I F + H	J * $\sqrt{I}$
0°	90.0	180.0	−1.000	0	0	0	0	0	0
10°	88.6	178.6	− .999	.001	.000001	024	00059	.00059	.024
20°	84.5	174.5	− .995	.005	.000025	.096	.0092	.0092	096
30°	77.9	167.9	− .978	.022	.00048	.209	.0439	.0444	211
40°	68.9	158.9	− .933	.067	.0045	.359	.129	.134	.366
50°	57.8	147.8	− .846	.154	.0237	.533	.284	.308	.555
60°	45.0	135.0	− 0.707	.293	.0858	.707	.500	.585	.765
70°	30.8	120.8	−.512	.488	.238	.858	737	976	988
80°	15.o	105.6	−.269	.731	.534	.963	.928	1.462	1.209
90°	0.0	90.0	0.000	1.000	1.000	1.000	1.000	2.000	1.414
100°	−15.o	74.4	.269	1.269	1.610	.963	.928	2. 538	1. 593
110°	−30.8	59.2	.512	1.512	2.28o	.858	.737	3.023	1 738
120°	−45.0	45.0	+.707	1.707	2.914	+.707	.500	3.414	1.848
130°	−57.8	32.2	.846	1.846	3.408	.533	.284	3.692	1.921
140°	−o8.9	21.1	.933	1.933	3.736	359	.129	3.8o5	1.9o6
150°	−77.9	12.1	.978	1.978	3.912	.209	.0439	3.956	1.989
160°	−84.5	5.5	.995	1.995	3.980	.096	.0092	3.989	1.997
170°	−88.o	1.4	.999	1.999	3.998	.024	.00059	3.998	1.999
180°	−90.0	0	1.000	2.000	4.000	0	0	4.000	2.000

* REPRESENTS LENGTH OF UNIT VECTORS

Table 1

Antenna Basics

Continued from page 36

or

$\Psi = \pm 1.0 = 180^\circ \pm S \cos \beta$ (Equatio

It is recognized that the cosin 180° is always -1.0. This Ψ can either a negative or a positive va The angle β represents the azim angle from the line of the tower the desired null bearing. Witl little experience you will easily le whether this phase angle (Ψ) negative or a positive. Gener speaking, if the null angle between zero and ninety degree is positive. A negative sign is u when the null falls between 90° 180°.

Null Fill

In summary there are two b ways to compute two-tower p terns. These are called the addi form and the multiplication fo In each case there is one t which is constant for each i vidual bearing. This is the t (Ψ+S cos Ø cos Θ). In fact once have calculated this term, the d other variables are the individ

Continued on page

REE!

our planning uide to a etter sound

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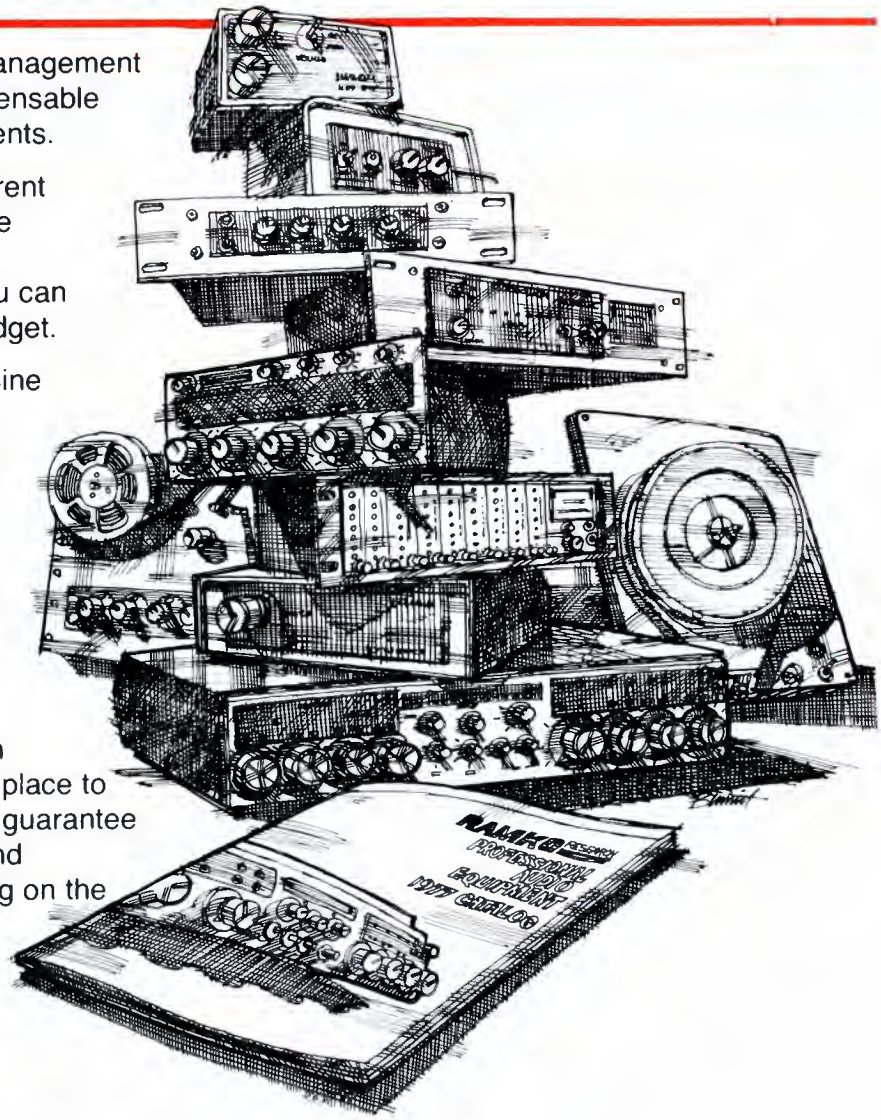

RAMKO RESEARCH

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Antenna Basics

Continued from page 38

fields radiated by each of the two towers. If we then say in our two-tower pattern that our null bearings are set, we then can vary the "depth" of this null by varying the field ratios. As you should recognize, when the individual fields are equal, the nulls will be "pulled-in" to a theoretical zero signal. As the ratio between E_1 and E_2 goes up, this null fills in more and more. By the time this ratio gets down to 100/1 you will have, for all practical purposes, a non-directional antenna.

Well-Formed Nulls

At this point I should point out that the nulls we have been talking about are those that you will find at a great distance over a conductive flat earth. In other words as you walk in closer and closer into a null, it will not hold. This is true for short distances, generally those less than 10 times the greatest element spacing. Near the directional array, predicted nulls cannot be deep, and may not seem like nulls at all. This is due to what I

Continued on page 43

MULTIPLICATION FORMULA

$$E_{UNIT} = \left(\frac{1+M^2}{2M} + \cos(\psi + S\cos\beta)\right)^{1/2}$$

WHERE $S = 90^\circ$, $\psi = 90^\circ$, and $M = 1.0$

A	B	C	D	E	F
β	90 cos A	90 + B	cos C	1 + D	E 1/2
0	90.0	180.0	−1.0000	0	0
10	88.6	178.6	−.9997	.0003	.017
20	84.5	174.5	−.995	.0046	.068
30	77.9	167.9	−.978	.022	.148
40	68.9	158.9	−.933	.067	.259
50	57.8	147.8	−.846	.154	.392
60	45.0	135.0	−.707	.293	.541
70	30.8	120.8	−.512	.488	.698
80	15.6	105.6	−.269	.731	.855
90	0	90.0	0	1.000	1.000
100	−15.6	74.4	.269	1.269	1.126
110	−30.8	59.2	.512	1.512	1.229
120	−45.0	45.0	.707	1.707	1.306
130	−57.8	32.2	.846	1.846	1.359
140	−68.9	21.1	.933	1.933	1.390
150	−77.9	12.1	.978	1.978	1.406
160	−84.5	5.5	.995	1.995	1.412
170	−88.6	1.4	.999	1.999	1.413
180	−90	0	1.000	2.000	1.414

Table

ow can we ffer digital TBC quality and flexibility– at a price this low?

Simply by designing a better time base corrector.

For example, the single most complex and expensive part of a digital TBC is the analog-to-digital converter. The TBC-110A eliminates the A to D converter through the use of a charge-storage analog memory. By sampling and storing the video signal at 14.318180 MHz, the TBC-110A provides the same sampling speed and video bandwidth as the competition's highest priced model — **without** the expensive A to D converter.

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Fades, wipes, and inserts possible with non H-lock VTR's.

The internal digital sync generator provides a full complement of pulse outputs that are locked to either the internal oven-controlled crystal, or a VCO that is tracking the video input. The tracking mode (floating window) can be used to lock cameras to the sync outputs of the TBC so that fades, wipes, and inserts can be accomplished with non H-lock VTRs.

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The TBC-110A provides complete video processing, including such features as separate luminance and chrominance processing in all modes, so that negative black spikes below sync are removed without clipping negative chroma. Chroma Gain and Chroma Phase are also adjustable in all modes (het and direct).

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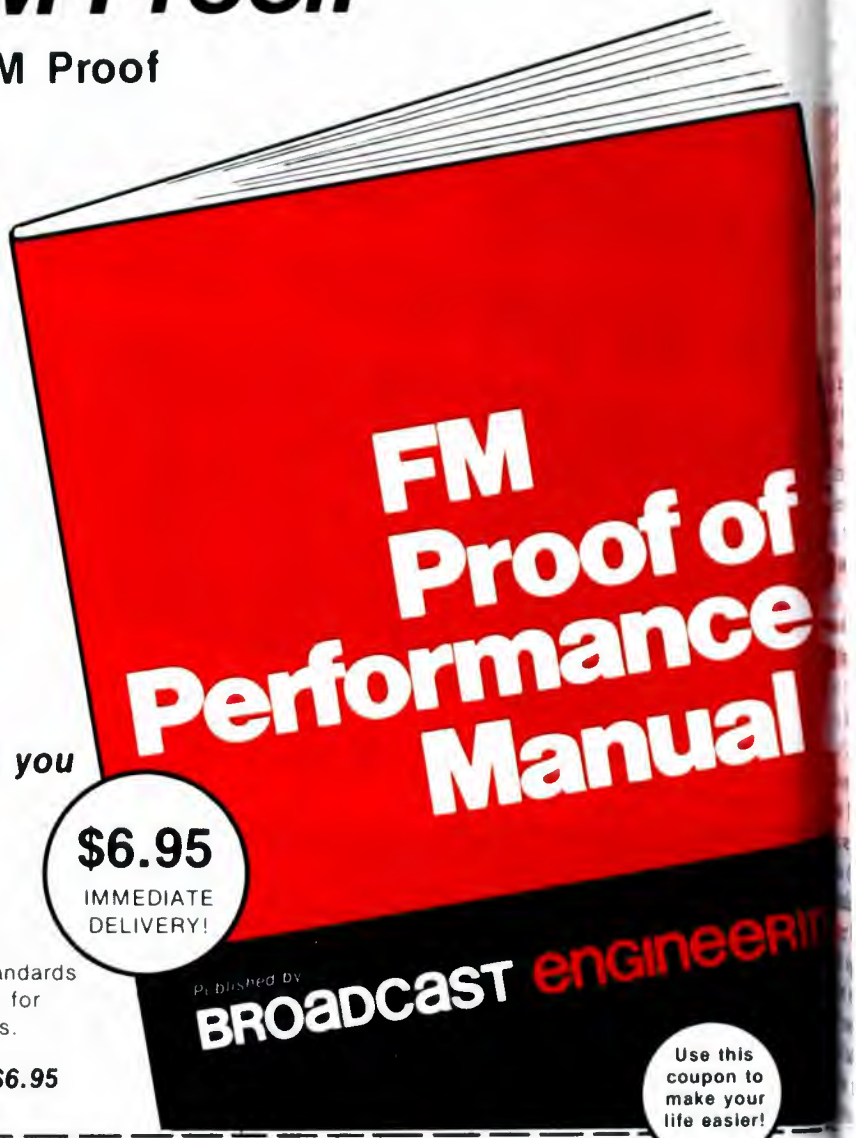

