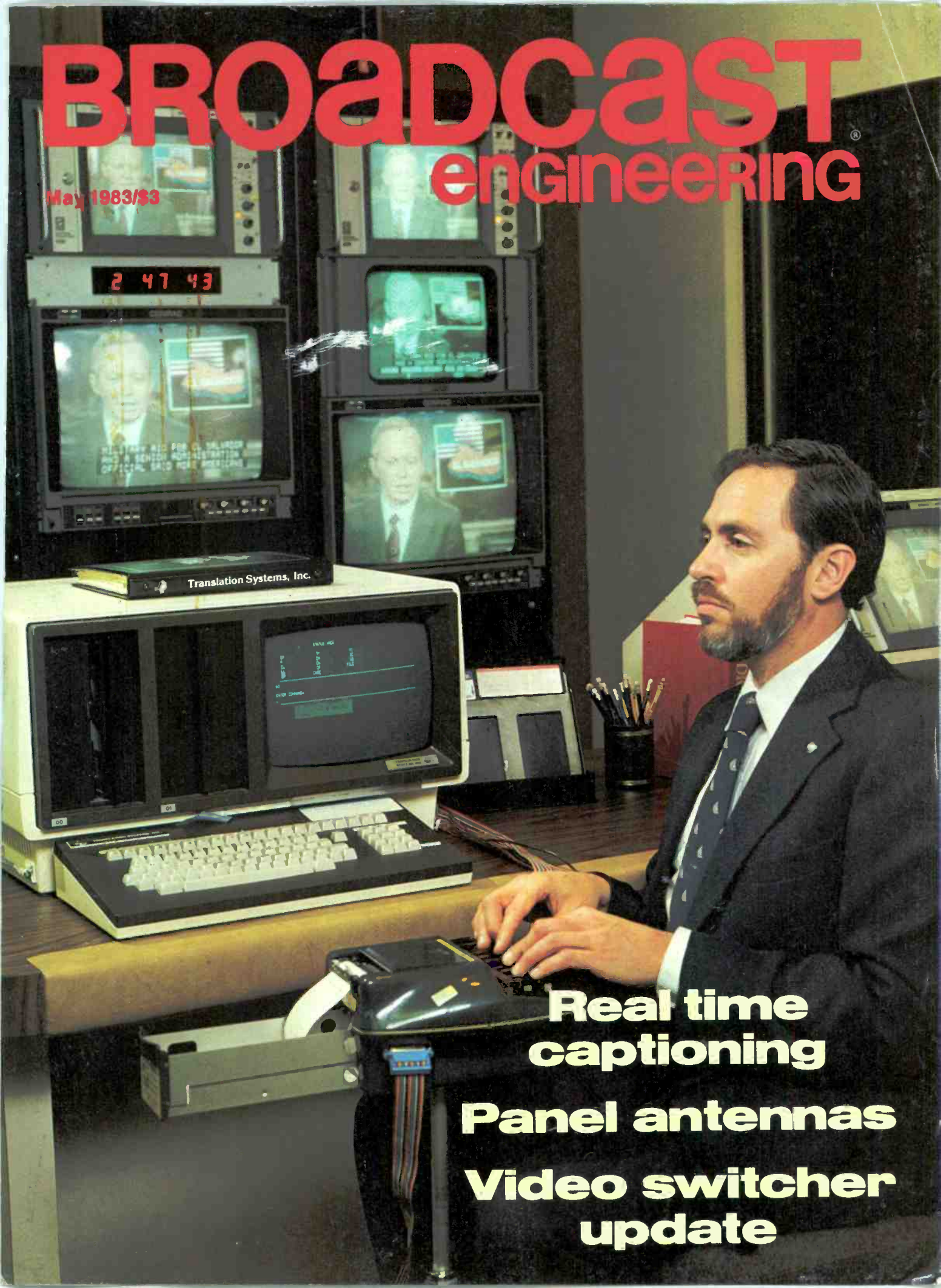
BROADCAST ENGINEERING®

May 1983/$3



Real time captioning

Panel antennas

Video switcher update

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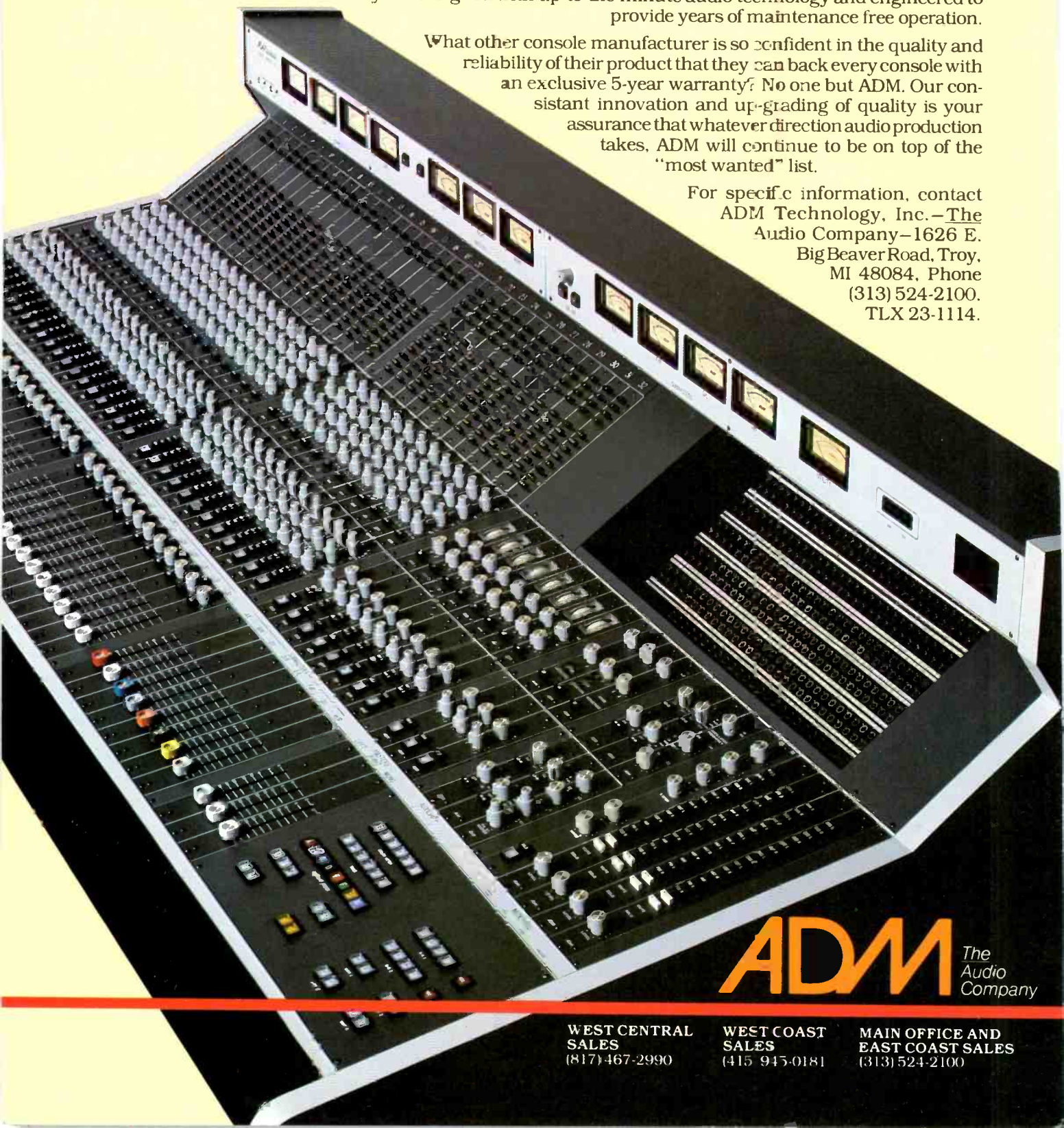

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"Taft demands the best, and when it comes to presenting to our viewers a clear and accurate picture of the world, we turn to Ikegami cameras. Their rugged durability, combined with the "studio" quality, that Ikegami delivers, brings the news in focus for the millions of viewers who depend on Taft news operations to keep them informed.

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WTVN, Columbus.

BROADCAST engineering

The journal of broadcast technology

May 1983 • Volume 25 • No. 5

THE COVER this month shows the facilities used for captioning at the National Captioning Institute (NCI), Falls Church, VA. The key to the real time closed-captioning service is a stenocaptioner who transcribes the audio into a stenotype machine. Marty Block of NCI is shown preparing captions for ABC-TV's *World News Tonight.* The captions appear on viewers' TV sets equipped with TeleCaption units. An article on the NCI advances in captioning techniques, "Real Time Closed Captioning at NCI," begins on page 19 of this issue. (Photo courtesy of June Farrell, director of public relations, NCI.)

Coming events

May 28-June 2
13th Int'l TV Symposium and Technical Exposition, Montreux, Switzerland

May 30
American Women in Radio and Television 32nd Annual Convention, Royal York, Toronto, Canada

June 12-15
National Cable Television Association (NCTA) Annual Convention, Houston, TX

June 22-26
Broadcasters Promotion Association (BPA) 26th Annual Seminar and Broadcast Association, Fairmont Hotel, New Orleans, LA

NEXT MONTH we will feature in-depth coverage of events and exhibits at the NAB-'83/Las Vegas convention. Included in our June wrap-up will be coverage of advancing technology for radio and television as brought out in the technical sessions, invited addresses and workshops. Regarding the exhibits, special emphasis will be given to new equipment introduced at the show as prototypes or production models.

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Its shock-mounted optical system—with Saticons® Plumicons® or Diode Guns®—gives you up to 57 dB S/N and 600-line resolution. All in an incredibly tough magnesium alloy package.

It has an auto-iris closure. A +9/18 dB high-grain switch. Horizontal and vertical blanking widths adjustable over a wide range. An auto black balance control as well as an auto white balance control.

The SK-81 gives you just a shade less performance for $22,000. The DU-91 at $18,900 lets you get great pictures with either the SK-91 or SK-81 whether you're shooting at the low-light levels of a coal mine or going to the top of the world. Who from? Who else? Hitachi Denshi America, Ltd., 175 Crossways Park West, Woodbury, NY 11797. (516) 921-7200. Offices also in Chicago, Los Angeles, Atlanta, Cincinnati, Dallas, Denver, Seattle and Washington, D.C.

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

Get it out of your system.

Television is an electronic medium. Yet TV graphics still involve messy paints, glue, air brushes, razors, and other paraphernalia.

MCI/Quantel's Paint Box can put your TV graphics into the electronic medium.

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It's incredibly versatile. You can produce the look of oils, watercolors, chalk, pencil. You can make stencils. Air brush. Cut and paste. Even animate.

You can grab TV frames off the air, resize them, retouch them, mix them with graphics.

You can set type from a large variety of the highest quality fonts.

And you can interface the Paint Box to Quantel's DLS 6000 Library System for a totally digital still-picture system. It's awesome.

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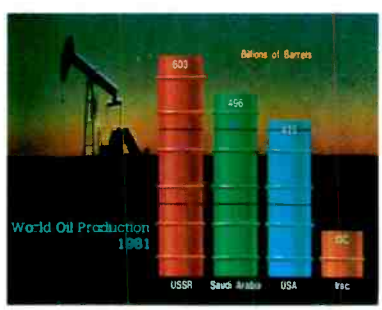

Graphics like this are easy on the Paint Box.

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FCC update

May 1983

Harry C. Martin, partner, Reddy, Begley & Martin, Washington, DC

Standards changed for approval of dismissal agreements

The FCC has interpreted a recent revision to the Communications Act as permitting settlement payments to a dismissing broadcast applicant in excess of "reasonable and prudent" application expenses.

In September 1982, Congress amended Section 311(c)(3) of the Communications Act, which deals with settlement agreements in comparative hearing cases. Under the new law, the FCC may approve buy-out or merger agreements if it is determined that approval is consistent with the public interest and that no party to the agreement filed its application for the purpose of entering into such an agreement. Previously the act did not permit the FCC to approve agreements that involved reimbursement to dismissing applicants in excess of their documented application expenses.

Even after Congress amended the act, the commission's administrative law judges continued to enforce the old standard. This was because the Mass Media Bureau issued a public notice in November indicating that the new law was not in conflict with FCC rules requiring submission of detailed expense accountings in connection with requests for approval of settlement agreements.

In December, however, the FCC Review Board ignored the bureau's public notice and approved a 10-year consultancy arrangement in a case in which the judge found the consultancy amounted to a monetary settlement with a value in excess of application expenses. The board said that approval of the settlement was permissible because, as the new law specified, the agreement was consistent with the public interest and there was no evidence that any party to it had filed its application for the purpose of reaching or carrying out the agreement. In March 1983, the commission affirmed the board's decision and repealed the bureau's inconsistent public notice.

In two follow-up decisions, the board has indicated that the FCC will approve any settlement agreement that meets the new, less restrictive statutory standard. Thus, applicants now may offer to pay competitors in comparative proceedings any amount they wish in order to induce them to dismiss. Dismissal agreements offering monetary reimbursement *and* a share of equity, which were difficult to have approved under the old standard, now are permissible as long as the minimal statutory requirements discussed previously are met.

Critics of the commission's new approach claim that many persons will file applications for the sole purpose of extracting monetary settlements. Others believe that the new liberalized standard will facilitate legitimate merger and buy-out arrangements, thereby speeding the authorization of new facilities.

Proposed revision of attribution rules

The commission has proposed to revise the standards for attributing ownership interests in broadcast and CATV properties under its multiple ownership rules. Major proposed changes would include the following: increasing the attribution benchmark up to 20% (interests above 20% assumed to be attributable); eliminating the distinction between closely held and widely held corporations; using a *multiplier* for vertical ownership situations to limit the reach of the rules to those with a reasonable relationship to the licensee; and using insulating mechanisms for officers, directors and others who have no equity interest in the licensee.

These revisions would impact upon the national, regional and local multiple ownership rules, including those dealing with the 7-station limit, network/cable cross-ownership, newspaper/broadcast cross-ownership, regional concentration of control, duopoly and the one-to-a-market limit.

The commission is requesting comments on, and data relating to, the following specific issues:

- whether attribution of ownership interests of less than 20% is warranted;
- whether using a definition and set of indicia of control applicable on a case-by-case basis is preferable to the current practice of specifying particular entities as subject to certain ownership benchmarks;
- whether all investors should be treated in a similar fashion;
- whether indirect interests should be attributed;
- whether minority groups and new entrants would have greater access to financing if the rules were changed;
- whether the attribution rules should be linked to other commission requirements;
- whether distinguishing between closely held and widely held corporations is advisable;
- whether subjecting private pension funds to the same benchmarks as investment and insurance companies and other apparently passive investors is advisable; and
- whether the commission should continue to monitor ownership activities through submission of FCC reports (Forms 323 and 325).

LPTV status

Progress is being made in implementing procedures to deal with the backlog of 8000 LPTV applications filed since 1980. The commission was scheduled to consider adoption of

In brief

An amendment to Part 73 has been proposed to permit TV broadcast services to operate with an aural power of less than 10% of the visual power.

A request by the SBE to extend comment dates on spectrum utilization policy for fixed and mobile services' use of certain bands between 947MHz and 40GHz was denied.

A Notice of Inquiry and Proposed Rulemaking was issued to re-examine certain technical regulations, to continue elimination of unnecessary rules.

Subscription TV Association and Wometco Home Theatre have petitioned the commission to reconsider a Report and Order that will allow the sale of STV decoders to subscribers. The commission has denied the petition.

Licensed broadcast station totals for February 1983 are as follows:

AM Broadcast	4704
FM Broadcast	3409
Educational Radio	1093
UHF TV Broadcast	306
VHF TV Broadcast	527
UHF TV Educational	174
VHF TV Educational	111

Continued on page 138

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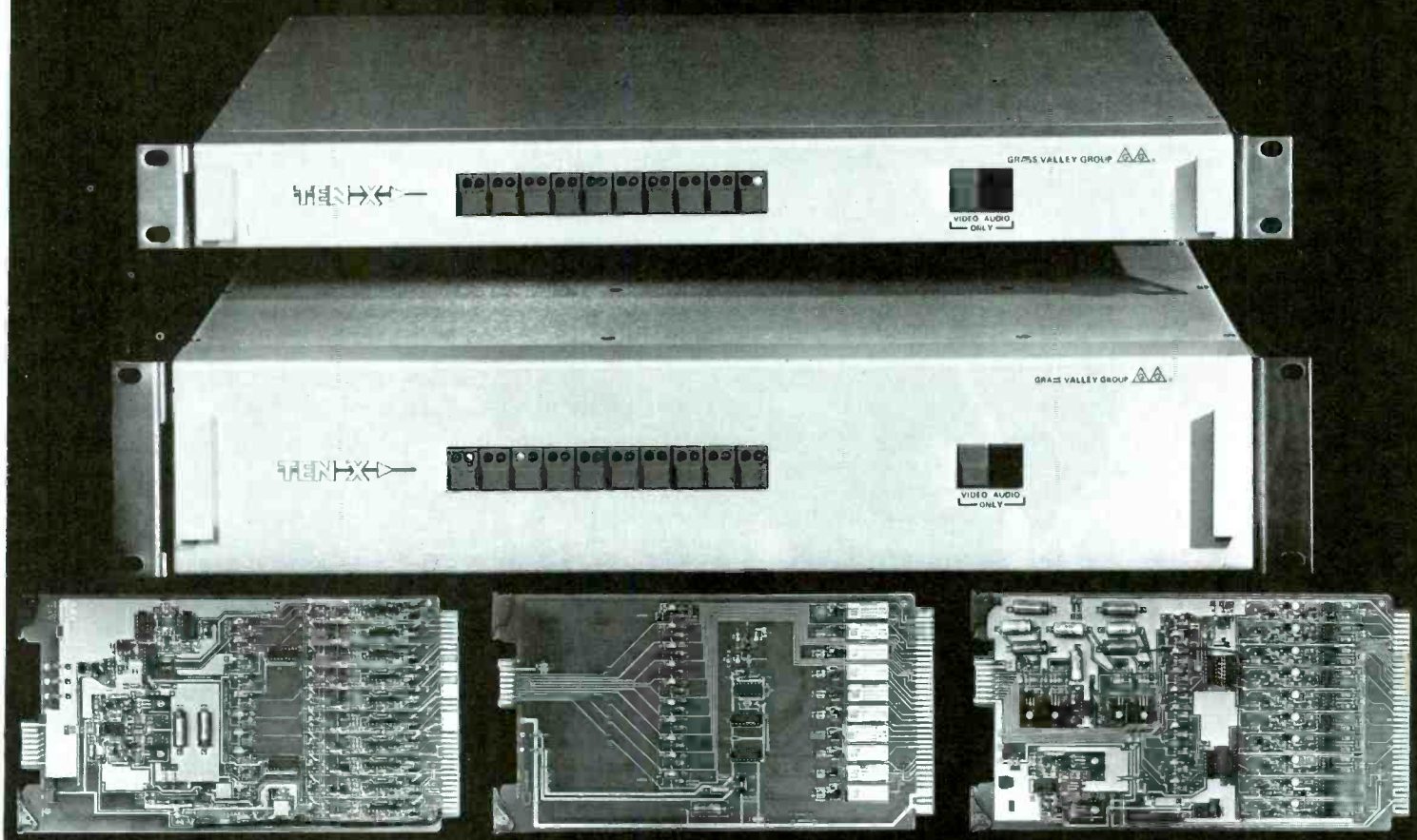

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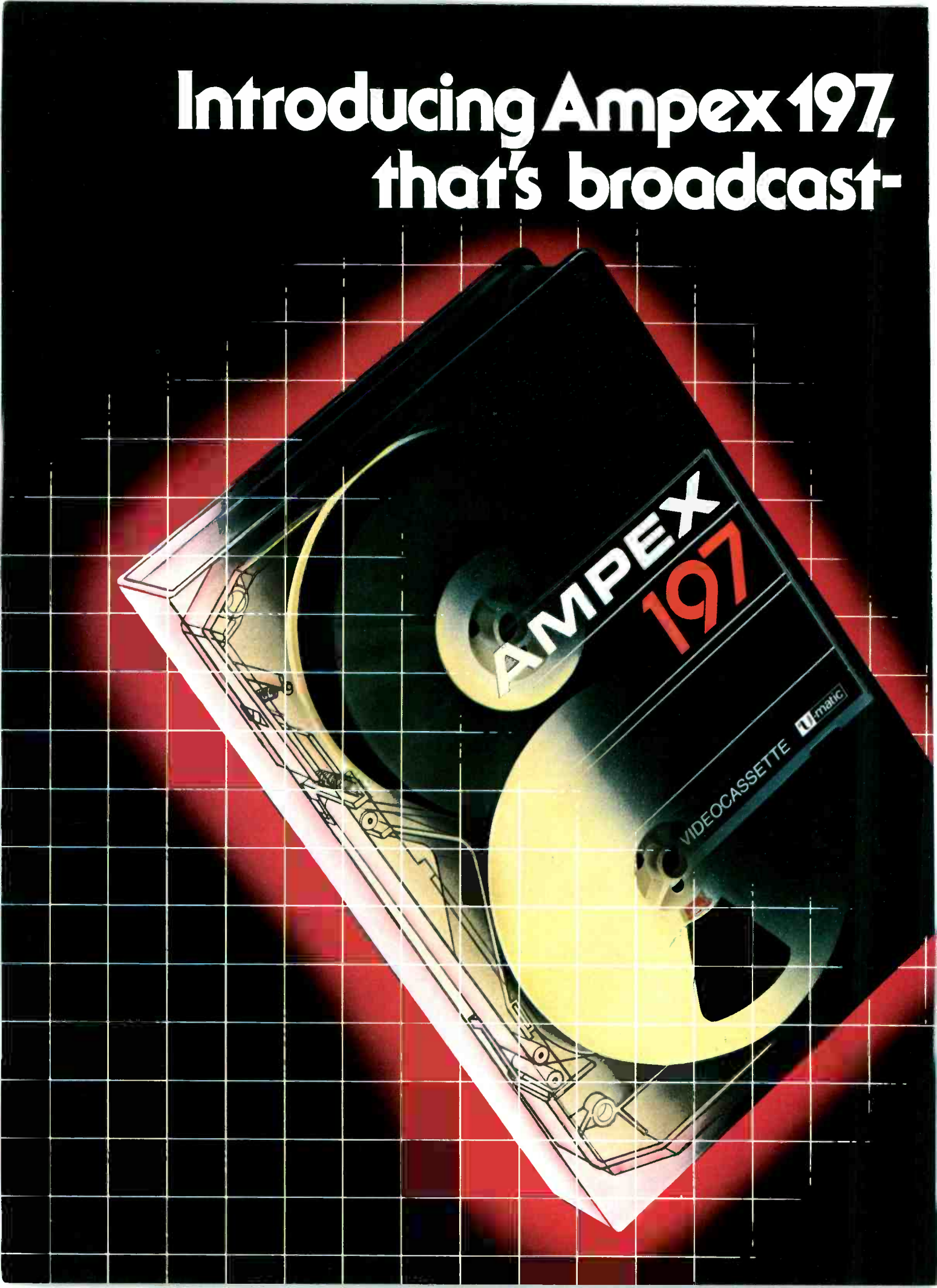
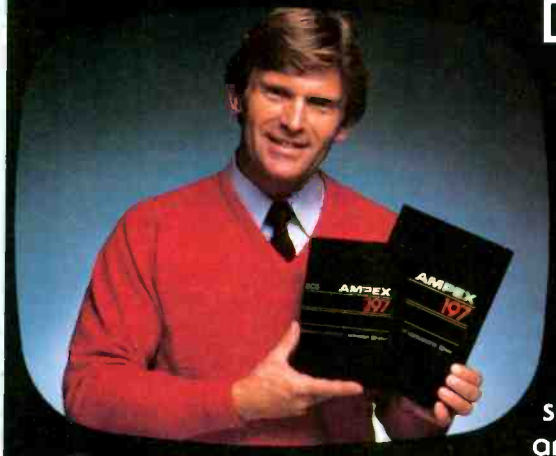


the new 3/4" videocassette quality in every way.



Broadcast-quality color & sharpness.

The new Ampex 3/4" videocassette has been designed with nothing less than perfection as its goal.

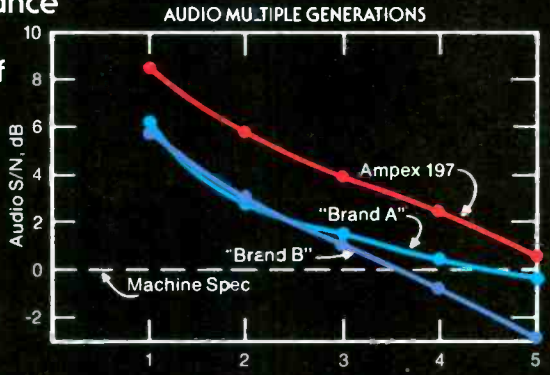
Its superb chrominance and luminance performance makes it ideal to meet the stringent demands of broadcast applications such as electronic news gathering, electronic field production and on-line editing.

And the tape in Ampex 197 has been especially formulated to optimize the performance of the Sony BVU series of recorders.

Broadcast-quality sound.

Ampex award-winning sound has been an industry leader for a quarter of a century. Now Ampex 197 brings this award-winning expertise to video.

Ampex 197 offers superior signal-to-noise and low distortion characteristics. This translates into crisper, cleaner audio performance under heavy editing conditions and multiple generation dubbing. It also delivers excellent stereo fidelity when used for music recording.



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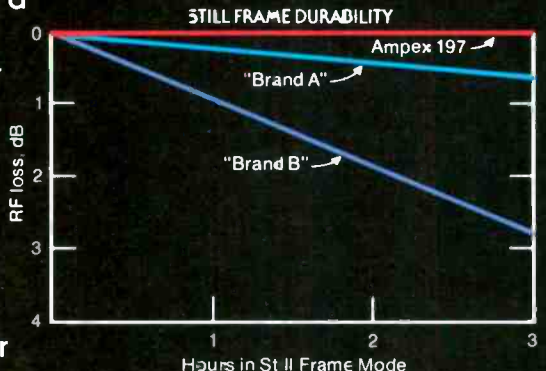

Laboratory tests proved that Ampex 197 held up for three full hours with no RF loss.