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enna Basics

nued from page 40

the parallax effect. In some s the "inductive field" also lestroy the null in close to the s. This generally occurs within imes the tower height. To use non FCC language, the null is dered not to be "well-formed." eral factors actually affect the signal you would observe on field intensity meter as you closer and closer to the array. e are the angular displacement parallel of each of the tower's als. As we have noted in ous comments, the designer s assumed that all signals all towers arrive parallel, and you are standing at an vation point that is more than times the greatest element ng, they are. But here, close e towers they are not. If you to walk directly into the le of a two-tower pattern, you d find that instead of being lel, the two signals would be ing from exactly opposite di- ons (180°).

second factor is the difference ath lengths. In the previous le, we had talked about the fact the difference in path lengths alculated by **S cos** Ø. This can nger be true because with non- lel signals the angle Ø to the ved is not the same. The third r one must apply as a cor- on factor is to account for the that the loop antenna on the ver's field intensity meter will iminate.

this point you might question or why the field meter's loop na will not read all signals lly, from all towers. This is use the nature of a loop na is to peak in the plane of oop and reject along the axis of loop. It is normally assumed this discrimination varies as a ion of the cosine of the angle een the plane of the loop and ngle of the respective incoming ls.

my next article, we will look the world of three-tower and tower arrays. □

Reference

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Montreux '77

A LOOK INTO TELEVISION'S FUTURE

By Joe Roizen

The International Television Symposium and Equipment Exhibition, held in Montreux between June 3rd and 10th, has once again achieved a new high in numbers of delegates, exhibitors and technical papers. In the last category especially, the Symposium Record had to be printed in 10 volumes that must have added at least four kilograms to every participants' already bulging bags full of brochures and baubles.

By all accounts it was a great television show. The big exhibits were lavish with fancy decor and eye-catching shows. ENG cameras relayed color images from hovering helicopters, extended fire ladders, artificial rain forests, or mountain climbing cogged railways. Mobile TV vans, enroute to exotic destinations like Abu Dhabi or Quatar, ringed the exhibit hall like a protective armada with their rooves bristling with extended zoom cameras and brightly-colored parabolas that connected to whirring machinery inside.

Cheek by jowl, the various minis and micros, shoulder-mounted or gyro-stabilized, wandered along the Lac Leman waterfront recording everything in sight. Spring flowers, snow capped mountains, stately swans and strolling lovers were TV fodder for the roving color cameras and voracious VTRs that recorded and repeated these fleeting scenes to prove their quality and versatility.

The one-inch videotape recorder mystery that raised its head at NAB was also in full force, now extending its dilemma to the PAL and SECAM world. For those seeking innovation, there was a back pack omni-directional microwave that relayed pictures from a portable camera without benefit of even triax cable. There was a portable standards converter that did everything from NTSC, PAL, SECAM, or even PAL-M to any other selected standard, all crammed into a mere 12-inch rack mount unit. U-Matics specially designed for Europe's higher bandwidth and color subcarriers were also sprouting at a few stands, bringing the introduction of Flaherty-style ENG a bit closer in Europe.

On the social side, there was an endless round of receptions, cocktail parties, banquets, bus trips and boat rides organized by either the committee or individual exhibitors. The 2,600 registered delegates from 55 countries who toured the 135-plus exhibits, sat through the 185 papers and attended the two round tables were in need of the relaxation afforded by the after-hour events. Any participant who left Montreux without having his or her palate satiated by Swiss cheese washed down with a local wine wasn't really trying.

The symposium

The Montreux Symposium is a major part of this international television gathering, and was reflected in the quantity and quality of technical papers that the event seems to attract. Even concurrent sessions were needed on some days to accommodate the topics to be covered, which ranged from satellite broadcasting to CATV, and everything in between.

The Symposium started on Friday with the morning session devoted to welcoming speeches by Fritz Locher, director general of the Swiss PTT, and H. R. Probst, chairman of the executive committee. Howard Steele, director of engineering for the IBA and chairman of the awards committee, announced the two gold medal winners for technical television achievements. This is a new award specia minted for the 10th Anniversa Symposium.

It was given to John Baldw of IBA for his work in digi TV and the creation of Di tal Intercontinental Conversi Equipment (DICE), and to Clau Mercier, the retiring technical di rector of French television and EBU Technical Committee. Sy posium citations for noteworthy c tributions to television technol were also awarded to Henri M tens, chief engineer of the EB Masahiko Morizono, director S Corp., and Daniel Sauvet-Goichon Television de France.

The keynote address was de livered by Werner Hess, director Germany's national television n work (ARD), and the 10th Int national Symposium was offici on its way.

International TV progress report

After a cocktail reception in t Montreux Casino, the afterno session on international televisi progress began. In keeping w tradition, experts from various organizations were invited to revi such progress in their areas.

Last year's Winter and Summ Olympic Games were reported on N. Wassiczek of the ORF in Vien and Marius Morais of ORTO Montreal. Wassiczek particula stressed the help given by neighb ing countries in loaning mobile ve and other equipment to permit t ORF to cover such a large televisi event. Morais used a series of slid specially taken by the CBS Staff a Donna Foster Roizen to illustr technical installations and metho of signal distribution both loca and world wide. Morais stress that the Montreal Games had t

Continued on page

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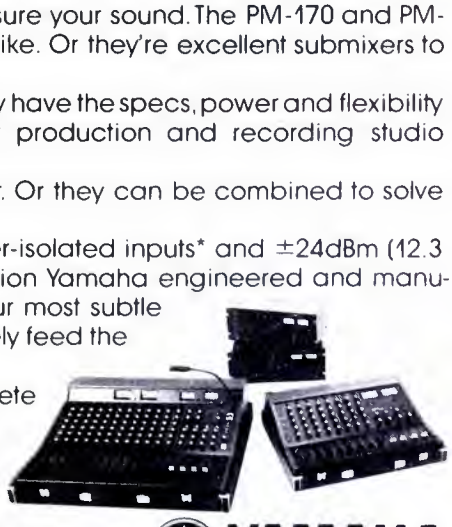

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largest audience ever for a televised event (1.25 billion), and used a record number of intercontinental satellite transmissions to achieve this.

Roland Zavada, engineering vice president of SMPTE, covered North American TV developments. He stated that the latest improvements in NTSC signal handling techniques, including VIRS, had finally removed the stigma of "Never Twice the Same Color" from the system. Victor Rojas of the OTI covered Latin America and the upcoming World Cup Games in Argentina. According to Rojas, these will be covered in PAL with new equipment obtained for this purpose. EBU developments were reviewed by R. Gressman who stressed the potentials of satellite communications for individual countries.

Mr. Balasubramanyam of the Asian Broadcasting Union in Kuala Lumpur gave a very interesting overview of new facilities and TV experiments in that area. The ultra-modern Avalon TV Center in New Zealand and the Indian CTS project, which sent satellite linked educational programs to thousands of Indian villages equipped with wire mesh parabolas, were among the items he covered. Television in the CCIR, the administration of RF spectrum space and operating frequencies was presented by the chairman of Study Group II, J. Krivosheev.

The round table conference

Another tradition at the Montreux Symposium is the round table conference that brings together users and manufacturers in a panel for a discussion about some aspect of television. Following this, the audience joins in to present opinions or ask questions. This year's round table conference was called "Trends in Video Systems Under the Impact of New Technology, Horizon 1985," and was chaired by Joseph Polonsky, who charged the panel members to look into the future with "both eyes open" to avoid any science fiction prognostications.

The round table opened with comments by Bill Connolly of CBS. Connolly pointed out that TV production is moving out of the studio and into the field where conditions are more hostile to the equipment. He would like to see new TV gear that is lighter, smaller and temperature stabilized. In Connolly's opinion, no cable at all is better than

triax.

Herbert Fix, the technical director of Germany's Institut für Rundfunk Technik, requested that the industry consider four aspects of TV post-production: (1) leasable post-production facilities, (2) simpler on-line editing devices, (3) film transfer to solve standards problems and cinema projection, and (4) improved laser recording for TV-to-film transfer. He wondered if people would still attend movies in 1985 or be satisfied with what comes into the home via TV.

Peter Rainger of the BBC supported Connolly's view of the exodus from studio to field production. He opted for better camera sensitivity and expects the new noise reducers to help. He saw no immediate competitor to magnetic tape, but felt film would still be widely used in 1985. Rainger also predicted that digital techniques will be used for archival recording and that high-quality 625-line TV will have a 34-megabit format.

Peter Hansen from Danish TV asked for sturdier equipment to suit outside broadcast requirements, and would like to see post-production systems in various sizes to suit different purposes.

T. Miuro of NHK concurred with his predecessors and described some developments at NHK (Japan) Research Labs where large screen, high definition experiments are going on.

The last speaker for the users was M. Remy, technical director of Telediffusion de France. He spoke about the new Antiope teletext service in France and the effects of video games, and questioned what to do with some of the new services offered by television.

The manufacturers

On the manufacturers' side, the first presentation was perhaps the most thought-provoking. R. D. Stewart of General Electric (USA) gave the only illustrated presentation. He stated that costs for new solid-state devices in the sensor and memory field are coming down by orders of magnitude. Stewart predicted that by 1985 there will be full broadcast quality CCDs. Both CCD and bubble memories will have roles in signal processing, time base correction, A/D conversion and bandwidth compression. Stewart foresaw a million bits on a chip and the start of an all solid-state recorder with no moving parts (or tape) by 1985.

J. Hillier of RCA followed with the view that 1985 will show what's

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already being worked on in the labs today. He saw two major areas of development: (1) equipment which is self-adjusting, self-aligning and self-testing; and (2) automation of editing and business functions in a TV facility. Hillier felt that technology itself is not the constraint on development, rather that technology's "future shock" limits adaptation and use of new devices.