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It's Greek to me

Guest editorial by Art Schneider, post-production consultant

I know that most of you, at one time or another, have purchased a consumer product or a piece of electronic equipment, opened the instruction book and thought, "Now I'll find out how to operate this thing." But, to your chagrin, you have stumbled onto a technical manual so complex that you think it has been written by someone from outer space.

Although not all equipment manuals fall into this category, those that do make you wish you could shake the author of the manual and say, "Listen, I'm not an engineering genius like you." Or you might say, "If you tried operating one of these things before you wrote the manual, maybe other people would be able to understand what you are talking about."

I strongly believe that too many technical writers are not familiar enough with the equipment they are writing about to accurately describe its operation in simple terms to potential users.

I'm not a neophyte in television. I've been at it for more than 30 years, and I've run across almost every kind of electronic equipment made, much of which I'm able to operate without reading the operating manual. There are times, however, when I have to use the manual.

For example, recently we purchased a time code generator. Not only could it generate and read time code, but also user bits, vertical interval time code, and display time code characters in the video. The specs looked great. At first glance, you would suspect that the unit might be easy to operate and that you could muddle your way through the controls before reading the book. Not so. I poked and pushed the buttons and shifted and unshifted keys and not a thing happened.

I finally opened the manual and tried to find out how to use the device. Eventually, I figured it out, but the way that the manual was written was so confusing that I wasted a lot of time trying various combinations of buttons and keys to get the system to display what I wanted.

This leads to a question: Why is it necessary for technical writers to prove how smart they are and how stupid the user is? They should use plain, simple language instead of complex technical terms. They should not assume that all of us have the same technical background that they do.

It would be helpful if operating manuals for all technical equipment gave step-by-step instructions with examples of the results you could expect to see. Then you would know whether or not the system was working without wasting your time.

Obviously, there is a lot of complex equipment (becoming increasingly more so) used in the TV industry today. However, there is no reason why manufacturers of this equipment could not get inputs from some *less technical* users (or staff members before finalizing their operating instructions.

Better yet would be field testing the manual in an operating environment. A survey report form could be filled out so that the manufacturer could correct any major operational errors before going into production, as well as make sure that the manual was clear and concise.

Incidentally, regarding the time code generator, we returned it—*not* because it did not work. Rather, the people who would be operating and maintaining this equipment believed it was much too complex, and the potential for error when using it in daily production was too great. As we all know, correcting a mistake is much more costly in time, material and client relationships than doing it right the first time.

We cannot assume that everyone buying a piece of complex electronic equipment will be able to operate it with ease the first time. However, better instruction manuals will help solve some of the frustrating problems associated with understanding, operating and maintaining new equipment. A spin-off will be better manufacturer/user relationships.

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Six-digit readout: Automatically tracks every CRT test. We call it digital autotracking. It's patent pending.

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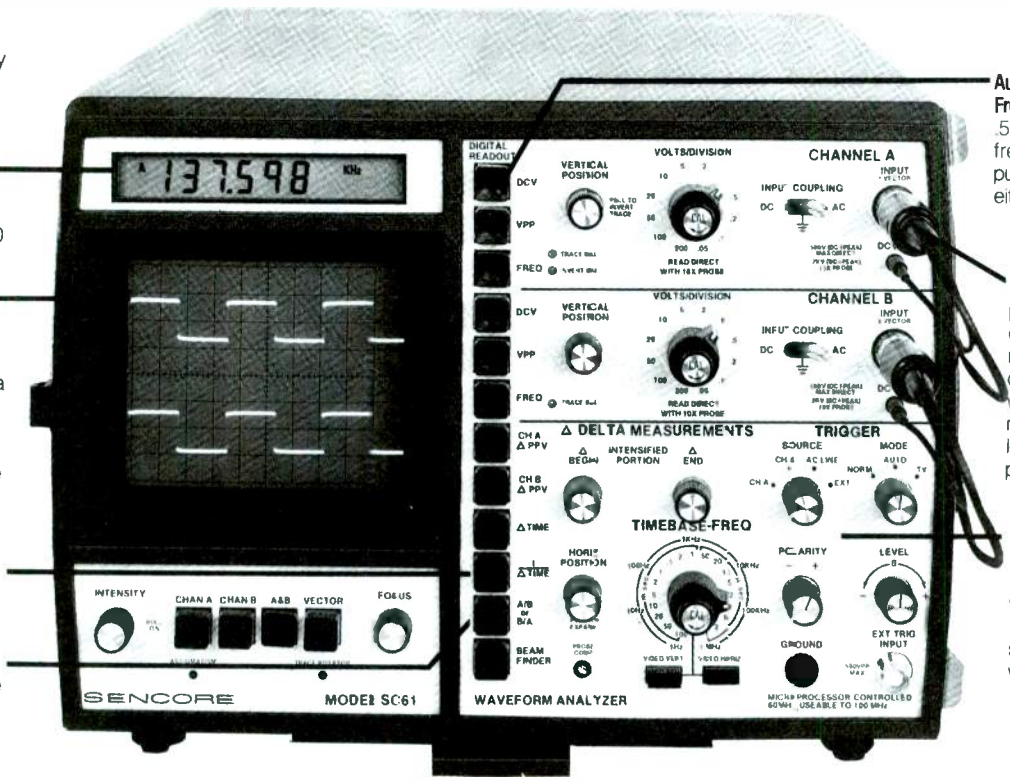

Autotracking DCV, PPV, Freq: Measure DCV to .5%; PPV to 2%; freq. to .001%. Just push a button for either Channel A or B.

One probe input: One probe input per channel for all measurements - digital and scope - with 5 mV to 2000 V measuring range. (2 lo-cap probes provided.)

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No more graticule counting. *Connect only one probe* to view any waveform to 100 MHz. Then, just push a button to read DCV, PPV, frequency and time — automatically!

There are no graticules to count or calculations to make, which speeds every measurement.

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A special Delta function even lets you intensify parts of a waveform and digitally measure the PPV, time or frequency for just that waveform section.

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Now. Authentic reproduction from any signal source. The Tek 110-S is the frame synchronizer with 10-bit resolution and accuracy. Performance that's every bit Tektronix! You get highest signal quality with correct SCH phase from any source. Resulting in the least signal degradation of any frame synchronizer on the market today.

Ten-bit digital circuitry offers digital signal processing with negligible quantizing errors. This 10-bit capability lets you cascade multiple units and depend on the 110-S for unexcelled performance. With four passes through the 110-S your signal is still better than with one pass through an 8-bit synchronizer. *Including quantizing effects,* the 110-S has the following specifications:

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Noise performance unmatched. Signals can be tracked to low signal/noise ratios, such as those encountered during ENG Microwave fades. Or the operator can select field freeze or black. Adaptive clamping prevents streaking while quickly responding to hot switches.

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Satellite update

By John Kinik, satellite correspondent

Rebirth of radio

Although satellite television has developed into a major new program delivery technology over the past 10 years, satellite radio has grown slowly. This situation promises to change dramatically in the near future as the cable industry begins to add more radio programming to its TV channels and as major broadcasters convert their radio distribution networks to satellites.

Recent developments in satellite transmission techniques and earth terminal technology have made it possible to configure cost-effective radio delivery systems, stimulating a rebirth of the concept of national radio networks. The inherent simplicity of radio technology is now being combined with the advantages of satellite broadcasting technology to pump new life into what for a long time has been an almost forgotten medium. In fact, there are indications that radio may once again become an important medium, competing for the TV viewer's attention, as the quality and variety of radio programming increases, and as more people reach the point of *video saturation*.

The following is a review of the current status of satellite radio programming and the key considerations involved in the delivery modes available to cable and broadcast networks, to provide a basis for understanding this major trend.

Satellite radio programming

A total of 45 satellite radio channels (as of March 1983) is being distributed to cable systems in the United States and Canada. The cable channels are *piggybacked* onto TV channels by means of audio subcarriers, which are multiplexed with the TV audio channel. Other types of radio channels (NPR, Mutual) are transmitted via separate RF carriers. A list of these radio channels is shown in Table I, with the primary *carrier* channel (transponder) identified.

One CATV channel (WGN) carries 14 subcarrier channels, including the seven radio channels listed, in its audio baseband, with room for several more. This indicates a tremendous capacity for growth if it is assumed that each TV channel is capable of carrying the same number of radio channels. However, there is some complexity involved in adding audio channels to existing TV channels, because not all audio multiplexing techniques are set up for a large number of subchannels, and there are several methods being employed to provide stereo channels.

Also, many of the TV channels are not desirable carriers to the radio program originators because they are not used by as large a percentage of cable systems. Thus, there is a natural concentration of cable radio channels on two popular TV channels, WGN (Chicago) and WTBS (Atlanta). As these and other carrier channels are used up, there will be a need in the future for dedicated radio transponders (such as the Westar 4 transponder), independent of any TV channel, to carry new radio programming to cable systems. There are two basic techniques now being implemented by major radio networks that may eventually be employed for cable systems also.

Continued on page 138

Table I.

Satellite	Transponder	Radio channel	Programming
Satcom 3R	2—PTL	Satellite Radio Network	Religious—mono
	2—PTL	Sunshine Entertainment Network	Music—mono
	3—WGN	Bonneville Easy Listening Music	Music—stereo
	3—WGN	Country Coast-to-Coast	Music—stereo
	3—WGN	Moody Broadcasting Network	Religious—stereo
	3—WGN	Seeburg Lifestyle Music	Music—mono
	3—WGN	Stardust	Music—stereo
	3—WGN	StarStation	Music—stereo
	3—WGN	WFMT Chicago	Music—stereo
	6—WTBS	Music in the Air	Music—stereo
	6—WTBS	Music in the Air	Music—stereo
	6—WTBS	Music in the Air	Music—mono
	6—WTBS	Music in the Air	Music—mono
	6—WTBS	Music in the Air	Music—mono
	14—CNN	CNN Radio Network	News—mono
	16—HTN Plus	HTN Plus	Variety—stereo
Satcom 4	3—SSS	Nationality Broadcasting Network	Multilingual—mono
	6—Bravo	Bravo	Cultural—stereo
	7—NCN	Family Radio Network	Religious—stereo
	7—NCN	Family Radio Network	Religious—stereo
	7—NCN	Sunshine Entertainment Network	Music—mono
Anik D1	8—CHCH-TV	CKO-FM Toronto	News
	14—TCTV	CKAC-AM Montreal	Music
	14—TCTV	CITE-FM Montreal	Music
	18—CITV	CIRK-FM Edmonton	Music
	24—CBC	CFMI-FM New Westminster	Music
Westar 4	2D	National Public Radio (NPR)	12 channels—variety
		Mutual Radio Network	5 channels—variety
		Muzak	1 channel—music
		Meredith Broadcasting	1 channel—variety

TEK 1910 DIGITAL TEST SIGNAL GENERATOR/INSERTER

WORKING HARD FOR YOUR SIGNAL QUALITY

The new digital generator that lets you access and configure the vertical interval any way you want it.

Now. Four external VITS inputs. Non-volatile memory. And 39 test signals. All wrapped up in one test signal generator with all-digital family features. The new 1910 from Tektronix gives you the most access offered to the vertical interval—for inserting and configuring the location of test signals, Teletext, closed captioning, source ID and more. No other generator gives you that kind of capability.

Plus, the proven performance of the leading family of digital test signal generators. With the 1910, Tektronix has combined its 1900 Series Transmitter, NTC7 and Studio Test Sets in one highly capable unit. You get a full signal complement, with the accuracy and stability of 10-bit digital signal generation. The digital code for each signal is stored in replaceable PROMs so your 1910 won't become obsolete.

Its RS232 control port adds even more versatility to the 1910 by providing a means for automatic control from such devices as the Tektronix 1980 ANSWER Automatic Video Measurement Set, with added flexibility for programming VITS and VIRS in either field on lines 10 through 20, signal matrixing, VITS sequencing, redefining signal selection in the front panel or remote control unit—and more.

Solid support completes the package. The 1910 comes with a worldwide service network and proven technical support, plus the Tektronix reputation for reliability, excellence and long-term value.

Contact your nearest Tektronix Field Office (listed in major city directories) for more information. Or call 1-800-547-1512 for descriptive literature. (In Oregon, 1-800-452-1877.)

Tektronix, Inc., P.O. Box 1700, Beaverton, OR 97075. In Europe: Tektronix Europe B.V., Postbox 827, 1180 AV Amstelveen, The Netherlands.

Tektronix
COMMITTED TO EXCELLENCE

For Literature Circle (10) on Reply Card

feedback

Narrower definition

The SeaTel product line distributed by Mariped Sales Company should be more narrowly defined than it was in the November 1982 issue of **BE** (page 64). SeaTel manufactures motion-stabilized antenna pedestals, radomes and related equipment for shipboard installations of satellite communications systems. Its factory is at 895 Howe Road, Martinez, CA 94553.

F.A.M. Buck
Mariped Sales Company

WNEV-TV

I've completed reading the January issue of **Broadcast Engineering,** and wanted to offer congratulations on running the fine article by Carl Renwanz, concerning WNEV-TV going to ½-inch (page 19).

Diane Talsma
Communications Manager
Convergence Corporation

Delivery to India

As the technical manager of one of the leading distributors of electronic equipment in India, I have been a proud recipient of **Broadcast Engineering.** Your journal is doing a great service to professionals involved in broadcast technology all over the world, and I want you to know that I really appreciate it.