More for the viewer

Representing Philips, F. de Vrijer had a promising word for home viewers. He said receiver improvements will bring home pictures closer to studio quality. He also saw a large increase in digital TV processing where it's better than analog.

Norman Parker-Smith of Marconi was emphatic about the continuing use of TV pick-up tubes in 1985, and Renville McMann of Thomson-CSF Labs supported him by saying that the cameras used eight years from now will resemble present ones, but will be smaller and more automatic. McMann did not expect camera sensitivities to increase by any great factor, but when solid-state sensors come along, there might be such a considerable improvement. McMann also saw microprocessors in cameras doing a lot of housekeeping, fiber optics from camera to CCU, and remote VTRs controlled by the camera operator.

Mashaiko Morizono had a few reservations about digital VTRs. Morizono from Sony saw better tape formulations with higher density recording solving current analog VTR problems in PAL and SECAM, thus getting to tenth generation utility as is now possible in NTSC. In fact, Morizono said that cheaper, simpler analog VTRs of the future may preclude digital advantages from making a serious entry into the field.

Ampex's Charles Anderson spoke of another aspect of the future, equipment investment return. Anderson queried the broadcasters as to whether they could afford a two-year equipment exchange even if the manufacturers could afford a biennial development cycle. He pointed out that Ampex equipment delivered in 1964/65 was still widely used and the investment of millions of dollars cannot be concisely disposed of just because technical breakthroughs occur at a faster rate.

Hans Groll of Bosch Fernseh followed this theme. He sided Morizono on the digital VTR tion, saying the answer was around the corner. He agreed Anderson that broadcasters live with current technology, even if the CCDs come along initial use will produce some q loss. Groll also felt that the use of frame stores will leac way to more digital processi other areas.

Comments anyone?

With the opening statem made, a lively discussion follo Howard Steele talked about recent digital VTR demonstratio Venice at an EBU meeting challenged the panel memb statements, reiterating tha megabits were enough.

R. Zavada of Kodak felt film w still be a major TV medium bec it uses little energy and operat low light. He predicted imp ments in sensitivity and the add of time code to further enh film's versatility. An EBU mentator suggested flexible uniform interfaces for comp assisted TV operations and Pouzols of Radiotechnique (Fra pointed out that receiver buyers spend 90 percent of the mon television hardware while b casters only represent 10 perce the total money spent.

The round table also includ session on receiver developm and the concensus among the p members was that future rece would include memory circ noise reduction, and teletext f ties at reasonable prices.

R. Gressmann of the EBU ask it was wise to continue to incr the technological gap between advanced countries and the veloping nations where, he said latter were still struggling basic services.

Dee Pourciau of IVC didn't to see any limits on develop and stated that TV gadgetry is limiting. This last comment have been in response to a s ment by Joe Roizen of Telegen, some new digital TV studio prod were unnecessarily complex effect variations far beyond no needs. As an example, Ro pointed to the numbers of swit effects which are unused or very limited duty cycles.

The summaries presented by panel members followed most their opening remarks, with a quotable statements. Hillier's

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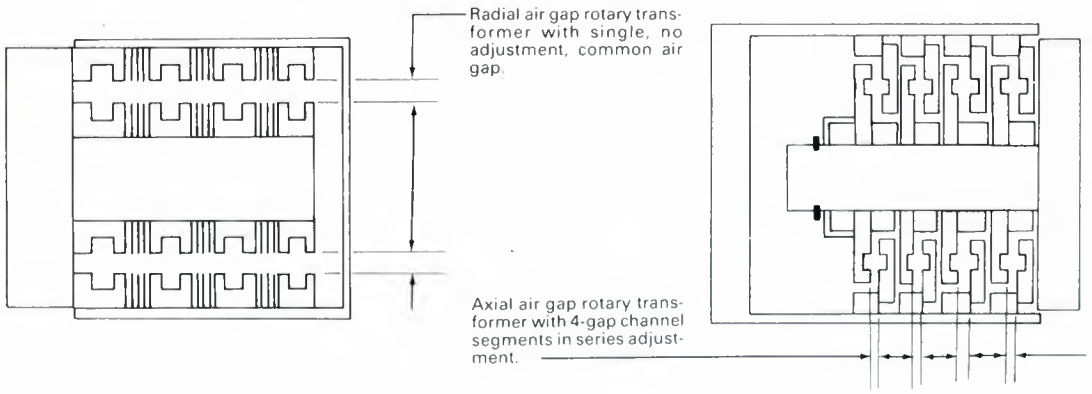

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clusion was that technology, if done right, simplifies an operation and that LSI will make more reliable equipment that is easier to use. Connolly clearly stated that all of the signal processing, digitizing, or manipulation won't make the program better, and many other panelists concurred. Urged by Polonsky to say a few words on behalf of the program producers, Peter Hansen postulated that the average producer wants a nice cozy environment, with a small group of known people who can work on understandable equipment which does not confront them with electronic wizardry beyond their comprehension. It is to this end that the broadcasters and manufacturers should direct themselves, according to Hansen.

Polonsky thanked the panelists and the audience and expressed the regrets of H. Jushkevitshus of the USSR for not having been able to attend. The round table conference closed with Polonsky's hope that progress towards better television equipment and services will continue in the future.

Increase use of ENG

With 185 papers in parallel sessions lasting five days, it would be impossible to give anything more than a thumb-nail sketch of the symposium. The sessions that attracted large audiences dealt with ENG, one-inch helical VTRs, satellite television, electronic editing and digital techniques.

As he has in the U.S., Joe Flaherty, engineering vice president of CBS, continued to champion ENG as the wave of the future in television operations. His statistics were impressive. According to Flaherty, over 700 U.S. TV stations are now all or partially converted to ENG. Of the 3,000 news crews, 1,200 are electronic with a continuing conversion rate of 300 a year. The use of videotape is also continuing to climb, and CBS is rapidly changing from film to tape on its coms.

Within his own network, Flaherty said that 53 percent of their programming is on tape, and this is increasing because of the impact of smaller cameras, one-inch VTRs and digital TBCs. CBS has only two film crews left and they will be converted this summer. Flaherty, speaking to over 300 delegates, felt that the new ENG equipment recently introduced in Europe will no doubt lead to a similar conversion of ENG practices on this continent and elsewhere.

A. Todorvic of Yugoslavian TV gave a concise summary of the history and current status of analog VTRs. John Baldwin of IBA then described a digital VTR developed in their laboratories at Crawley Court (UK). Their test base is the IVC 9000 segmented helical two-inch VTR, but Baldwin indicated that other machines could be adapted.

He suggested that for editing the VTR signals, stay in digital form, thus keeping a first generation quality regardless of the number of dubs made. Then conversion to analog form could be done for final airing of the edited program. The IBA digital prototype VTR still only produces half a TV image, but with smaller, cheaper memories Baldwin said a full-scale VTR was in sight.

M. Favreau of Thomson-CSF (Paris) followed with a well-illustrated paper on their videodisc, a thin plastic film using laser techniques for readout. Picture quality is good enough on this device to warrant serious consideration for some broadcast applications, e

Continued on page

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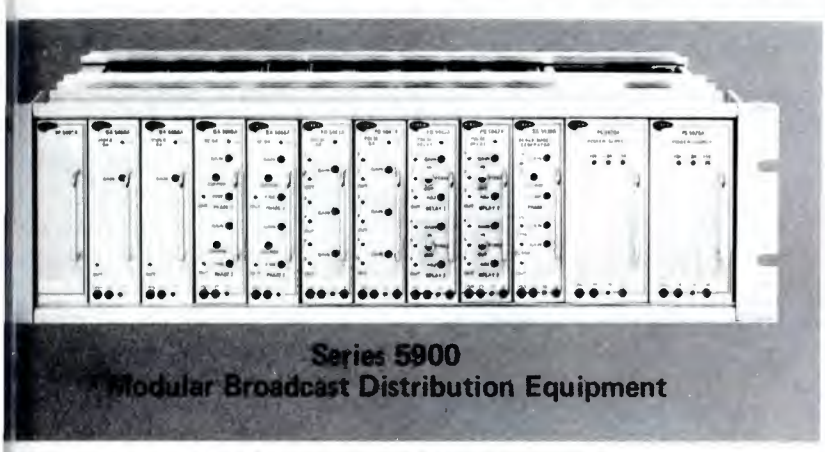

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cording to Favreau.

One-inch helical

The later morning session was the most controversial one. The proponents of three new one-inch helical formats, Ampex, Bosch Fernseh and Sony were pitted directly against each other in a series of three papers describing each system. Fred Remley of the University of Michigan and chairperson of the working group on non-segmented helical VTRs, preceded the technical reps of the three companies with a survey of the role of one-inch helical recorders in broadcasting. He touched upon the various formats and pointed to their current incompatability. He also explained what the SMPTE working groups were doing to standardize the segmented and non-segmented formats now being offered.

Bosch Fernseh's representative Henry Zahn described the segmented BCN machine made by his company and also offered by Philips, IVC and RCA. Zahn pointed out that the problems of slow and motion both for editing or for o use were solved by the addition frame store and showed tape ples that illustrated these feat very well. Zahn also showed cassette portable BCN which extends the configurations of format into every application, dio, field production, ENG or v ever the broadcaster wants.

R. Ravizza of Ampex follo with a detailed explanation of VPR-1 and VPR-10, the one- non-segmented helical recorder fered by Ampex as the latest for studio and ENG use in bro casting. Ravizza's paper includ detailed description of the autom scan tracking system (AST) w gives the VPR-1 the ability to broadcastible slow and still fra images. A piezzo-electric w under the playback video hea mechanically deformed by app voltages derived from error sig that are generated by RF enve sampling. The tape playback dem strations included a tenth gen tion dub of acceptable quality, the above mentioned features.

Sony's BVH-1000 was then sented by Y. Suzuki who gav graphic breakdown of the fo features and the VTR design le ments. Sony's format eliminated typical helical dropout period in vertical interval by having a s rate head write the vertical inte near the bottom of the tape. call this the 1.5 head princi Suzuki claimed this made it pos to retain the original VIRS, V teletext, or any other vertical in val insertions that may be pre in the incoming signal. The B 1000 also has slow and stop mo for editing purposes and a venient shuttle or jog mode search tape or select edit points addition, Suzuki described operational advantages of this direx" system, as they call it.

The discussion following spirited, with users or poten users complaining that the pr erating, non-interchangeable mats are causing concern and fusion in the field. However, member of the audience closed session by stating that this confusion is what provided a these well-paid, talented deleg with a 10-day vacation in Montr where they could enjoy the amenities while studying the p lem!

Better audio?

The two first papers in the a noon session dealt with measu

Continued on pag

ıe Dolby System in M Broadcasting – April 1977

ne 1973 Dolby Laboratories proposed an improvement in FM dcasting which would overcome high-frequency overmodulation ems and at the same time reduce receiver noise. The iique combines a reduction in the pre-emphasis time constant microseconds and the use of the Dolby B-Type noise tion system. In May 1974 the new method was approved by the ral Communications Commission for optional use in the A. A number of other countries either have approved the system e considering it.

mitters

1974, 160 FM stations in the U.S.A., in addition to 25 in countries, have purchased the Dolby Model 334 FM broadcast der unit.

ivers

urrently, Dolby consumer product licensees have been aring tuner and receiver models incorporating Dolby FM decoder its. At the present time there are 51 different models of such vers from 22 manufacturers. About 300,000 units are in use. asing by some 30,000 units per month.

ning Advantages Gained

- High-level high-frequency signal recoverability
- Noise reduction

Dolby FM process works at both extremes of the dynamic e. The maximum permissible level of high frequency signals is increased while low level noise is reduced. The 10 dB action of the Dolby B system is split in an optimum way between these two equally important areas of operation. The net result is an FM system which can pass signals from transmitter input to receiver output with high integrity.

Information Available

To find out more about this new development, please write to us for further details.

A NOTE ON DOLBY LABORATORIES

Founded in 1965, Dolby Laboratories specializes in complementary noise reduction methods and systems. In London the company manufactures equipment for professional use by recording studios, broadcasters, and the motion picture industry. In the consumer field, Dolby Laboratories functions purely as an R & D and licensing organization, based in San Francisco, California. Licensing is handled by a subsidiary, Dolby Laboratories Licensing Corporation, which has world-wide non-exclusive agreements with about 60 manufacturers for the incorporation of the Dolby B Type noise reduction system into consumer audio products. A uniform royalty rate is applied on a sliding scale based on circuit quantities; the average royalty paid is about $0.21 per circuit (two circuits for stereo). All Dolby circuits are manufactured to meet standardized performance requirements for universal interchangeability of hardware and software. 20 million such circuits have been made since 1968. Software products (duplicated tapes and FM broadcasts) are produced on a royalty-free basis.

Dolby®

oy Laboratories

' and the double-D symbol
demarks of Dolby Laboratories

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techniques on VTRs and a new q tape with better audio performa G. Weltz and G. Eitz of the described methods of precise ratio measurement as well as o parameters. Norman Ritter of showed the audio improveme possible with their recently in duced 8250 quad tape and playe short tape segment which g audible evidence of this factor.

Dr. Boris Townsend of the and Charles Urban of the teamed up to do a joint paper on state of ENG within the EBU. To send's main theme was that u now the really portable gear not quite good enough. What EBU needed was a magic "b box" which would eliminate n moire, chroma/luma delay and other defects of a third gener color-under tape.

Townsend showed a slide of front panel of such a device only an "on/off" switch above label "Magic Image Improver." next slide showed the inside of box, which was totally empty ex for a short wire lead on the bac the switch. His message was cl The EBU members want better gear suited to their standards.

Charles Urban followed with s examples of ENG operations u various portable or mobile comb tions of equipment from diffe countries. The pictures were g but none of the gear could be scribed as being low-priced.

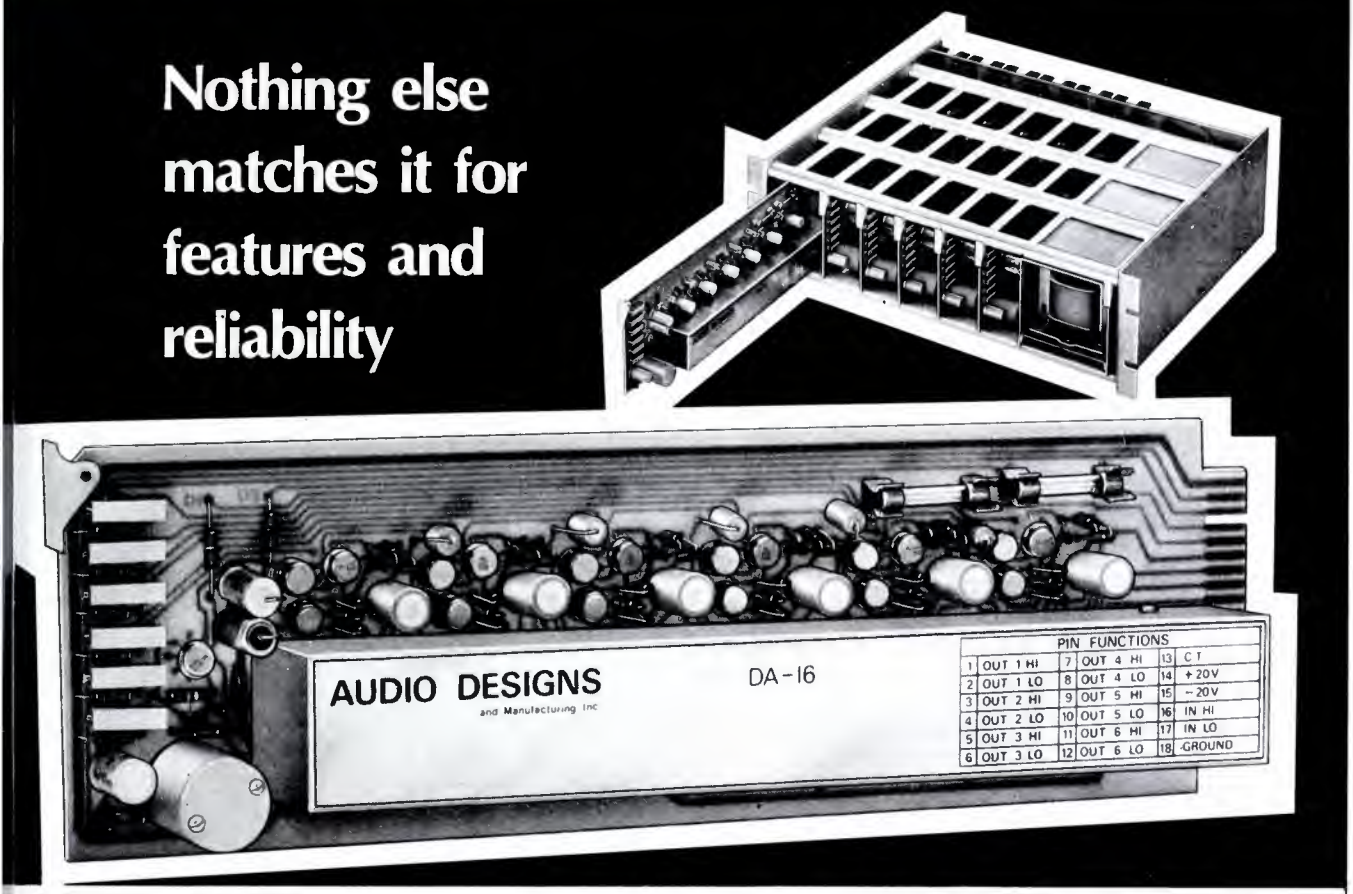
As if cued to respond to previous speakers, T. Morita Sony described an upgraded ¾-i cassette VTR (U-Matic) that designed for the PAL and SEC standards. A variety of mechan and electrical changes have b made to the standard U-M format to accommodate the gre bandwidth and higher subcar frequencies of the SECAM/PAL coding systems. Morita showe color playback from this impro U-Matic format which, even at third generation, looked like q an acceptable broadcast qua picture. Of course, the Europ networks will have to test system themselves before any g eral acceptance of this type of g for ENG is made. Several re sentatives of the larger TV servi indicated they were about to s such trial periods.

Electronic editing

The following subsession on e tronic editing of videotape had th

Continued on page

Nothing else matches it for features and reliability



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The ADM® DA16 incorporates an advanced-design approach, with superb specifications. It is the ultimate in audio distribution amplifiers. Each amplifier is a one in, six output plug-in card with +24DBM input and output capability.

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Up to six DA16 amplifiers can be housed in the Audio Designs® CH20 rack frame, which includes a redundant power supply with automatic changeover. Built to exacting quality standards, DA16 amplifiers offer exceptionally high reliability. For complete information write or call for specification sheet.

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papers which covered both tu and hardware descriptions.

W. Habermann of the IR Munich started off with a revie the field of automation as appli video recording and editing. He mann pointed out the reasons automation in TV studios: (1) s people-power, (2) efficiency in use of expensive studio gear, (3) organization of available equipment for central control. conclusions were that autom both for normal equipment and editing systems is rapidly beco mandatory for television studios need to produce more prog hours on relatively shrinking gets.

Stan Busby of Ampex gave a specific set of recommendation his paper with regard to t editing systems. Busby defen first the use of distributed int gence as applied to TV equipm He claimed that such devices carry out complex commands on receipt of a relatively simple sig The other part of his paper d with the standardization proble computerized editing systems. B suggested that all interfaces and signal formats used between controllers and the machines sh be common, thereby allowing fo interchange between editing syst that will benefit all.

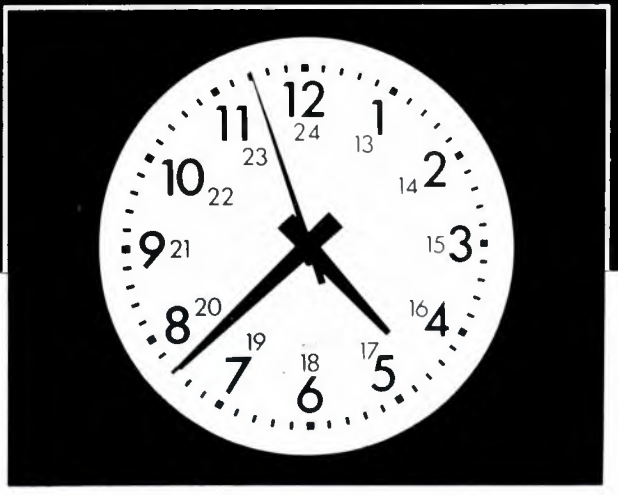
He also proposed a higher ba rate than is currently used by m electronic editing systems. Acc ing to Busby, the alternative adopting some standards is m copper, more contacts, more c puter core and more continued fusion. Adopt some of the meth already developed for data proc ing, he said, and the televi editing world will benefit sig cantly.

The last paper titled "Distribu Processing Techniques in P Production Editing" was jointly sented by Klaus Eichstadt and Roizen of CMX Systems. Roi made a short review of the pres use of computer-assisted edit systems in fast-paced editing popular variety shows and sitc in the U.S. and Canada. The m benefits expressed to Roizen editors he visited was a better s and a substantial time saving.

Eichstadt then presented a tailed review of the distribut processing system used on CMX-340-X, and the application

Continued on page

In the beginning, Time was a reflection of motion in the universe.



Today Time is earth-bound, measured precisely by action of the Cesium-133 atom.

With the coming of the twentieth century man has discovered space travel and broadcasting. Both demand micro-second accuracy to a degree never imagined before.