Vish Sahai
Technical Manager
KATONIX
New Delhi, India

Unipole antennas

A client is interested in making a modification to his vertical AM antenna and wants to explore the possibility of using the *unipole* (sometimes called *monopole)* design. I remember that **Broadcast Engineering** published an article on such an antenna in the early '60s. In the process of moving, some of my back issues of your splendid publication have become lost, so I cannot locate the article. Can you provide me with a copy?

R. F. Van Wickle
Consulting Engineer
Columbia, MO

The article, titled "The Folded Unipole Antenna for AM Broadcasting," appeared in our December 1960 issue. A copy is on its way to Van Wickle. This was the second request this year for the article.

Closed captioning

We are in the process of starting a Patient Education Station at our hospital. Due to the special interest of our hospital—eye, ear, nose and throat—we are looking for unique programs and also information on closed-captioned television. Your recent institution of closed-captioned television for the hearing-impaired on KCMO-TV 5 sounds very interesting. Please send me more information on this project (**BE** March 1983, page 14).

Alys Weissman
Massachusetts Eye and Ear Infirmary

Testing AM stereo

I am writing to you because of the relative lack of published information regarding the testing of various AM stereo transmission systems. Why has there been no information made public regarding the Delco tests made at Radio Station WIRE? Has WIRE been prevented from discussing the outcome of the tests that occurred at its facility?

There are dozens of radio stations throughout the country testing AM stereo systems. In fact, some of the stations are testing more than one system. Why have there been no published reports regarding the performance of the various systems in the field? Are we to believe that with all of the tests occurring now that no manufacturers have made any design improvements in the systems that they are promoting?

Other questions I have pertain to the manufacturers of AM stereo equipment. The advertisements by these companies list the stations that are using their system, however none of the advertisements describe any of the relative merits or performance specifications of the equipment in question. Also, why are some select major market facilities receiving preferred treatment in the form of loans of AM stereo equipment from

Continued on page 139

Editor's note: Our March editorial cited broadcast/printed media efforts to ease the nation's jobless plight. When the issue was on the press, we received the following material from WSB-TV, Atlanta, showing another effort along the same lines.

Job program

In what is the most ambitious community-sponsored effort of its kind, WSB Television devoted the month of March to attacking the problem of unemployment in Atlanta through its comprehensive campaign, WSB On The Job.

In explaining the objective of the month-long campaign, Lester Strong, executive producer, said, "Our goal is 2-fold: One is to find more metro Atlantans job opportunities; and two, which may even be the most important goal, is to teach people how to creatively look at their skills and market themselves to employers and find jobs on their own. That's where our largest impact is in my judgment."

WSB On The Job officially began Feb. 15 with the announcement of the On The Job hotline. As *classified ads* were broadcast on the air listing actual job openings, viewers called the hotline number and were directed to the Georgia Department of Labor job service center in their area to apply for specific jobs.

WSB-TV contacted 10,000 Atlanta employers asking them to donate at least one position to the campaign. All jobs were coordinated through the Georgia Department of Labor. Employers were encouraged to call if they had a job to offer or if they had questions about the campaign.

Unlike other job programs, WSB On The Job encompassed an entire month of seminars, programming and news to help get the city back to work.

Each weeknight in March on Action News at 6 p.m., WSB reporters looked at finding a job—from how to get in the door to how to act in the interview. As part of the project, on March 17 and March 18, 4000 Atlantans had the opportunity to participate in job seminars at the Georgia World Congress Center. Each seminar was specifically designed to meet the needs of skilled and semi-skilled workers and professionals, clerical workers and technicians.

The culmination of WSB On The Job was a telethon on March 26. As well as taking applications by telephone for the classified ads that were broadcast, job counselors demonstrated such job-seeking skills as knowing what employers look for, determining how applicants are screened out and using proper body language.

The station's efforts were commended by a letter from President Ronald Reagan. The job program was a cooperative effort of WSB-TV, WSB Radio, The Junior League of Atlanta; City of Atlanta, CETA; City of Atlanta; The Junior League of DeKalb; Georgia State Employment Service; Georgia State University; Job Watch; National Alliance of Business; and Private Industry Council.

TEK TELEVISION PRODUCTS

WORKING HARD FOR YOUR SIGNAL QUALITY

A completely automated audio analyzer package and advanced portable scopes to simplify your job.

Now. Four new products from Tektronix deliver more capability and performance than ever before. **SG 5010 Programmable 160 kHz Oscillator/AA5001 Programmable Distortion Analyzer.** Two new members in our TM 5000 family of modular, IEEE-488 compatible instruments. The SG 5010 is the first oscillator to offer both GPIB programmability benefits and less than 0.001% (−100 dB) total harmonic distortion. Plus all the standard IMD test signals and high level, fully balanced, fully floating output. Together, the SG 5010 and AA 5001 make a completely automated audio analysis system with the highest performance available today. Fully automatic even when the oscillator and analyzer are separated, by yards or by miles.

2236 100 MHz Portable Oscilloscope. Measurements that had taken three or four instruments can now be done with one: the 2236 with integrated counter/timer/digital multimeter. It's a whole measurement system packed in a portable scope that's lightweight, versatile and easy to use. Priced-right performance for tasks from circuit continuity testing to gated frequency, time and event counting. Standard features include TV field and TV line triggering.

2445 150 MHz Portable Oscilloscope. The new industry standard with more performance for the dollar than you've ever seen before. Four-channel capability. Auto level "hands-off" triggering. Standard Δ time and delay sweep. 1 ns/div sweep speed. Overdrive aberration of only 0.5%. Extensive CRT readout. Plus more. And state-of-the-art microprocessor design keeps the 2445 simple to operate. It's everything that a portable scope should be and the only one that is.

Contact your nearest Tektronix Field Office (listed in major city directories) for more information. Or call 1-800-547-1512 for descriptive literature. (In Oregon, 1-800-452-1877.)

Tektronix, Inc., P.O. Box 1700, Beaverton, OR 97075. In Europe: Tektronix Europe B.V., Postbox 827, 1180 AV Amstelveen, The Netherlands.

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For Literature for TM 5000 Circle (11) on Reply Card
For Literature for Portables Circle (12) on Reply Card

WE JUST MADE HIGH PERFORMANCE STANDARD EQUIPMENT.

TASCAM's M-50 is the compact 12x8x8 mixing console audio production professionals have been looking for. With its multiple inputs per channel, plus assignable submixes and monitor sections, you get the flexibility to get the job done in all production modes—record, overdub and remix or assembly.

By including direct boxes to accept instrument inputs, phono pre-amps for replaying effects library or reference disks and stereo solo "in place" permitting monitoring of individual channels or whole portions of a mix, you get what you need. High performance functions as standard equipment.

The M-50 is reliable and fast, with extremely flexible signal routing. A valuable asset to the ad agency production room, the small video production/post-production company, the multi-media production facility, and in many other applications.

Because the M-50 includes Solo and PFL, multiple auxiliary mixes, plus balanced and unbalanced inputs and outputs, it is also well suited to final film assembly, small club P.A., and broadcast with clean feeds provided.

TASCAM's extensive design and manufacturing experience in professional recording equipment made it possible to create the M-50. Compact and affordable, this modular 8-track mixer is within the reach of any serious professional.

For additional information, see your TASCAM dealer, or write TASCAM Production Products, 7733 Telegraph Road, Montebello, CA 90640, (213) 726-0303.

TASCAM
TEAC Production Products

Circle (13) on Reply Card

Real time closed captioning at NCI

By Jeff Hutchins, director of systems development, National Captioning Institute, Falls Church, VA

Oct. 11, 1982 was a historic day for the closed-captioning service. On that day, the National Captioning Institute and ABC-TV and its affiliates began the world's first national closed-captioning of a live news program, ABC's *World News Tonight*. Funds for closed-captioning the program are provided to NCI by the US Department of Education.

To offer this service, the institute developed a way to caption a program without seeing a script first. The method is called real time captioning, and its development was a tremendous breakthrough for the closed-captioning service.

There had long been a need for a means of captioning *live* TV programs so that they were understandable to hearing-impaired viewers. Although this audience welcomes captioned entertainment, NCI's research indicated that hearing-impaired people wanted access to timely news and information programming as well.

Needed: Two technologies

Providing this service was not possible, however, until two technologies were developed and married: closed captioning and real time captioning.

The Public Broadcasting Service had worked through most of the 1970s to develop a closed-captioned system in which caption data could be encoded on Line 21 of the vertical blanking interval for display only on specially equipped receivers. This sys-

Continued on page 22

Courtesy of June Farrell, NCI public relations director

Marty Block, NCI stenotypist, prepares captions instantly for *World News Tonight*. The captions appear on TV sets equipped with TeleCaption units.

TECHNOLOGY YOU CAN TRUST

For years, broadcasters have trusted that an Otari tape machine would perform to the highest specifications, day-in and day-out. Regardless of the age of their Otari machine, they have relied on a continuing commitment from the factory and dedicated dealer support. The Otari MTR-10 production recorder has maintained this tradition.

Broadcasters know they can trust the MTR-10 to provide uncompromised audio specifications and unique, useful features. In fact, the MTR-10 makes a broadcaster's life less complicated because it's faster to operate, easier to maintain and faster to service.

Broadcasters have discovered that investing in an Otari MTR-10 is an effective way to address today's broadcast needs while preparing for tomorrow's.

The MTR-10 Series recorders are engineered with fully microprocessor-controlled transports and are available in four formats: 1/4" full-track; 1/4" two channel; 1/2" two channel and 1/2" four channel. Each version has a long list of sophisticated editing and production features: return-to-zero; 3 speed operation with individual equalization and bias; two master bias presets; controlled wind for library spooling; back timing; on-board test oscillator; user adjustable phase compensation; speed display in percentage or ips; cue speaker and headphone monitoring; shuttle edit control; ±20% varispeed and an optional ten memory locator. All models easily

The Otari MTR-10 Series ¼" & ½" Mastering/Production Recorders

interface with any SMPTE-based video editing system.

All models come with the following typical specifications:

- ☐ Wow & Flutter: 0.03% (DIN 45507 Peak Wtd.)
- ☐ Frequency Response: 50Hz – 20kHz, ± 0.5 dB (Record/Reproduce)
- ☐ Signal-to-Noise Ratio: 75 dB (unwtd., 30Hz – 18kHz) (3%, Third Harmonic Distortion to Noise floor)
- ☐ Distortion: 0.15%, Third Harmonic (@ 1 kHz)

All specifications at 30 ips, 250 nWb/m Operating Level, Two Channel.

To receive your own comprehensive brochure or to arrange a hands-on evaluation, call us for the name of your authorized dealer.

The MTR-10 Series recorders are like no other tape machines: built with quality you can hear and feel, reliability that has made Otari the "Technology You Can Trust."

Otari Corporation, 2 Davis Drive, Belmont, CA 94002 Tel: (415) 592-8311 Telex: 910-376-4890

OTARI

Technology You Can Trust

Circle (14) on Reply Card

Continued from page 19

tem allows captions to be sent with any program during its original telecast without affecting the viewing pleasure of people who do not need or want captions.

The breakthrough came in March 1980 when Sears Roebuck offered consumers a decoder for the Line 21 closed-captioning system; ABC and NBC joined PBS in offering closed-captioned programming; and NCI, having been formed a year earlier as a private non-profit company, was in place to provide the closed captions.

With the closed-captioning system and NCI in place, half the problem of captioning a live newscast was solved. In comparison, that was the easy half. What remained was how to *create* and *encode* the captions.

Subsequently the institute developed two methods for captioning live programs. The first is what is called *live display* captioning, which involves recall and transmission of captions prepared in advance. This method requires NCI to have an advance copy of the script, which is possible with live drama and presidential speeches, for example, but not with sports events, awards programs, press conferences, news reports and most other live telecasts. This latter group of programs requires *real time* captioning, which involves the simultaneous creation and transmission of captions—in effect, instant captioning.

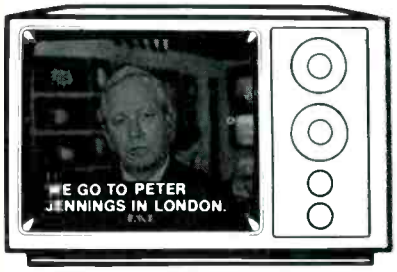
World News Tonight falls into the second category, even though much of the program is taped or pre-scripted. Getting those scripts in advance is nearly impossible because the ABC format calls for origination from several cities each evening and because of the general nature of news programs. Late-breaking stories may be read live in the studio without even a prompter copy or may be ad-libbed from the field.

It is not practical in a program as dynamic as a newscast to alternate between live display and real time captioning. It quickly became clear that the only workable means for captioning the news was *real time*.

Theoretically, three methods for real time captioning exist. The first is speed typing using standard keyboard entry. The second option is speech recognition. The third possibility, the one that NCI chose to pursue, is stenographic translation.

In simplest terms, stenographic translation is the computerized translation into real words and names of a stenotypist's machine shorthand strokes, which are phonetic representations of what the stenotypist hears and inputs.