Leitch provides it with the Leitch Precision Impulse Clock. Controlled by impulses accurate to within one nine billionth of a second, Leitch clocks can be fully synchronized to the exact second. Compatibility with other impulse drive systems allows them to be added to existing drivers or to be installed separately as a totally new system.

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Intelligent Interfaces™ (I^2) unit[s] the controlled VTRs or other st[udio] devices. Eichstadt claimed this [sys]tem could be extended to any st[udio] equipment needing integrated [re]mote control. Eichstadt also poin[ted] out that much in the CMX-34[0] was similar to the proposals for[the] AFRABUS system to provide [ma]chine control through single ca[ble] line pairs looped to all applica[nces] studio devices.

Editing and automation are [pre]viously progressing at a para[llel] pace to cope with modern V[TR] production demands.

Symposium summary

According to many delegates [who] were questioned, there were [still] too many papers and often [two] conflicted in time if they w[ere] opposite each other in concurr[ent] sessions. Some delegates clai[med] the papers were repeats of SM[PTE] or NAB presentations and co[uld] have been eliminated in favor [of] more open discussion periods.

This may be true for th[ose] participants in Montreux who [are] constantly on the conference circ[uit]. However many delegates in M[on]treux do not attend the other sy[m]posiums in America, the UK [or] elsewhere and probably did ben[efit] from hearing or seeing first-he[and] some of the technical presentati[ons] offered. Digital techniques not [yet] operational in PAL or SECAM, l[ike] showing the potential path w[as] exposed in papers on noise reduc[tion] or digital video effects, and n[ew] satellite techniques and services [for] direct broadcasting using high-[and] powered travelling wave tubes w[ere] exposed for scrutiny and discussi[on].

The exhibition

It was a good news/bad ne[ws] exhibition. The good news was th[at] many important people came, a[nd] apparently committed themselv[es] for equipment that suited the[ir] needs and pocketbooks. The b[ad] news, according to the exhibito[rs] was the limited space, high te[m]peratures and matching high pric[es] in the local hostleries.

Nevertheless, Montreux '79 is [al]ready an assured happening a[nd] the organizing committee is pr[o]posing building extensions to t[he] exhibit hall to relieve the pressu[re] and maybe even a few new hotels [to] handle the overflow crowd e[x]pected.

OTARI MX-5050 the original (and still the best) compact professional recorder

Just over two years ago, Otari introduced a unique new product —the first truly professional recorder in a compact package—the MX-5050. Since then, the performance and reliability of this innovative new machine have been tested and proven in over a thousand critical professional applications—by broadcasters, recording studios, A/V departments, musicians, and semipro recordists worldwide. Universal acceptance and repeat orders by these satisfied customers tell this remarkable recorder's success story better than we can.

Bias can be re-optimized in seconds.

As you compare the MX-5050 with other recorders, keep this in mind. The MX-5050 is not a hi-fi machine with a few professional features added later as an afterthought. It was designed from the ground up based on Otari's 10 year experience as Japan's leading manufacturer of professional recorders and high speed duplicators. It is a full professional machine with the performance, features, and field proven reliability that you expect to find only in the larger professional recorders.

Here are some of the key reasons why the MX-5050 is the best compact recorder available today.

Production Features: Creative production is simplified with: Front panel edit to spill tape. Lift-up head cover to mark splices and clean heads. Built-in splicing block on head cover. Adjustable cue to defeat head lifters. Selective reproduce to add new tracks in perfect time synchronization. Two speed operation, 15 and 7½ or 7½ and 3¾ ips (field changeable in dc servo versions).

Performance Features: Headroom is 19 dBm, a full 15 dBm over the switch selectable fixed output of +4 dBm. This standard reference level output can be rear panel switched to −10 dBm to drive a PA system or power amplifier. S/N ratio is NAB weighted 69 dB full track, 68 dB half track, and 65 dB quarter track. Crosstalk is greater than 60 dB half track. Outputs are 600 ohm balanced (standard on half track) or unbalanced. Line input and output connectors are XLR.

Operating Features: Bias is front-panel continuously adjustable (not limited to fixed positions). With built-in test oscillator (not available on other compact professional recorders) bias can be optimized in seconds when changing tape. Record EQ and standard reference level are also front adjustable. Straight-line tape path simplifies threading. Capstan is located on back side of tape for improved tape life. An extra reproduce head is standard on all versions to allow playback of tapes in different formats. For pitch control and freedom from power line variations, an optional dc capstan servo is available with ±10% correction range.

Easy threading; capstan on back side.

Versatility: Available in full-track (with half-track reproduce capability standard), two-track, and quarter-track versions. Walnut case (standard), rugged portable road case, rack mounting adaptor, or floor console. Universal power supply standard. Low impedance input and output transformers and remote control also optional accessories.

See your nearest Otari dealer for the full story or contact Otari. And, if it's multichannel you need, ask about the standard-setting four and eight channel versions of the MX-5050.

OTARI

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The FM PROOF is no picnic

By Peter Burk, *CE, WKBW, Buffalo, NY*

Let's face it...FM proofs can be a real pain. The number of measurements required and, in some cases, some pretty tight tolerances to maintain contribute to the discomfort at proof time. But the biggest problem is usually *confusion*. The rules are a little vague, and the procedure has to be slightly different at every station.

We can't make the FM proof a Sunday school picnic, but perhaps we can make the task easier by removing some of the confusion.

Test equipment

Last month's AM proof coverage included some suggestions on test equipment, selection and testing. For FM, the requirements are slightly higher since the FCC specs are tighter. The basic rule of thumb is that *the test equipment should be four times as accurate as the tolerance allowed by the rules.* When you connect the audio generator directly

Continued on page

The most exciting new recording combo in Music City

Willi Studer's Revox family of tape recorders and components for the audiophile has joined Willi Studer's family of professional audio equipment to form Studer Revox America, Inc., in Nashville, Tennessee USA.

This provides all Revox audiophile and institutional users the obvious benefits of factory direct sales and service enjoyed by professional studios and broadcasters.

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FM PROOF

Continued from page 60

into the distortion analyzer's audio voltmeter, the residual should be -70 dB or below, and total harmonic distortion should less than 0.25 percent.

Note that the bandwidth for and distortion is different: 50 I 15,000 Hz for noise, and u 30,000 Hz for distortion. It's erally easier to read both noise distortion wideband (with no pass filter), but if it bec necessary to use a filter to mak noise measurement meet specs, is entirely acceptable, as lon the bandwidth of the filter is ap priate. Of course, the one kilo high-pass filter included on analyzers must *never* be lef during the measurements.

When you check the test eq ment, include the test leads tha will use for the actual meas ments, as well as any transform pads or low-pass filters that intend to use.

Set-up

Every station will have sli different requirements for con tion of the test equipment. *Broadcast Engineering Proof of formance Manual* for FM contain detailed discussion on test eq ment interface. If your statio fully automated or for some o reason has an obscure "main mi phone input terminal," last mon "Workshop" might help you fin good place to inject the signal.

For stereo stations, a lot of t can be saved by constructing "proof box." Using either tra formers or resistive pads an rotary switch, build a unit that be switched to provide left, ri L+R, and L-R signals. Again, *Proof Manual* shows one metho accomplishing this.

Pre-test

Before proof night, make a qu check to see that the station ready for the proof. If the stat meets performance requirements the extremes, it will most likely p the proof.

Put a priority on noise

Check the noise first. If the no level is high, it will invalidate other measurements. The FCC quires that noise be at least 60 below 100 percent 400 Hz modu tion. Make sure that the ste subcarrier is on if you're doing stereo proof.

The noise measurement should made with de-emphasis switched

FM PRE-EMPHASIS CURVE

(75 usec.)

Frequency (Hz)	Attenuation (dB)
50	*0.00*
100	*0.01*
200	0.04
300	0.09
400	*0.15*
500	0.23
600	0.33
700	0.49
800	0.58
900	0.72
1,000	*0.87*
2,000	2.76
3,000	4.77
4,000	6.58
5,000	*8.16*
6,000	9.54
7,000	10.75
8,000	11.82
9,000	12.78
10,000	*13.66*
11,000	14.45
12,000	15.18
13,000	15.86
14,000	16.49
15,000	*17.07*

d the modulation monitor. Note t t some monitors don't adequately enuate the 19 kHz pilot. If ssary, you can use a 15-kHz v-pass filter to decrease the ount of pilot you are reading.

f the noise is satisfactory, mea- e the distortion at 1 kHz and both extremes (50 Hz and 000 Hz), using 100 percent modu- ion. If the noise measurement s marginal, you should make sure t the distortion is well below the its, since the noise will be added the distortion readings and make to 25 percent and 50 percent dulation distortion appear high en you make the complete proof.

Next, make a response check at frequency extremes. There are eral ways to make this quick ck. An easy method is to leave de-emphasis switched in and run quick sweep with the audio nerator. You'll have to reduce the el by at least 17 dB at 400 Hz to keep the 15,000 Hz tone from overmodulating. Note that this method is not acceptable for the actual proof. It is intended merely to tell you that the system appears to be fairly close to the curve and that when you run the official proof you won't be surprised by a strange bulge or dip in the response.

Another method is to set the generator for 100 percent at 400 Hz, then note the amount of attenuation required to hold 100 percent on the modulation monitor at 50 Hz and 15,000 Hz. Fifty Hz should be about the same as 400 Hz, but 15,000 Hz should be close to 17 dB below the 400 Hz level. This method is more precise, but doesn't tell you what's happening between the extremes.

A third method involves construction of a 75-usec de-emphasis filter which is installed on the generator output. This saves a lot of level adjusting and is really handy for spot checks in between proofs, but the filter must be carefully calibrated if the measurements are to be meaningful. The filter can be made a part of your "proof box."

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FM PROOF

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Stereo pre-test

Spot check separation and cross-talk during the pre-test before proof night, too. Remember that any adjustments made during the actual proof will invalidate all previous measurements. It's like going back to "GO" and not collecting the 200 dollars. Adjust the stereo generator for best performance *before* you run the official proof.

Your separation pre-test should be made at 15,000 Hz, since that's where it's most difficult. To confirm that pilot phase is within the required three degrees, your separation must measure at least 29.7 dB in both directions.

Check for at least 40 dB of cross-talk attenuation, both main to sub and sub to main. It is permissible to adjust the console master gain controls for best cross-talk at *one frequency* (400 Hz), but they must be left in that position for the remainder of the measurements.

Are stereo proofs necessary?

The rules don't specifically require separation and cross-talk measurements, but they do require that your station be capable of meeting all stereo specifications. You can't prove that you are capable of meeting specs unless you actually do a full stereo proof. In any case, they aren't that difficult or time comsuming, and it isn't even necessary to graph the results.

Dolby

At this time, there is no approved procedure for proofing with Dolby equipment in the line. Patch out your Dolby encoders and run a normal stereo proof with 75 usec pre-emphasis.

Running the proof

Our objective when we run the official proof is to document the fact that the station's *normal operation* complies with the rules. The numbers don't mean much if they don't reflect the way your station is normally run. Sometimes it's necessary to make some changes in the equipment to make the station pass the proof. This is all right as long as the station is left adjusted this way after the proof.

Good engineering practice indicates that we should document the procedure used in sufficient detail that another engineer could duplicate the procedure. Settings of various attenuators and the mode

audio processors are in should cluded in the documentation. ult the *Proof Manual* for more s.

ore you begin the actual urement run, get organized! should know ahead of time just ly what sequence you will . There are several efficient ods for taking the readings, but ps the sequence suggested in ter 3 of the *Proof Manual* saves ost time. The basic idea is to as many measurements as ble while the frequency and ntage of modulation are held ant.

n't forget that the response urement is actually *modulation tivity*. Hold the percentage of lation constant and adjust the rator output level for each ency. If you plot the generator t level vs. frequency, you'll lly have a mirror image of the nse.

More on response

The FCC provides a curve that d be used to plot the response Unlike AM response curves, FM curve has no reference ency. That is, it is acceptable to slide the whole curve up and down, just so that all points lie between the limits.

Since there is no actual requirement that the response be graphed, you don't have to use the FCC graph with the 75-usec. curve. (Of course, the values would have to fit on the curve whether you actually graph them or not.) One of the problems encountered in graphing on the curve is that, especially at the upper end, a straight line between two values doesn't really reflect the actual interpolation of values in between the points.

One solution is to mathematically extract the 75-usec. curve and plot the values on a straight line. The FCC limits can then be added below the line. Part 73.317 (a)(2) spells out the exact limits.

To determine the exact amount of pre-emphasis at any frequency, use the following formula:

$$A = 10 \log [(2\pi fT)^2 + 1]$$

where A = attenuation in decibels, f = modulating frequency in Hz, and T = time constant in seconds (normally 7.5×10^{-5}). The accompanying table provides the calculated attenuation for 75 usec.

Other measurements

In addition to the response, distortion, cross-talk and separation measurements, stereo stations should measure pilot injection level and 38 kHz suppression. All stations must read AM noise and spurious emission. The best way to check for spurious emission is with a spectrum analyzer. Most of us aren't lucky enough to have one, so we have to apply a little ingenuity. If you're affiliated with a TV station, you might be able to borrow theirs. If not, several firms rent them for a modest charge. Besides being necessary for the proof, the results of a spectrum analysis can be helpful if you're involved in interference complaints.

I can't really cover all of the details that go into an FM proof in the "Workshop," but hopefully I've helped to reduce some of the confusion. *BE's FM Proof of Performance Manual* is, however, a comprehensive guide to conducting a thorough proof.

The author thanks Dennis Ciapura, BE's audio editor, for assistance in preparing this month's "Radio Workshop." □

people in the news

Four executives have been appointed to ... management positions in the Cetec Broadcast Gr... **Dale Evans,** former audio product manager, has ... named acting general manager of the Sp... Division, Sacramento, CA; **Rich Weichbrod** has ... Broadcast Electronics, Inc., where he was directo... engineering, to accept the position with Cete ... product manager; **Jack Lawson,** who was the Sp... sales manager, is now the international marke... manager of the group; and **Grant Campbell,** fo... corporate manager of internal audits, was appoi... group controller.

Systems Resources Corp., the manufactur... subsidiary of CHYRON Corp., announces the ap... pointment of **Joseph L. Scheuer** as president. Sch... succeeds **Eugene Leonard,** who resigned.

Ronald Briggs joins CCA Electronics Corp. as ... manager-international. Prior to his appointm... Briggs was director of engineering for the Ministr... Information in Quatar, and was in charge of ... radio and television services...and **Jason S.** ... president of CCA, announces the appointmen... **Lynd J. Carter** as sales manager of TV products.

Hugh F. Gillogly steps into the position as natio... sales manager of the Broadcast Equipment Divi... of NEC America, Inc...**Richard J. Reilly,** fo... western regional manager for International Ve... Corp., announces the formation of his own ... Francisco branch of United Media, Inc. Reilly wil... marketing video equipment to broadcast and ... broadcast users in Northern California, Ore... Washington, Nevada and Alaska.

Curtis I. Kring joins Broadcast Electronics, Inc... vice president of marketing...**Abbott Sydney** move... the position of international sales representativ... Berkey Colortran, Inc.

Charles S. Craigmile, former chairman of ... board and chief executive officer of Belden C... died April 30th in Hinsdale, Ill. Craigmile was ... **Richard F. White,** vice president and gen... manager of Belden Corp.'s Electronic Division, ... been elected president of General Wire & Ca... Ltd., a Belden subsidiary in Ontario.

Jerome P. Vondergeest joins Thomson-CSF Lab... tories as territorial manager...**Alan Schoenberg** ... been appointed northeastern field sales engineer... Telemation.

James M. Hoak, Robert Dickinson and **Kenn... McCarthy** have been elected directors of the Ka... State Network, Inc.

Glenn H. Sacra, president of GTE Internati... Systems Corp., announces the appointment ... **Herbert C. Edgar, Jr.** as vice president for market... Edgar will be responsible for directing the worldwi... marketing and sales of satellite communicati... ground stations, microwave systems and ot... activities.

Lawrence P. Fraiberg, former vice president ... general manager of Metromedia's New York flags...

ision station WNEW, has been promoted to ident of Metromedia Television.

avid P. Haney, who is the sales manager of NA in Iowa City, has been elected executive vice ident of Communicators, Inc. Haney formerly the post of vice president of this corporation...

Robert K. Norton, Jr., program director and f engineer of KRNA, was elected vice president.

ncent T. Wasilewski, president of the NAB, unced the appointment of four new members to 's Radio Code Board.

ected to the Radio Board are: **Enzo De inicis,** general manager, WRCQ, Farmington, n.; **Ron Gomez,** vice president and station ager KPEL, Lafayette, La.; **H. Wayne Hudson,** ident, WMPS, Memphis, Tenn.; and **Roy inson,** general manager, KFQD, Anchorage, ka.

illiam L. Viands, Jr. succeeds **Joseph F. Aber-** y as general manager of WIOD-AM and WAIA- Miami...**Clark W. Davis** moves from corporate president to president of the Starr Broadcasting vision Division, as was announced by **Bruce F. lson,** president and chief executive officer of the r Broadcasting Group, Inc.

arlene T. Palmer joins the NAB as assistant to director of the Broadcast Management Depart- t. Ms. Palmer formerly was a division president Litt Enterprises, a Washington, D.C. manage- t consultant firm and holding company.

he National AM Stereophonic Radio Committee named **Chris Payne** as project manager of its ming field tests of AM stereo.

PPA honors photographers r excellence in TV coverage

Winners in the 1977 National Press Photographers ociation (NPPA) television news competition were ored at a special awards banquet July 3. Hosted Eastman Kodak Company, the ceremony was held ail, Colo. during the NPPA's annual convention.

enver station KBTV and its assistant chief tographer **Sam Allen** were named earlier this year he "Television News Photography Station of the r" and the "Television Photographer of the Year" he NPPA.

Winners in other categories of competition include: news—tie between **Josep Lee,** ABC-TV, New k and **John Elder,** WKRC-TV, Cincinnati; mini- umentary—**Sam Allen,** KBTV, Denver; feature— l **Fine,** WMAL-TV, Washington, D.C.; sports— r **Hakel,** WMAL-TV, Washington, D.C.; docu- tary—tie between **Jan Morgan,** CBS-TV, New k and **Mykola Kulish,** WCAU-TV, Philadelphia; eral news—tie between **Scott Berner,** NBC-TV, York and **Paul Fine,** WMAL-TV, Washington,

BE takes a look at Japanese television

By Joe Roizen

Sophia Loren dons her crash helmet and rides off on her Honda, Yul Brynner sells Fuji film, and Coca-Cola ads are about as subtle as they are stateside. Japanese television has all of the attributes of our own, with a few differences that are quickly evident, even during a one-week visit.

The TV receiver in the hotel room has no picture adjustment controls on it. On-off/volume and channel selector are all the visitor can manipulate, yet the images on all seven channels are good, having a colorimetric uniformity that is surprising when compared with what is seen in most American hotels. Most channels go on at 6:00 a.m. and run into the early hours of the following day.

Many of the staple programs have a familiar ring even if the language is inscrutable. There is a Taco Lalainusan who vigorously directs three young beauties in their morning calisthenics, the morning news report has a lot of Jimmy Carter images chroma-keyed next to the announcer, the educational channel starts in monochrome with a shot of Rodin's "Thinker" while Nippon Hoso Kyokia's (NHK) entertainment day begins with rising suns, flapping flags, national anthems and all the hoopla befitting a national network that is supported by license fees and no commercials.

However, if you are nostalgic for a little hard sell, the other channels in town (TBS, JOKR, JOEX, etc.) will complement your day with clever visual pitches for everything from sushi to Sonys. In fact, the sin-

gh language cable service piped into hotels for rs to watch is like an endless commercial intered with fleeting programs. It's no wonder that verage tourist getting on the departing 747 at da is usually loaded down with bulging bags that in the wares of such suppliers as Nikon, Seiko, oto, Panasonic and Suntory. This situation has n so bad that Japan Air Lines have large posters eir ticket offices and at the airport advising ngers to travel more comfortably by carrying one bag of tax free bargains on board.

Anwhile, back on the 19-inch Trinitron, the day ds with noontime melodramas obviously aimed at ousewife tending her electric rice cooker. The fternoon promises lots of educational programs as those that tell you know to solder transistors boards and teach you English or German. The of such educational material that is on the air is astonishing, and switching channels at difrt times of the day yields snatches of history, gy, anthropology, various hard sciences and some general material that resembles Sesame Street or ype art and craft documentaries.

e early evening offers audience participation and shows with seemingly more participation being by children. Light sitcoms from the U.S. such as witched" also appear with Japanese-dubbed l, which doesn't come close to matching the h movements. However, the names are not ged to protect the guilty and Samantha, Tabatha Darren are still recognizable, even with Oriental nts.

Those familiar nights

this pleasantry and low-key programming gives to the late night shows that produce a crop of age that matches ours, or even exceeds it. In tion to imported mayhem of cops and robbers or ern shoot-outs, there is a good collection of e-grown Samurai swinging, martial arts and ive features (Godzilla is a local boy who made to satisfy any yen for blood and thunder. I was on good authority that there are also X-rated e Movies" on after midnight, but I never caught ith the jet lag enough to stay up that late.

e Japanese adopt American ideas with a zeal that s to surpass the originals. Basu Boru (baseball) is ional passion, so much so that even Little League s get color coverage on local TV, complete with ple cameras, professional announcers, player overlays and rooting sections of drum-beating ers and costumed chearleaders. And when the re yells "Outu!" no kids in the world ever looked crestfallen.

rigued by my TV set's performance and equipped a Swiss Army knife that bears a Phillips screwr blade, I removed a side panel that gave access e controls. Rolling the vertical I found that at four stations were transmitting vertical interval signals, and that I could not improve on the ance/chrominance settings manually, even when

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Japanese TV

Continued from page 69

the pre-dawn set of color bars were on each cha

Japan today is the source of much innovation i products, as well as in other fields. Some come the product development done by companies suc Matsushita, NEC, and Sony, others from the rese facilities of NHK's laboratories dedicated to o theoretical investigations.