Some closed-captioned programs by NCI



ABC World News Tonight
photo courtesy of ABC

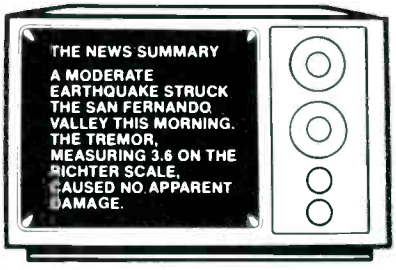
Fantasy Island
photo courtesy of ABC

Charles Dickens' The Life and Adventures of Nickolas Nickleby.
© 1982—Primetime/Mobil Showcase

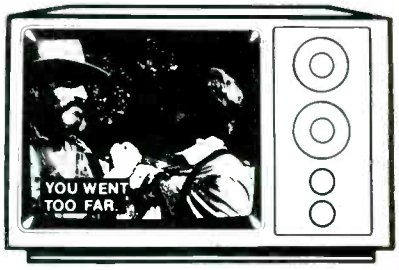
All Presidential speeches and press conferences are closed captioned.

Three's Company
photo courtesy of Three's Company

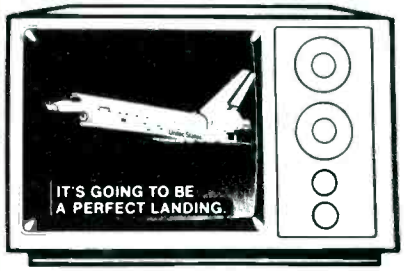
The Winds of War
© 1983 Paramont Pictures Corp. All Rights Reserved.



Two text channels cover the day's news, caption program schedule, weekend sports, and hearing-impaired articles.

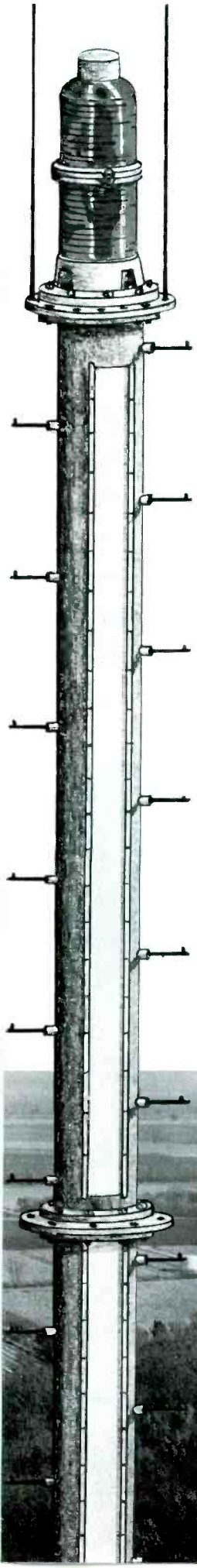


Little House: A New Beginning
photo courtesy of NBC.



Columbia Space Shuttle Launch and Landing

Robert Schuller and the Hour of Power
photo courtesy of Schuller Ministries



New Harris Wavestar™...

The most reliable UHF slot antenna ever designed... because it's waveguide!

The new Harris Wavestar is the only slotted waveguide UHF antenna now available...the ultimate in design simplicity. No center conductor. No couplers. No insulators. Fewer parts mean fewer problems. And that means less off-air time and lower maintenance costs.

Additional advantages of waveguide over coax antennas include higher power handling capabilities and greatly increased safety margins to prevent arcing.

The Wavestar pattern performance is excellent by any standard. Cardioid and peanut directional patterns are currently available, and a highly circular omnidirectional pattern will follow soon. All of these Wavestar configurations provide the smooth elevation patterns necessary for high signal strength and minimum ghosting over the entire coverage area.

The Wavestar is a low windload design for tower top or side mounting. High mechanical strength and rigidity minimize picture variations caused by wind sway.

Every Harris antenna is completely assembled and tested at the Harris antenna test range...the largest, most comprehensive facility of its kind.

The range is located in an area far from the pattern-distorting clutter of urban development. Situated atop a 230-foot bluff, with test transmitters located up to 3 miles away on flat, unobstructed bottom lands, the range offers ideal conditions for testing, approaching the "free space" situation of an installed antenna.

Here, theoretical azimuth and elevation patterns are verified with the most accurate and sophisticated test instruments available—translating the theory of a calculated pattern into the reality of actual antenna performance.

You can depend on Wavestar for top reliability. And you can be confident that your Wavestar antenna will be thoroughly tested by Harris to meet your exact pattern requirements.

Contact Harris Corporation, Broadcast Division, P.O. Box 4290, Quincy, Illinois 62305-4290. 217/222-8200.

HARRIS

Circle (49) on Reply Card

Three dictionaries used

Development of this system covered more than two decades. A number of entrepreneurs over the years refined this new technology, but Translation Systems Inc. (TSI) of Maryland came up with a unique approach. Briefly, it called for a combination of three dictionaries containing the possible stenographic outlines for each English word.

The main dictionary, the one unique to TSI, is the *universal* dictionary. Containing thousands of words likely to be used frequently, it is permanent and can be increased in size.

Next is the *personal* dictionary in which a stenotypist makes entries, such as special abbreviations, used only by him or her, or specialized vocabulary not found in the universal dictionary. Because each stenotypist has a unique style of writing, careful maintenance of the personal dictionary tailors the system and increases the likelihood of making accurate translations.

The third dictionary to which the computer turns to look up a word is the *dope sheet*, which contains entries appropriate to a specific task, such as names and places likely to be mentioned in a given newscast. The dope sheet is not permanent unless added to one of the other dictionaries, but it can be used to complement any user bringing up any personal dictionary.

A team effort

Work on captioning the evening edition of *World News Tonight* begins early each day as a team of text editors scans a number of major daily newspapers and the weekly news magazines for names and places likely to be mentioned in the program later that day. The wires are checked for late-breaking news reports. Following a story conference, the results of this day-long research are used to prepare the daily *dope sheet*.

In making its translations, the computer checks each of the three dictionaries and matches the stenographic outline entered on the stenotype machine with the corresponding English word or words. NCI's two stenotypists, Marty Block and Bobbie Showers, have a 97% accuracy rate using this process.

If the computer does not find a dictionary match, the word will appear in its original stenotype form, a phonetic representation that may or may not be understandable. For example, the word "should" would appear "S-H-U-D," which most persons would recognize. But the word "copyright" would be "K-O-E-P" and "R-A-O-I-T."

The dictionaries are stored on a 24Mbyte hard disc drive with one removable and three fixed platters. Massive storage is necessary because each word in the dictionary must be entered with all the permutations of steno outlines that might be used to transcribe that word. Few words have less than two possible combinations of strokes, and many words have as many as 100 outlines. Fortunately, because of standardization of input, most words require less than five outlines.

TSI then worked with NCI to create

Kathryn Puckett, NCI section supervisor, makes a thorough final check of the captions prepared for an episode of *Sesame Street* before the episode is sent to the client. Among the elements she checks are accuracy, placement, word usage and spelling.

THE VPR-80/TBC-80 COMBINATION FOR TYPE "C" PERFORMANCE. AT THE LOWEST COST.

$49,500.*

The VPR-80, and its new TBC-80 digital time base corrector, are the key elements in a full-featured, economy-priced one-inch type "C" format VTR system. The VPR-80/TBC-80 package assures you highest performance for under $50,000.

VPR-80 and TBC-80 together offer you slow motion and still-frame playback with AST™ Automatic Scan Tracking as a standard feature. Other high-performance features include: picture in shuttle up to 300 ips, a built-in editor with keypad for edit point entry and trim, slow-motion playback from stop to 1.5X play speed, an advanced tape transport for playback of spot or two-hour reels, and dual-microprocessor design for comprehensive diagnostics.

The new TBC-80, designed as a companion to the VPR-80, features the very latest in video processing technology to enhance the VPR-80's playback signal. In addition, TBC-80 includes selectable heterodyne processing for use with either ½" or ¾" VTRs.

Compare These Features:

- Flawless slow motion playback (stop to 1.5X play)
- Picture in shuttle
- AST™ standard on all machines
- Powerful frame-accurate editing
- Comprehensive diagnostics with test probe
- Dual-microprocessor design
- Many configurations (including tabletop, rack mount, pedestal, consolette and full studio console)

The VPR-80/TBC-80. A perfect match. And the price is right.

For more details about the VPR-80/TBC-80 combination, simply contact your local Ampex AVSD sales office: Atlanta 404/451-7112 • Chicago 312/593-6000 Dallas 214/960-1162 • Los Angeles 213/240-5000 • New York/New Jersey 201/825-9600 • San Francisco 408/255-4800 Washington, D.C. 301/530-8800

AMPEX

Ampex Corporation • One of The Signal Companies

SETTING THE FASHION IN BROADCAST VIDEO

*List price U.S.A.

Circle (18) on Reply Card

InstaText, a version of the basic stenotype system that allows direct input from the shorthand machine and that produces an English transcript modifiable for display in any predefined format.

Normal stenotypists use a Jacquard J-100 computer, which can support many terminals. The J-100, however, is too slow for the throughput speeds needed for real time captioning. So, NCI employed a higher speed single terminal, the J-500, to which was attached a specially altered stenotype machine using a 25-pin connector. In addition to translating the shorthand received from the machine, the J-500 formats the resulting English text into captions, adding the specific control codes necessary to drive the Line 21 closed-captioning encoders and decoders.

Currently, there is an average 6s delay between the spoken word and its appearance in a caption. Two things cause the delay: First, the stenotypist cannot transcribe the word until he or she hears it; and second, the computer needs time to do its work. In order to keep up with the reporters, it is necessary occasionally to cut out a little of what is said. For this reason, reporters' identifications such as, "This is Peter Jennings in London," are usually omitted.

For the most part, however, the news captions are verbatim: i.e., they repeat exactly what is being said. If a person speaks slowly, the words in the captions appear slowly; if a person speaks quickly, the captions move along at a quicker pace.

As translation takes place, the text is formatted according to parameters set by the stenotypist or a display editor operating the main computer keyboard. These parameters include line length, indentation, upper or upper/lower case, and line justification for left, right or center display.

The text then is transmitted to a line 21 decoder via a Line 21 Smart Encoder, a device used by the broadcaster to insert data onto Line 21 of whatever video is being fed through it.

The Smart Encoder integrates the real time caption data with previously encoded material or with data in the encoder's memory that is destined for one of the four channels displayed by the home decoder. NCI uses InstaText to communicate with a Smart Encoder at 1200 baud asynchronous over standard unconditioned telephone lines. Specific software was added to the basic InstaText system to allow further display formatting for Line 21 users.

Thus, NCI controls whether the captions scroll up onto the viewer's screen a line at a time or pop on caption-by-caption. It also controls how many lines display at one time, and whether each word is outputed and encoded as soon as it is translated or whether words are buffered until complete lines or complete captions are formed. The institute also controls whether the captions appear at the top or bottom of the screen and whether to color or italicize the words. The blanking of captions is also controlled. This occurs either on command or automatically after they have displayed on the screen for a pre-set number of seconds.

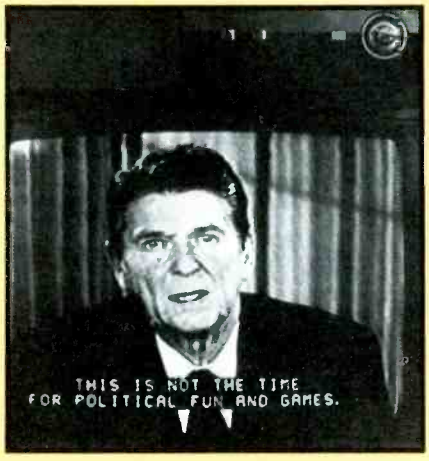
NCI tested this stenographic captioning system for approximately seven months to caption the early feed of *World News Tonight* before launching the service nationwide. During this initial period, stenotypists

Photo: Richard N. Greenhouse

Dave Crane (left), NCI director of technical operations, and John Klein (standing, at right), NCI systems analyst, work with the author on refinements to the data control software of the Smart Encoder.

Photo: Richard N. Greenhouse

Laurie Creasy, NCI text editor, prepares the team rosters for the play-by-play system used in NCI's sports captioning.



Presidential press conferences and major speeches are among the news events regularly closed-captioned by NCI using its real time system.

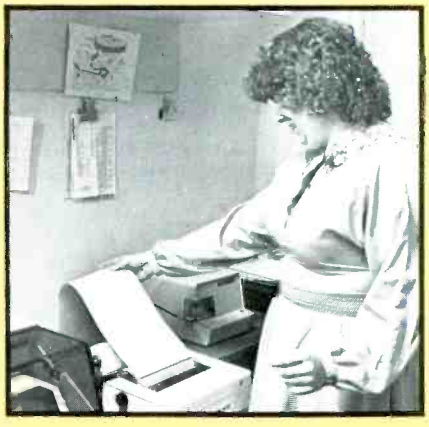


Photo: Richard N. Greenhouse

Staying current with the news of the day is one of the key elements in helping NCI prepare for its nightly real time closed captioning of *World News Tonight*. Here, Laurie Creasy, NCI text editor, checks the AP wire for names of persons and places likely to be mentioned during the actual newscast.

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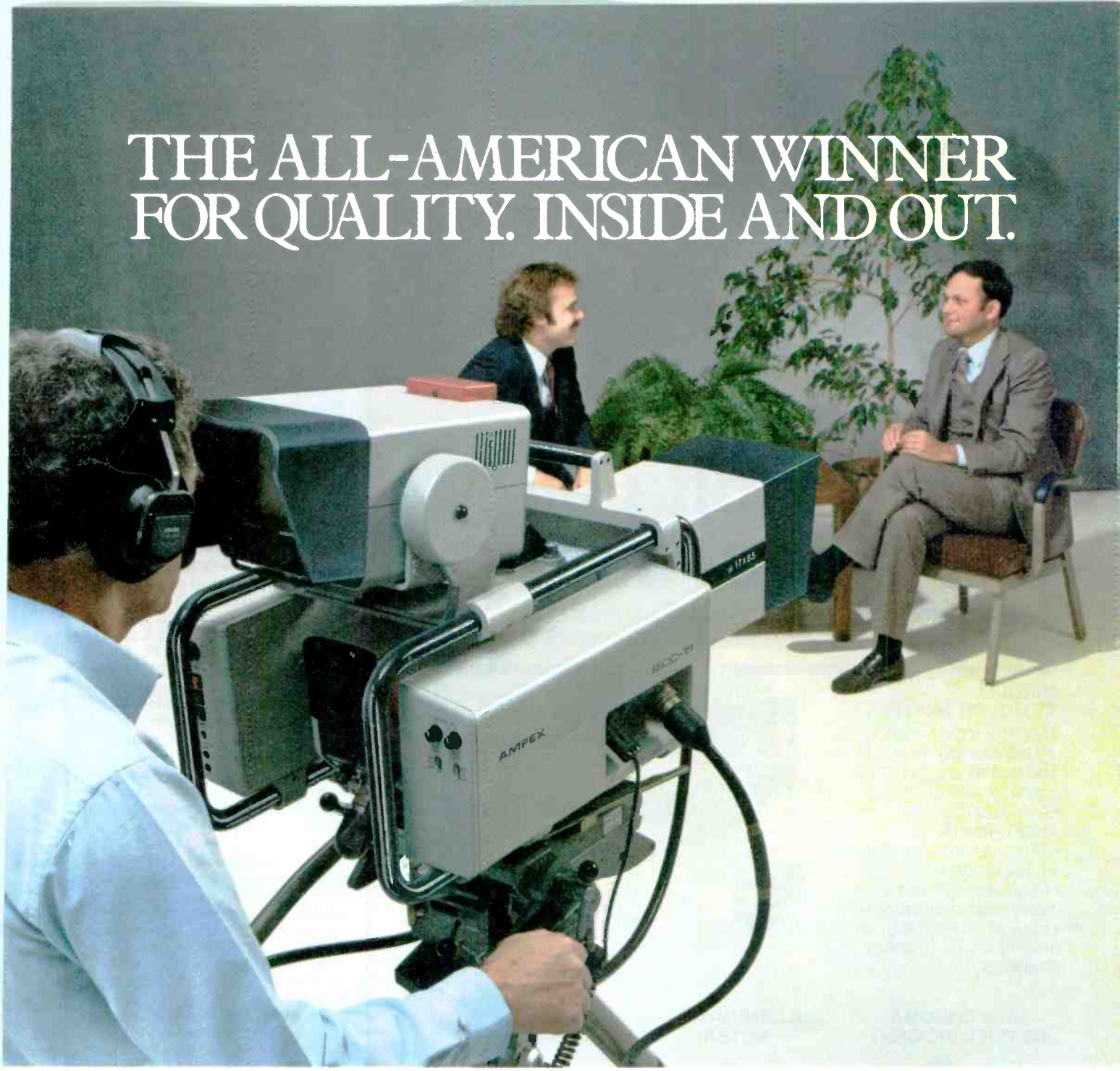

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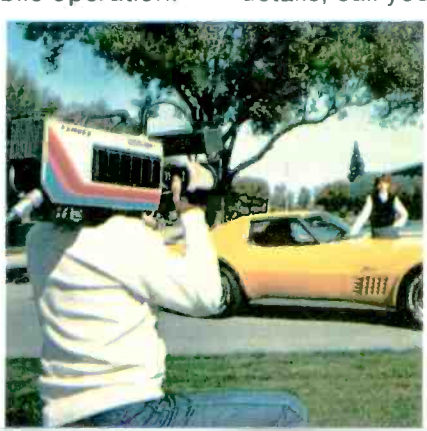

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Circle (19) on Reply Card

transcribed the program in real time during the 6:30 p.m. EST feed. Rather than transmitting the captions at that time, however, the transcript was copied onto floppy discs in small increments. Editors then transferred the floppy disc to a word processor to clean up any mistakes while the stenotypist continued to transcribe the next portion of the program. The corrected files were then used to produce captions for the 7 p.m. EST feed using another InstaText feature that allows previously created text files to be recalled and outputed in the live display mode.

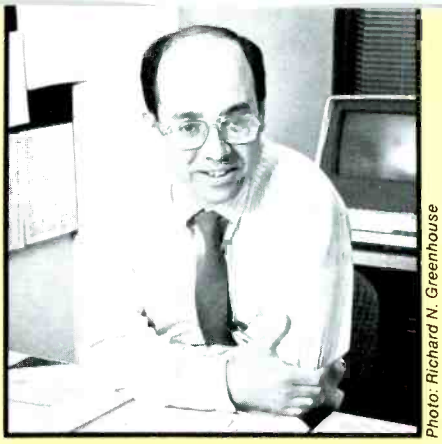

Photo: Richard N. Greenhouse

The author, shown at the National Captioning Institute.

The Smart Encoder

By Dave Crane, director, technical operations, National Captioning Institute

The brains behind the Line 21 system used by the National Captioning Institute to close-caption TV programs is the Line 21 Smart Encoder manufactured by EEG Enterprises, Farmingdale, NY.

In addition to its versatility, the Smart Encoder is the only unit NCI has found that meets its specifications for data manipulation and signal quality. The encoder also offers broadcasters a number of benefits, including the capability for providing a local teletext service with captioning and full-screen text services.

Essentially, the Smart Encoder enables broadcasters to tailor their systems, based on their objectives, by choosing from a variety of data origination devices such as digital talent prompters, page creation terminals and wire services. It acts as a multiplexer for the four data channels (two caption, two text) of the Line 21 system and, under a broadcaster's control, provides complete command over the Line 21 signal.

Broadcasters can insert into their program line outputs a text service of local interest without affecting network captions. They can add their own program captions or emergency news and weather information interleaved with network or other local text pages.

Because the encoder has a built-in decoder module, broadcasters can also use it to monitor Line 21 activities without installing additional equipment, or to open up the data and display it for all home viewers to see, effectively using it as a simple character generator. (NCI, however, restricts head-end decoding of its closed captions.)

The ABC Network uses several Smart Encoders for live captions and for national text services provided by NCI. PBS does the same, but on a more limited scale. More than 20 local stations and some statewide public TV stations also use these encoders for everything from providing constant AP wire news services to mercantile exchange commodities futures information. And, KCMO-TV in Kansas City, MO, uses it to caption its local newscasts.

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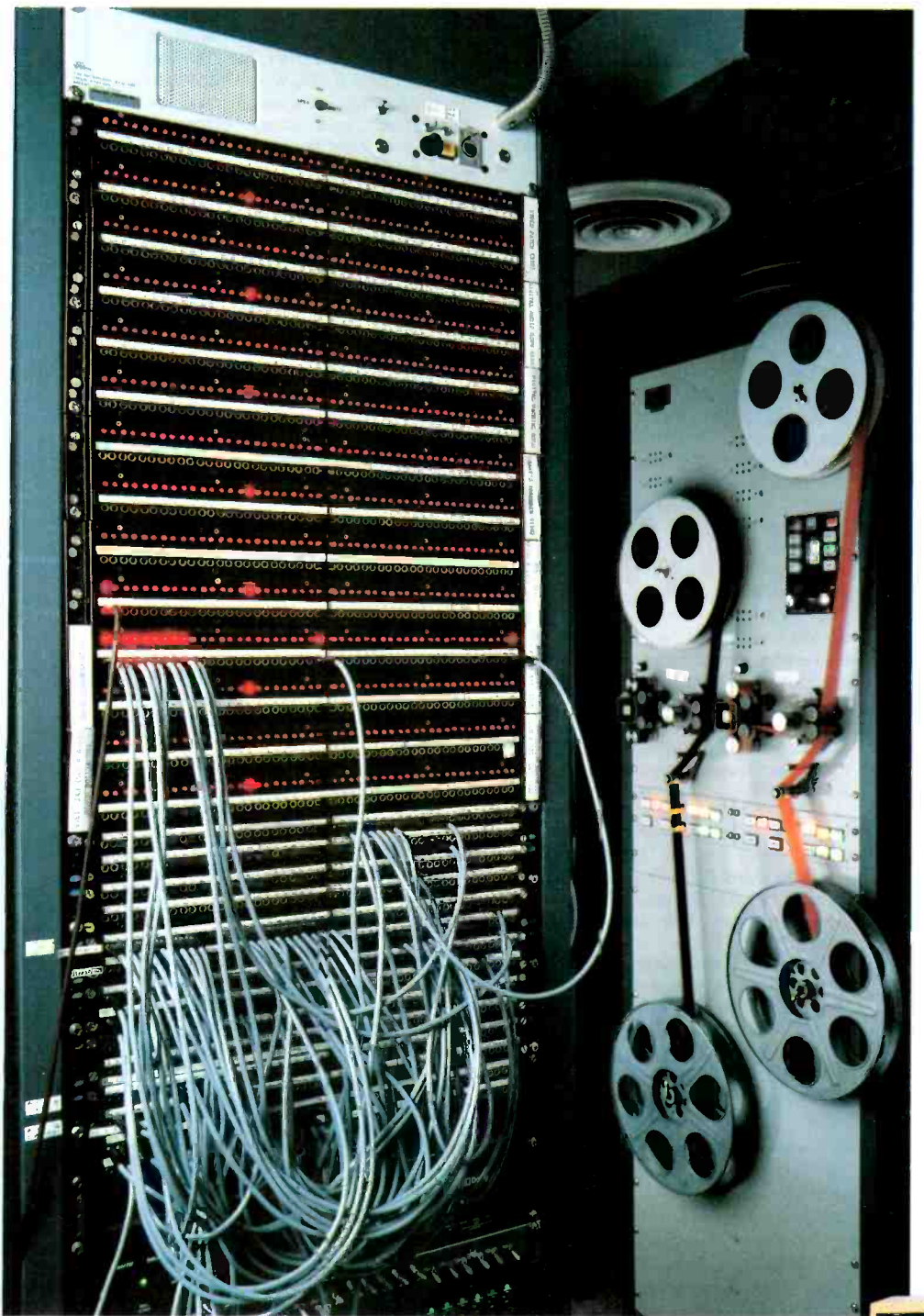

Lucasfilm's special effects in sight and sound have become the hallmarks of the STAR WARS saga. To achieve those other-world sound effects takes a lot of patching, switching, and mixing.

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(Above) ADC custom jackfields form an integral part of Lucasfilm's state-of-the-art audio technology.

(Right) Tom Holman, Chief Audio Engineer for Lucasfilm Ltd., selected ADC for responsiveness, quality and reliability.

Circle (21) on Reply Card

Reliability and resourcefulness: Key to NCI's commitment to captioning

By June Farrell, director, public relations, National Captioning Institute

"We take enormous pride in never having missed a deadline in the three years we've been in business," Linda Randall, production manager at the National Captioning Institute, said. "At times, over the years, we have had to really move quickly, but we always manage to get the job done and get it done accurately."

Randall is in a position to know. Earlier this year, she participated in a captioning project that tested NCI's resourcefulness and ingenuity: the monumental task of closed-captioning the 18-hour miniseries, *The Winds of War,* for ABC-TV. It was the longest miniseries to be closed-captioned for hearing-impaired viewers and, at times, captioning the program seemed to take on the logistical and strategic planning normally associated with a major military operation.

"The nature of television is such that program producers often re-edit up to the last minute to make the program as good as it can possibly be. This was the case with *The Winds of War.* The same held true for the captioning. Everyone involved wanted everything about it to be perfect," she said.

Although a few programs may seem to flow through the production process effortlessly, many others, including *The Winds of War,* do not. NCI expected to have closed-captioned 10 of the program's 18 hours two weeks before its Feb. 6, 1983, premiere. By late January, NCI had received and captioned just one hour and 40 minutes, a little more than half of the first episode.

"We realized early on that we would have to discard our original schedule. Instead, we prepared for every possible eventuality so that we would meet our commitment no matter what came up," Randall said.

Thus, while captioning other regular programs continued uninterrupted, both of NCI's production units (Falls Church, VA, and Hollywood) took on the additional task of captioning into service *The Winds of War* in less than half the time normally needed to caption. Most of the work was done on the East Coast with the West Coast office serving as a backup.

Despite 1-day turnarounds, time zone differences, each facility captioning different segments of the same episode simultaneously time and last-minute changes—not to mention the intervention of a blizzard that dumped more than two feet of snow on the Washington, DC, area as work was ready to begin there on the final episode just two days before its air—all episodes of *The Winds of War* were delivered on time to ABC.

Work on captioning *The Winds of War* began immediately after NCI received tapes of the first episode. Names of places, historical figures, characters, dates and acronyms of the era were researched and documented. Treatment forms were prepared to ensure spelling consistency and to reflect the tone of the times. Without NCI's research, no one would have known, for example, that the word *Bu Pers* was military shorthand for *Bureau of Personnel,* and not the name of a character.