A tour of the Sony showroom on the Ginza revi a few unique products that have not yet exported to overseas markets. The most interestin a direct view, 32-inch diagonal Trinitron televi receiver housed in a large mahogany cabinet hi includes a Betamax and other accessories li remote control wand. Going price in Japan fort gargantuan glass eye that makes head and sho shots larger than life is a cool $3,700. Anot recently introduced product is a 12-foot (diagon large screen projector using individual kinescopes lenses (like Advent), but the red and blue chan have been combined through a single lens, h simplifying the projector optics by 33⅓ percent. I the devices make good pictures in their own conx The projector is not intended for home use and cai a $20,000-plus price tag. Sony also had on displa two-hour version of the Betamax using half the nor tape speed to achieve this time compression on one-hour cassette.

Technical research

A visit to the NHK Technical Research Laborato where basic work on future TV developments is bei done, was most informative. Dr. Kenji Hiwatashim host and a division director of this facility, had se a tour that included stops in individual labs that er working on high definition TV, digital conversio CCD camera, a teletext system and a small dish f satellite reception.

The high definition TV system uses a 30-inch vi shadow mask color CRT with a 5:3 aspect ratio. I spacing is about ⅓ of the normal and the scanni rate is 1,125 lines at 30 frames, with 2:1 interfa The test images come from a special 70 mm fi scanner or an RGB camera using larger than nor Saticons, also developed at NEC. The color ima were simply superb. NHK considers this one of t future possibilities for vastly improved public color TV service.

The 3 CCD color camera is the size of a one-pou box of chocolates and makes color pictures with 30 foot-candles of light. There are 228 x 242 pict elements covered by the NEC pickup unit that me sures about 1 cm^2. The engineer working on th camera was quick to point out that they are sti a long way from a practical product and that sensitivi resolution and picture uniformity don't come near th of current color TV cameras. However, the di vantages of having no registration or lag proble added to the potential small size, weight, pow consumption and reliability that makes this camer a very plausible goal to pursue.

National teletext

Japan does not yet have a national teletext ser such as the Ceefax or Oracle systems in the U.K., bu they have developed such a system which is to be tested late this year. The system will provide Japan

ers a great deal of graphic information with al decoders in their home receivers. An index ibing nine different teletext programs is trans- d digitally in the vertical interval of a normal TV mission. A digital IC memory in the TV receiver selection through a keyboard access will allow sing and viewing the programs, which will de weather forecasts, shopping guides, news ines, etc. Cost of the home adapter should not d $100.

More than satellites

rhaps the most exciting work is going on in NHK's r High Frequency (SHF) lab where they have oped a 0.6 meter (2-foot) diameter dish and ver which has reproduced good pictures from missions over the Communications Technology llite originated by NASA. The whole package , receiver, converter and monitor) goes into a n wagon—the dish itself being packed in a ed, oversized metal suitcase—and can be set up here. The engineer working on this project d have a business card that says, "Have dish, ravel!"

orking at 12 GHz with a down converter that uses ittky and Gunn diodes to convert to an IF at 360 , this miniature earth station makes possible t home reception from geostationary satellites. n is sponsoring the launch in late '78 of a satellite omestic service, and this antenna and receiver n are intended for that application.

ere are other technical wonders such as dual d TV over normal transmission channels that can ceived with an adapter estimated at $10-$30 in tity, two-inch return beam, Saticons for higher ution pickup, higher density video recording on , computer animation devices, and even an -head transverse VTR on one-inch tape. One item terest not ready for exposure to visitors, is a tial large screen display using gas discharge ls which are fairly thin and can achieve the ure on the wall" display device that has been t after for so long.

Summary

levision is a dynamic and growing force in both fect on the viewing public and in its contribution e industrial muscle of Japan. The local citizen has de choice of attractive products to buy and an lly broad spectrum of programs to watch or d on a "time machine" with a magnetic cassette . The factories use native skills and modern niques to create an ever-increasing torrent of ision products that have penetrated every part of world where home TV service is available.

walk through the Sony U-Matic plant at Atsugi s an efficient operation with the parts coming in ond and the finished units going into styrofoam- cartons at the other. In between, talented men women in company uniforms assemble, adjust and k with traditionally meticulous care, every aspect will assure an acceptable product going to the umer. The research laboratories contribute the ard thinking that helps maintain the overall nced state of the art that keeps Japanese onic products in the forefront of the outside l. □

SOCIETY OF
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P.O. Box 50844, Indianapolis, Indiana 46250

SBE Address Change

The SBE National office is now located at 5987 E. 71st St. and the mailing address is P.O. Box 50844, Indianapolis, IN 46250.

Pat Satter, the newest member of the SBE staff, announces that Chapter Formation Kits have been mailed to many engineers throughout the country who have expressed the desire to get a Chapter started in their area.

The Society congratulates our newest Chapter 43—Sacramento, Calif., and extend a very special thanks to Bob Venditti for all his time and efforts in getting this Chapter off the ground. Baltimore, Md.; Charlotte, N.C.; and Houston, Tex. have scheduled "second meetings," so it won't be long before we can add their names to our growing list of active Chapters.

Following is a partial list of people forming new Chapters who would like the support of all SBE members in their areas. Next month, we will conclude the list.

If you do not see a name for your area and are interested in forming a Chapter, please write or phone (317/842-0836) and I will be very happy to send you the kit of starting material. Remember that SBE is one of the few organizations that gives Initial Chapter Rebate monies to be used for starting expenses such as postage, special mailings, etc.

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it, MI 48220 (313) 546-9600

pter 2—
theastern Pennsylvania

e final meeting of the season
held June 13 in the studios of
A-TV/FM in Pittston. The
ram featured a viewing of the
oductory videotape for the
se "Digital Technology for
dcast Engineers." This course
been produced by the Univer-
of Wisconsin Extension and at
future date the course might
vailable to SBE Chapters for
p enrollment for members.

pter 5—Atlanta, Georgia

the April 25 meeting of
pter 5, it was reported that Chapter 5 now has 91 members with average attendance better than 30 percent. Chairman Artz appointed a nominating committee to recommend officers for 1977-1978.

Bob Wehrman, their new national president, gave a report of the NAB meeting in Washington, D.C. and presented certification awards to nine of the members.

Chapter 26—Chicago, Illinois

Chapter 26 held their May 19 meeting at Telemation Production Inc., in Glenview. They toured the Telemation Production facilities. John Bagby, senior magnetic head engineer of Spin Physics, Inc., was the guest speaker and gave an interesting presentation on "Quad Video Head" which provided a great opportunity for all involved in magnetic recording to get first-hand information in this highly technical subject. Chapter 26 also presented their first Certified Broadcast Engineer Certificates along with congratulations to their brother members who had been granted certificates.

new products

TV graphics system

Recently introduced in a PAL version at Montreux, *TeleMation's* software-based Compositor I Graphics System features a 999-page memory and one-button call-up of sequence pages. Sequences can be in any order and can be added to or rearranged in seconds. Pages can be rolled or crawled at any of six speeds through "surround" pages containing static copy. These surround pages can be programmed to change as each new page of copy appears on the screen. The roll/crawl speed can also be programmed to change as each new page appears, or can be manually increased or decreased at any time.

As many as eight fonts can be mixed within a single page on a character-by-character basis. Two additional font groups (with eight fonts per group) can be stored on the Compositor I's disk memory, permitting selection of an alternate group for display as required; no disk changing is ever needed.

The three keyboard-selectable character edge styles—"shadow", "border", and "outline"—can be displayed at four luminance levels. An expanded edging option permits six widths of shadow edge and three widths of border/outline.

Twenty-eight colors are available for characters and backgrounds. Characters can be colored individually while backgrounds are colorized in four-scan-line increments. The operator can also select external camera background or an external/internal-color combination. A unique "swap" mode allows characters to be multicolored or shaded with various luminance levels of the same hue.

For More Details Circle (101) on Reply Card

Production Switcher

J & D Electronics has annou the availability of a complete li professional video switchers. J Electronics is a division of J International. Their featured n is the 712, a 12-input, 4 swit buss unit that goes for u $7,000.

The 712 includes a built-in b burst generator, colorizer and chroma keyer. The unit also tures downstream preset and gram busses with cut bar, justable wipes and edges, matte, and a built-in pattern lator with frequency and ampl controls.

Because of its compact size NTSC specifications, the 71 adaptable for studio or van op tions.

For More Details Circle (102) on Reply Ca

STL, remote control, SCA equipment

Micro Controls, Inc. announc new line of radio broadcast STL, remote control - telemetry SCA sub-carrier equipment.

The Studio Transmitter Link tems, available as either a band composite employing P Lock Loop technology or narrowband single or dual-ch system, offer state-of-the-art niques.

It features direct reading for and reflected power, a 2-8 monitor amplifier built into receiver, built-in RFI module both transmitter and receiver, a full 10 watts of RF output po

The accessory sub-carrier e ment for the STL also employs techniques in the generator. V normally set for either 41 or 67 as it comes from the factory, i

ntinuously programmed for any
al frequency from 26 through
Hz.
new "Digi-Log" remote control
m, available for 9, 19, 29 or 39
el operation, is adaptable to
radio or wire line operation
s field-convertible from either
of operation. This new system
acterizes design philosophy and
n technology from the best of
the digital and analog worlds.
r More Details Circle (103) on Reply Card

Audio operational amplifier

The *Holland Electronics* model
00 was developed to provide an
native to modules currently on
market. Priced at only $27 in
ities up through 24, and $25 in
r quantities, the model OA-100
he following features:
has a maximum output voltage
least 7.75 vrms (equivalent to
Bm 600 ohms) with bipolar
lt power.
an supply full output voltage to
ohm load.
has a high slew rate (10 volts
icrosecond typical).
pin-compatible with currently
ted audio op amps.
More Details Circle (104) on Reply Card

RENG transmitter

Comrex Corporation is introducing the ENG-MIC, a completely self-contained hand-held transmitter with one full watt output and built-in electret microphone for broadcast quality ENG sound pickup.

The ENG-MIC, model HHT-1KA, features crystal control, automatic modulation control and operates on replaceable alkaline penlight batteries.

The ENG-MIC produces all the power permitted to broadcasters by FCC Rules & Regulations, Part 74, Subpart H.

The frequency range is 450-451 MHz and 455-456 MHz. (Available on special order at 161.625-161.775 MHz and 947-952 MHz.) The HHT-1KA is also available with tone generators for Radio ENG repeater systems.