Being able to adjust to different program disciplines is another feature of the NCI staff. "We caption a variety of videotaped programs including news documentaries, children's programs, movies and dramas. Each requires a different process," Randall said.

For example, a program such as *Sesame Street* requires captions to be written so they can be read at a child's 60-word-a-minute reading rate. Language must be simplified, and every effort is made to repeat those words being stressed in the teacher's guide accompanying each episode.

On the other hand, *The Life and Adventures of Nicholas Nickelby* represented a different set of captioning problems. It probably was the most difficult captioning assignment NCI has had. The dialogue moved quickly, many sentences were incomplete and many actors were on stage at the same time.

"This presented our editors with a lot of judgment calls on caption placement, reading speed and even the language itself. You can imagine how challenging it is to edit Dickens, yet keep the spirit and tone intact, and stay within the average 120-words-a-minute reading rate for adults," Randall said.

Accomplishing reliability and accuracy, and making a commitment to the client is made easier by the team concept used by the institute.

"We have 35 editors, operators and supervisors on staff at our two captioning facilities," Randall said. "Because they have a range of liberal arts and broadcast TV backgrounds, they're familiar with stringent TV deadlines and bring to each captioning project a different set of experiences and insight. If a staff member doesn't know a correct term used in a *National Geographic* special, for example, chances are excellent that someone else on staff can help out."

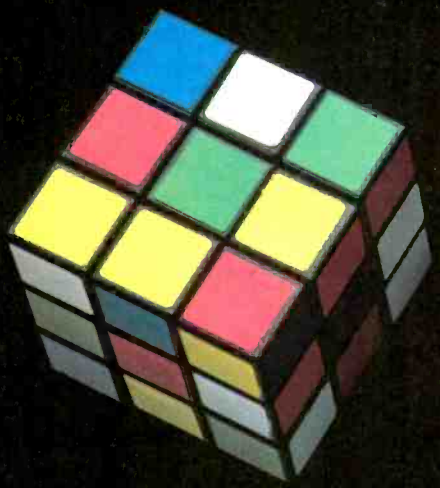
Going nationwide

By October 1982, NCI had fine-tuned InstaText so that it could transmit and encode the raw real time data during the 6:30 p.m. feed. It was at that point that all parts of the country had what NCI set out to give them: simultaneous captioning of a live network newscast.

Even stations that record the ABC feed for delayed broadcast do not have to be concerned about the captions because the Line 21 data is so rugged that it can be recorded and reproduced on any medium, even down to a ½-inch videotape, without requiring reshaping on playback. At its low data rate, the captions can be recovered error-free by home decoders even in fringe reception areas.

But even with its success, NCI's use of real time captioning is still evolving. The institute is currently using real time to caption presidential press conferences and other live news events such as space shuttle launches. Improvements such as reducing the translation time and the error rate and making use of the system in captioning areas other than real time are expected.

NCI's experience has proved that real time captioning is viable. With it comes a practical means of bringing hearing-impaired people into the *Information Age.*



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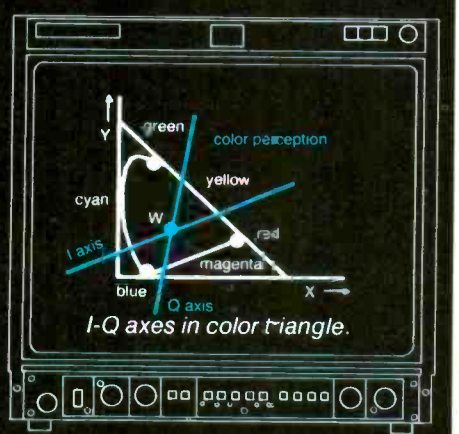

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Circle (23) on Reply Card

The development of a panel antenna

By Robert A. Surette, manager, RF engineering, Shively Laboratories Division, Howell Laboratories, Bridgton, ME

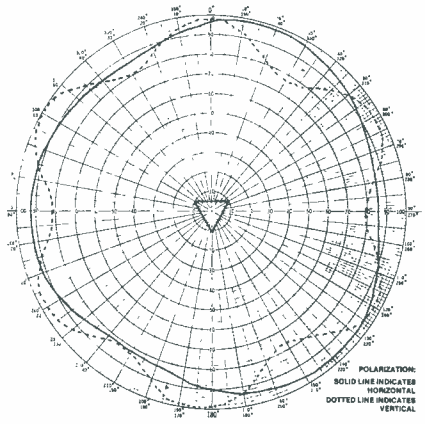


Figure 1. Pattern produced with a full-size 6015-12R panel antenna at 95.6MHz.

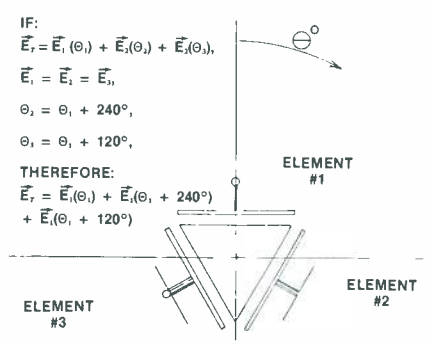


Figure 2(a). E is the radiation field vector for one element, including an amplitude and direction value. Although the E for each element is identical, the physical orientation of the three elements causes the fields to combine into an overall radiation pattern, given by the final equation. This is the basic panel antenna diagram, with its design equations, according to Kraus.

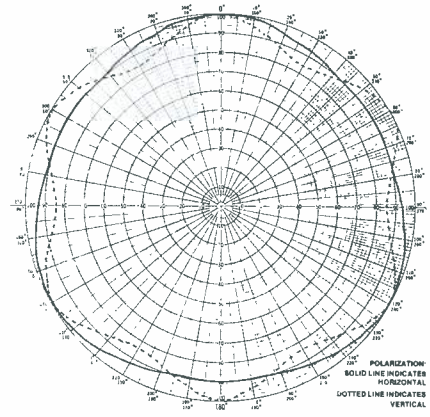


Figure 2(b). Pattern calculated for an ideal panel antenna according to Kraus.

The theory of operation of a panel antenna is basic; it is, in fact, a dipole on a flat reflecting surface. Dr. John Kraus devotes a whole chapter of his book, titled *Antennas*, to this subject. The design engineer has, therefore, a good source of information to make his task easier than if he were developing an antenna as a first of a kind. If the panel radiator is so basic, then what is all the fuss about? When it comes to directional coverage, a panel antenna works well, because there is an almost infinite combination of patterns attainable. Pattern modifications can be achieved by different panel spacing, different feed systems or the combination of both spacing and feed systems. The only difficult coverage using a panel antenna is the truly omnidirectional pattern. Figure 1* shows that the patterns of the horizontal and vertical components are not alike. Therefore, even though the dipoles are the same, each component must be treated separately. The phrase "truly omnidirectional" implies a perfect circle. Figure 1 is not a circle and, after six months of trying, was as close to a circle as could be obtained.

A project was undertaken to supply an omnidirectional antenna to the Canadian Broadcasting Corporation, North Bay, Ontario, Canada. The CBC wanted a dual-frequency, circularly polarized, omnidirectional antenna to be installed on an existing 7-foot-face tower. Satisfying these needs required the use of a panel antenna. Because a dipole is a fairly broadband device, the bandwidth of the system was never a major concern. The main thrust of the design project was to get the pattern as circular as possible.

Shively began by determining the theoretical pattern. Figure 2(a) shows the basic diagram and equation from Kraus, with which one may calculate the ideal pattern from an array of point sources. This ideal pattern is shown in Figure 2(b). In theory this pattern is the best that can be done, and that was the goal. Comparing Figure 1 and Figure 2(b), you can judge for yourself the achievement of that goal.

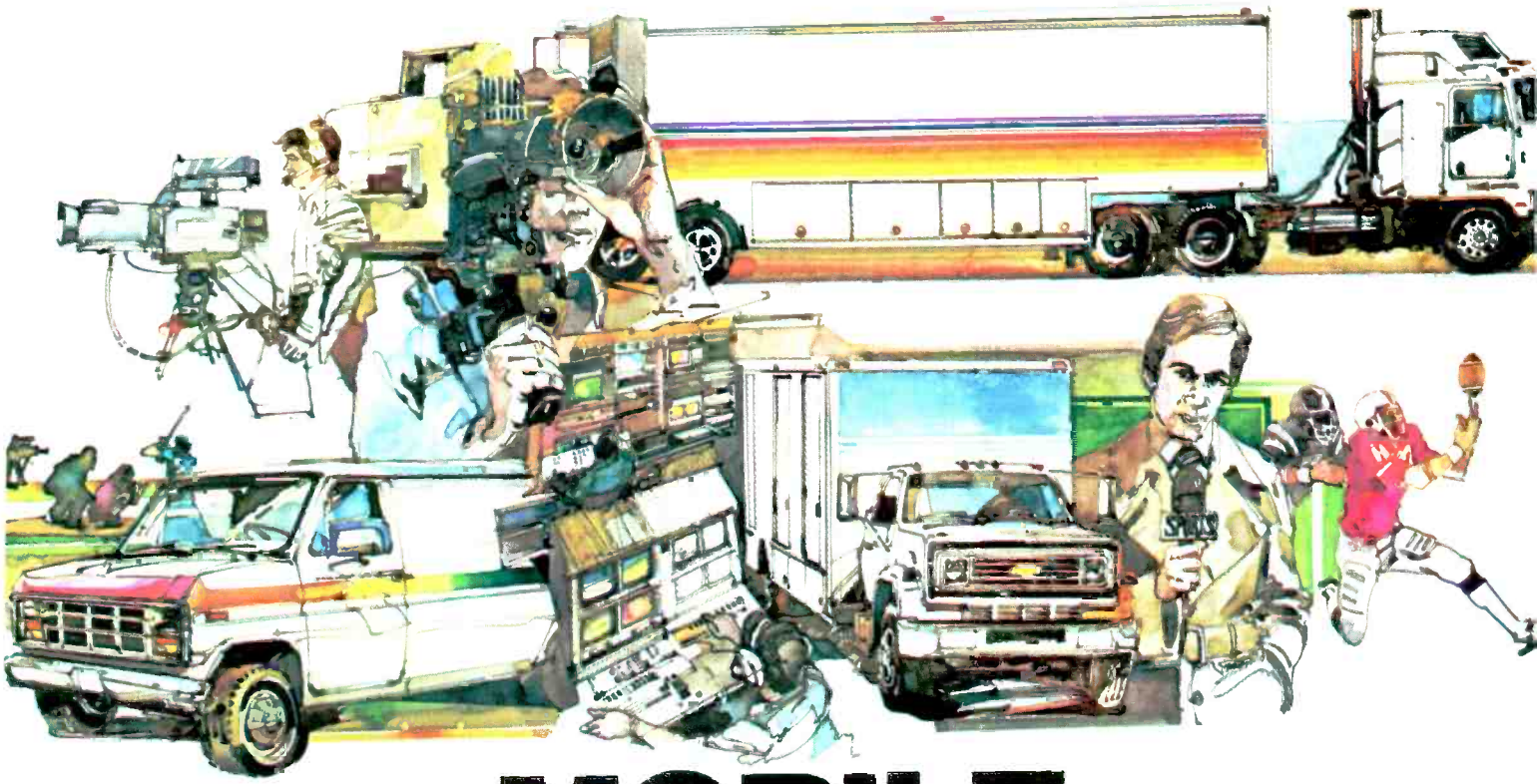
The starting point was to see if an available standard ring-style radiator could be used. If so, the project would have had a head start with no need for a new radiator. In Figure 3 (page 34), the patterns using the ring-style radiator showed us that this was not the easy answer we were looking for. Note that the ring radiator is more complex in its radiating characteristics than a standard dipole.

The development stages of this project were done with scale models for ease of manipulation and for obvious economic advantages. Radio frequency and electrical wavelength are inversely related. If you exactly scale a mechanical dimension down, then multiply the operating frequency by that scale factor, the electrical properties are preserved. That means that the radiating patterns measured at 446MHz on a 21.41"x20.12" panel should give the same results as a pattern measured at 95.6MHz on a 100"x94" panel.

The photo (page 34) illustrates one of the first standard dipoles used for test. The initial idea was to make the radiator as small as possible to minimize windload. The picture shows the attempt to reduce the overall span of the dipole arms by rotating them back toward the tower. The radiating pattern did not change when the arms of the dipole were bent back, simply because the arms did not have the room to move much.

The next step in the development of the radiator was to make the dipole arms occupy as little area as possible. The problem was that the individual

*Schematics and photographs presented are courtesy of Shively Laboratories. Azimuth patterns depict performance of the type 6015-12R panel antenna unless otherwise noted. Horizontal polarization is indicated by a solid line; vertical polarization is shown with a dashed line. Specific frequencies used in tests and the antenna size (reduced or full-size) are noted.



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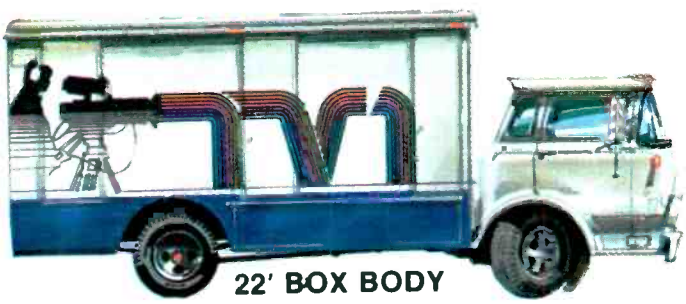

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arms need to be ¼-wavelength-long (λ/4) at a frequency f_0 to tune that frequency. The shape of the arms minimized their length. Also, vertical parasitic elements helped shape the vertical pattern and gave general information on how to manipulate a pattern.