For More Details Circle (105) on Reply Card

Chromatic switcher

Shintron has announced the model 373-DX Chromatic Switcher, a high-performance unit designed for all facets of production including broadcast, ENG, CATV, and CCTV applications.

The 373-DX is fully plug-

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new products

Continued from page 75

compatible with Sony DXC 1000, 1600, and 1610 series Trinicon cameras. It has a built-in color sync generator equipped with a multiple distribution amplifier for sync pulses and front panel controlled subcarrier phase adjustment for each camera input. All switching is done in vertical interval.

For More Details Circle (106) on Reply Card

Radial air gap rotary transformer

Videomagnetics, Inc., (VMI) has a radial air gap rotary transformer available that the company says will eliminate the basic problems of the axial multi-plane types used as original equipment on Ampex MK X rotary head assemblies.

The VMI air gap setting is built into the diameter of the rotor and stator units and are held to tolerance of 100 micro inches, a design aimed at eliminating parasitic modulation of the RF.

Grounding is achieved by using a graphite brush with sufficient eccentric wipe to be self-cleaning and to avoid intermittent contact. According to VMI, there is no condition where microphonics, band noise, or moire are created.

Simple disassembly and reassembly during refurbishing allows straight forward cleaning. The complete unit mounts on the MK X interchangeably with the axial type. In fact, there is no change in outward appearance.

For More Details Circle (107) on Reply Card

Disc memory system

Knox, Ltd. announced a new versatile disc memory system, the KD128, as an add-on option to new and existing K128 graphic arts character generator. The KD128 offers 280 pages of permanent memory on each diskette. Each page is stored on interchangeable 5-inch flexible discs. The disc itself costs $5.00. A studio can have a library of over 1,100 pages.

The KD128 is composed of two separate units. The first, rack-mountable, contains the drive unit. The second is the control system which allows the operator, through a 16-key pad, to select pages at random, or sequentially. Continuous roll or crawl is possible through all of the pages. Maximum search time is 1.5 seconds.

For More Details Circle (108) on Reply Card

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BROADCAST ENGINEERING OPPORTUNITIES—(coast to coast). We specialize in the placement of well qualified people in the Broadcast Engineering Industry. Openings at all locations—all levels. Confidential—no cost to applicant. Employer inquiries invited. Contact Alan E. Kornish, KEY PERSONNEL, 116 South Main Street, South Main Towers, Wilkes-Barre, Pennsylvania 18701, (717) 822-2196. 4-77-tf

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HELP WANTED (Cont.)

TRANSMITTER TECHNICIANS—Voice of America has opportunities for qualified technicians at VOA stations in California, North Carolina, and Ohio. Duties include operations/maintenance of high power shortwave transmitters and related facilities on shift basis. Minimum qualifications: 3-years broadcast chief engineer 5 to 50 KW, or 3-years supervisor of operations/maintenance high power military transmitting plant, or equivalent. U.S. citizenship required. Salary $15-19,000. Submit standard government application form, SF-171 to: VOA Personnel Office, Code 05-77, 330 Independence Avenue, S.W., Washington, D.C. 20547. AN EQUAL OPPORTUNITY EMPLOYER. 6-77-3t

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KTVP TELEVISION STATION, Soon to be on the air in Fayetteville, is looking for experienced television engineer to be chief. Must have strong technical and administrative background. Good pay and excellent benefits. Contact Don Vest, Director of Engineering, Jonesboro, Ark. (501) 932-4288. 7-77-1t

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VIDEO EQUIPMENT REGIONAL SALESMAN wanted for Nebraska and Iowa, with knowledge of broadcast and CCTV equipment. Locate in Omaha, operate your own office and territory. Salary plus commissions and expenses. Call collect 612-835-3080. 7-77-1t

HELP WANTED TECHNICAL. Opening for a studio engineer with first phone. Must be experienced with RCA color equipment, camera, film and VTR's. Please submit resume and references to Wayne Semple, Chief Engineer, WAND-TV, P.O. Box 631, Decatur, Illinois 62525. AN EQUAL OPPORTUNITY EMPLOYER. 7-77-1t

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We offer favorable career prospects in a growth environment, competitive salaries, excellent benefits, and relocation assistance. Please direct resume in confidence, giving full pertinent details including salary progression, to Lawrence Carlstone, Professional Employment Supervisor, Harris Corporation, Broadcast Products Division, Quincy, Illinois 62301.

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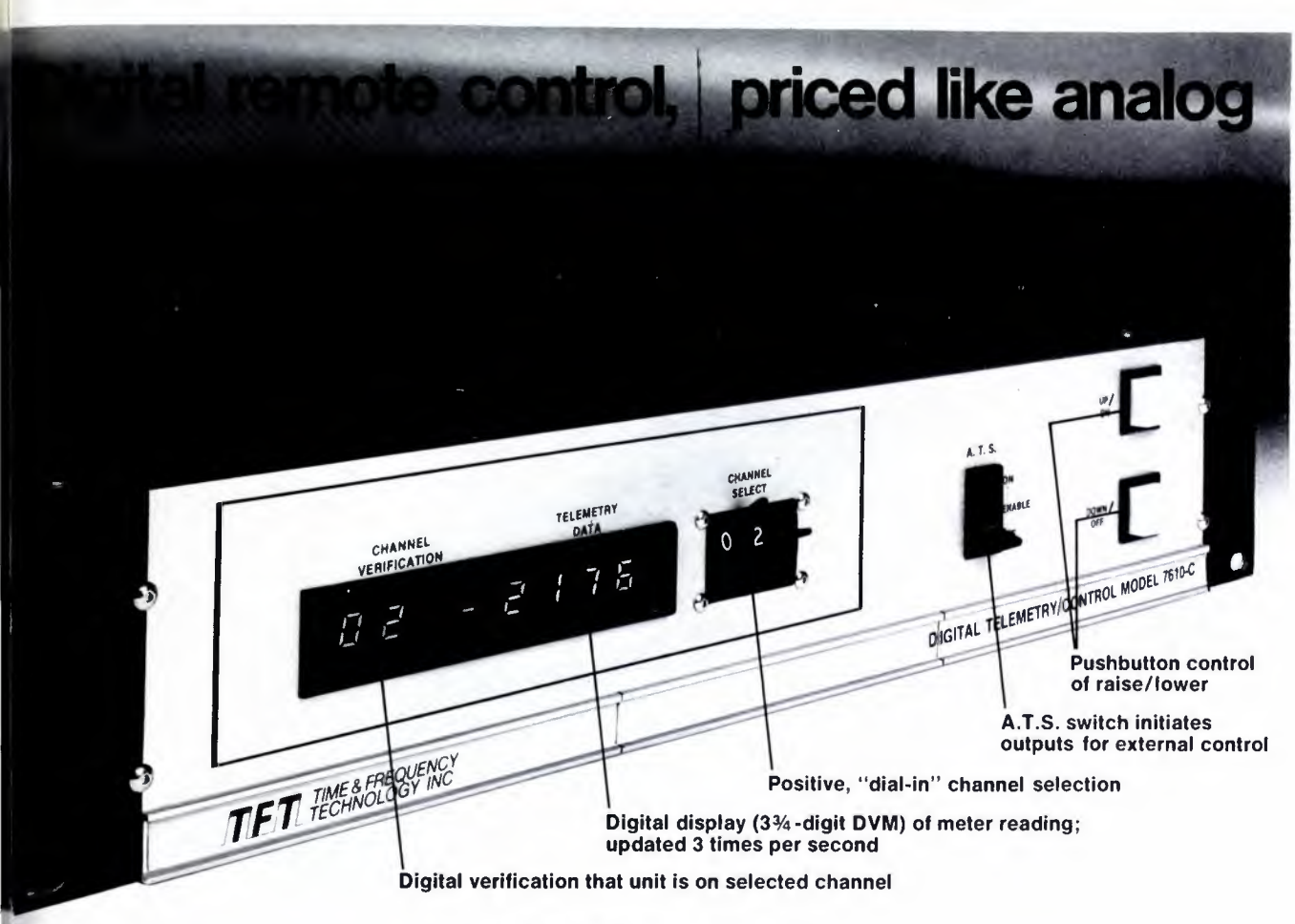

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Model 7610 control point (bottom) and remote point modules.

Now you can have ten channels of raise/lower and telemetry in a digital remote control system — the TFT 7610 — that costs only a little more than the most basic analog systems.

With the 7610, you don't have to twiddle calibration knobs or interpolate from meter scales. Instead, you get a positive, unambiguous data display. In addition, you get BCD (digital) outputs that make the 7610 compatible with computer and ATS systems. Most importantly, with TFT digital designs, you get increased data accuracy and fewer errors because of special closed loop data verification.

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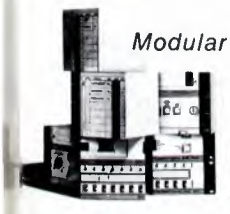
For details and a demonstration, contact your TFT representative or call the factory. In Canada: Caldwell A/V Equipment Co., Ltd., Toronto (416) 438-6230.



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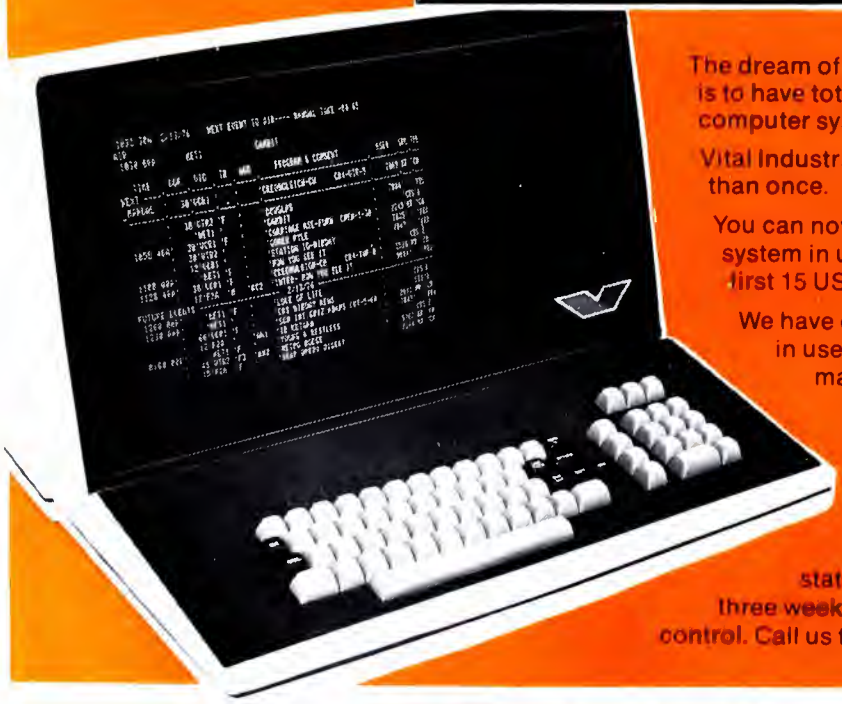

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