With the shape of the dipole fixed, the method of feeding the dipoles was next. Because the bandwidth was not critical, a common shunt feedline system was chosen to feed the radiators, instead of a broadband branch feed. That left the *type* of balun to be developed. Because the standard feed system provides only one tap per bay, a 4-post balun with two inputs was not workable. The hope was to have a single input with four arms attached—two for horizontal and two for vertical components. The first model was similar to that shown in the photo (page 38, upper left), except it only had one feed point instead of two. A second feed point was added because the single-feed balun lacked symmetry of radiation. The model shown in the photo radiated with one set of arms a little longer than λ/4 and the other set of arms shorter than λ/4. The overall tuning of the radiator was 446MHz. The two sets of arms were phased 90° apart to yield circular radiation. Figure 4 (page 38) shows the measured pattern of the radiator on a screen made of ½"x½" wire mesh. Figure 5 on page 38 shows the array patterns measured when three of these radiators were driven in phase with equal amplitude. The patterns obtained using this type of balun met present industry-acceptable standards of ±2.4dB. However, the goal of the project was ±1.5dB, so a different balun was tested.

The photo (upper right, page 38) shows a close view of the final design of the radiator. It consists of a standard 2-post balun with two sets of arms attached to each post. The bottom arms are the driven elements or positive arms of the dipoles, and the top set are the negative arms. Threaded rods at the dipole ends are used for tuning. Note that two arms have more threaded rod showing than the other two. The longer arms are defined as

Continued on page 38

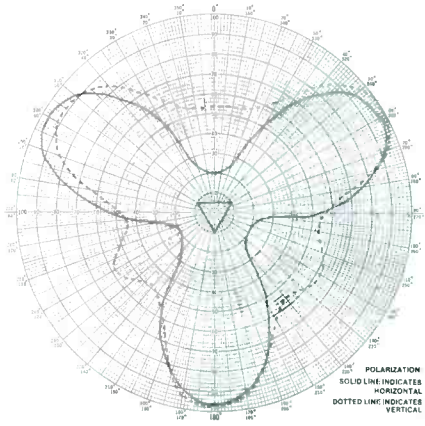
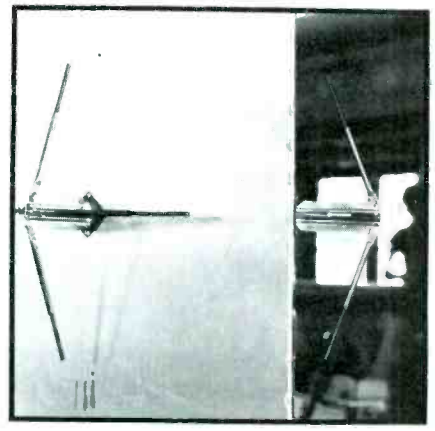


Figure 3. Pattern produced by a reduced-size type 6810 antenna using a ring-style radiator at 446MHz.



Standard dipoles used in early tests were rotated back toward the tower to reduce span and wind loading. A reduced-size model is shown.

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3CX20000A7 ..1855.00	4-250A 86.00	5762 .....675.00	8874 .....185.00
3-400Z 82.00	4-400A 86.00	5867A 143.00	8875 .....190.00
3-500Z 88.00	4-400AX 159.00	5894A 55.00	8890 .....3053.00
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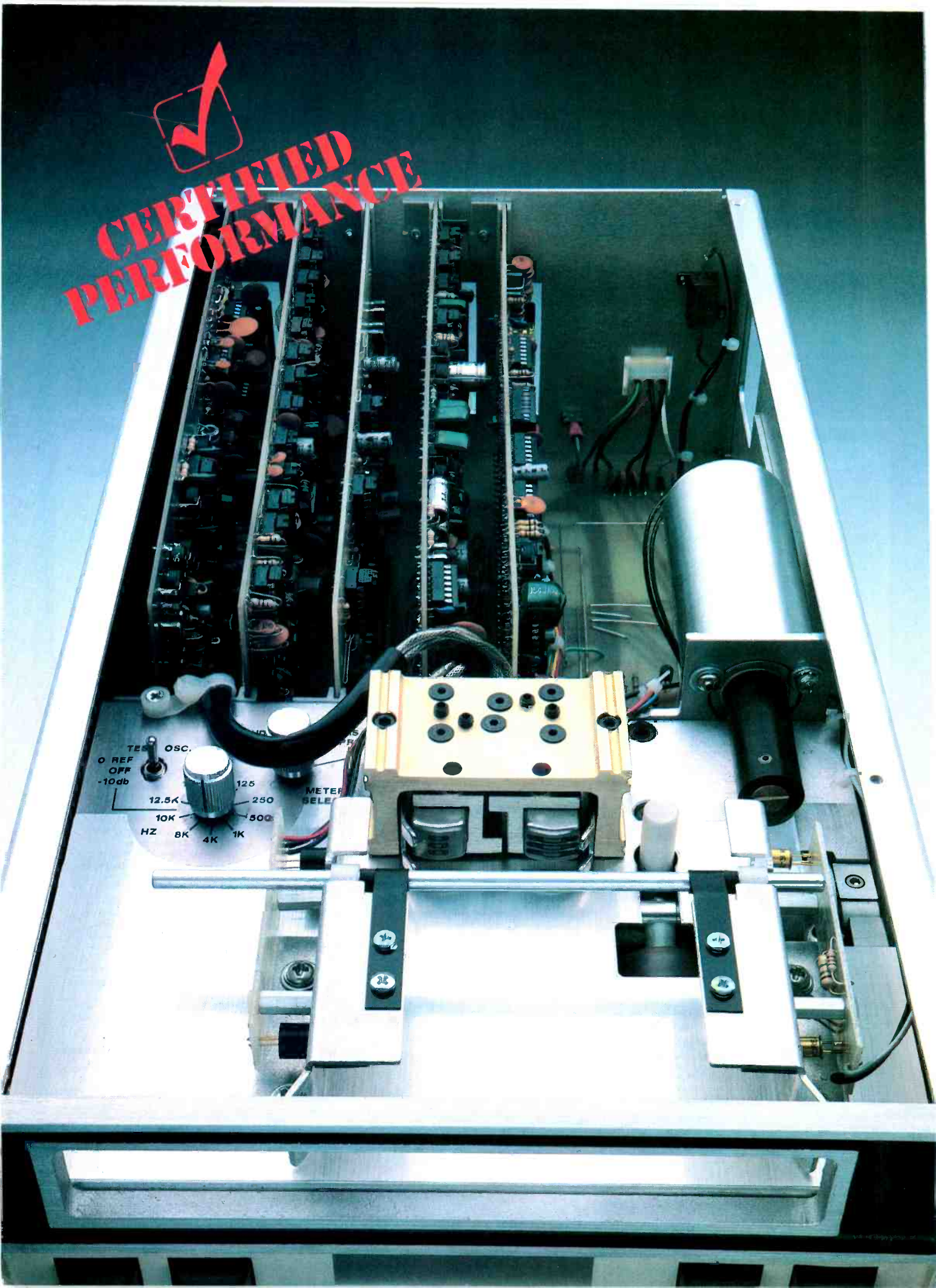
CERTIFIED
PERFORMANCE
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125
250
500
1K
4K
8K
10K
12.5K
HZ

TAKE A CLOSE LOOK AT THE NEW PRIMUS™ CART MACHINES.

Introducing the PRIMUS (prē-mŭs) cartridge recording/reproduction system from Ramko Research.

These new cart machines are engineered to be demonstrably and dramatically better than any other cart machines in the industry. They deliver signal-to-noise, distortion and frequency response specifications that are unrivaled. They set a new standard for the lowest wow and flutter. They're built rugged throughout to guarantee adherence to specifications.

COMPARE THESE SPECIFICATIONS: YOU BE THE JUDGE.

	PRIMUS™	ITC RP SERIES	AUDICORD #126	RK SERIES 3200
Signal-to-Noise Ratio:	−60 dB	−50 dB	−47 dB	−52 dB
Distortion (System):	0.9%	2.0%	1.0%	2.0%
Frequency Response: 50 Hz - 16 kHz	±1.5 dB	±2.0 dB	±2.0 dB	±2.0 dB
Wow & Flutter:	0.095%	0.2%	0.15%	0.15%
Price:	$2,550	$2,810	$1,979	$2,45[illegible]

All measurements referenced to 160 nWb/m, distortion is THD @ 1 kHz.
All models are R/P stereo, priced with three cue tones.
All prices are based on latest available manufacturers' information 3/83.

	PhaseMaster	TOMCAT	ITC SERIES 99B	ATR-800* (Reel-to-Reel)
Signal-to-Noise Ratio:	−65 dB	−59 dB	−56 dB	−60 dB
Distortion (System):	0.9%	0.9%	0.8%	0.3%
Frequency Response:	40 Hz - 16 kHz ±1.5 dB	40 Hz - 1 kHz +5, −10 dB	31.5 Hz - 16 kHz ±1.0 dB	40 Hz - 16 kHz ±2.0 dB
Wow & Flutter:	0.08%	0.09%	0.15%	0.06%
Real-time Phase Correction:	locks to 5° @ 16 kHz	none	none	none
Price:	$3,850	$5,2[illegible]0	$5,330	$6,230

All measurements referenced to 250 nWb/m, distortion is THD @ 1 kHz.
All models are R/P stereo, priced with three cue tones (excepting ATR-800)
*measurements referenced to 370 nWb/m

A CLOSER LOOK AT BETTER ENGINEERING

Mono or Stereo, R/P or playback, here are more reasons why the PRIMUS cart machines are the industry's most advanced.

The PRIMUS transport deck is ⅝" thick cast alloy for superior stability. It's covered with stainless steel for wear resistance and EMI shielding. The machined headmount allows easy and precise adjustments. In addition, the heads are internally illuminated for cleaning and inspection. For smoother insertion and withdrawal and to prevent distortion, carts are securely held at the edges by spring-loaded rollers, rather than friction springs. To prevent tape skew, pinchroller parallellism is adjustable with the motor running. The pinch roller is engaged by an adjustable air-dampened solenoid with a Teflon-coated plunger for friction-free, quiet operation. Optical sensors start the motor when a cart is inserted. This not only eliminated start-up wow, but it means there are no mechanical switches to break or jam. Bearings have a longer life too because the motor doesn't need to run continuously. A crystal-controlled, brushless D.C. servo motor insures timing accuracy to within 0.05%. The minimal motor heat is kept away from your tapes by a high traction, ceramic capstan. Tape speeds (7.5 & 15 ips) are field selectable.

With PRIMUS, you have three cue tones with sharp, error-free digital sensing. Solidstate bar graph meters and dynamic noise reduction are standard. An automatic 4½ digit timer is optional. All electronics are on plug-in modules and rear panel connectors are quick disconnect type.

In summary, the PRIMUS cart machines have been engineered to be the most sophisticated broadcast reproduction system you can buy for under $3,000.

COMPARE THE PHASEMASTER™: YOU'RE THE JUDGE AGAIN.

If you're in the market for the ultimate Stereo phase-correcting cart machine, look to our PhaseMaster, the broadcaster's premier phase-correcting, stereo cart machine.

The PhaseMaster has all the features as PRIMUS plus, the advantages of consistently repeatable, accurate electronic phase alignment. A front panel phase meter and internal diagnostics are added for operating ease.

PhaseMaster works flawlessly with any cartridge and eliminates the compromise of unreliable and inconsistent electromechanical schemes. The trade-offs imposed by noise-inducing and non-compatible matrixing approaches are now history. Complex, inexact cross-correlation techniques have been discarded. With PhaseMaster you're positively guaranteed compatibility with all your previously recorded carts. Here's a cart machine truly ready for superior FM & AM Stereo applications — a machine that rivals the performance of an open reel recorder.

THE CERTIFIED PERFORMANCE GUARANTEE

Whether you invest in PRIMUS or PhaseMaster, you'll receive a two year warranty* and a *Certified Performance Gold Card* that instantly puts you in contact with our Technical Assistance Department over our toll-free hotline.

To put PRIMUS or PhaseMaster to task call (800) 821-2545 or contact your nearest Ramko Research sales representative or distributor. Ask about our two week free trial.

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PRIMUS

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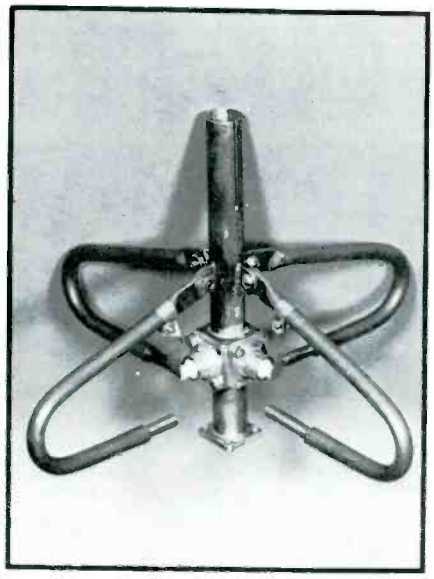
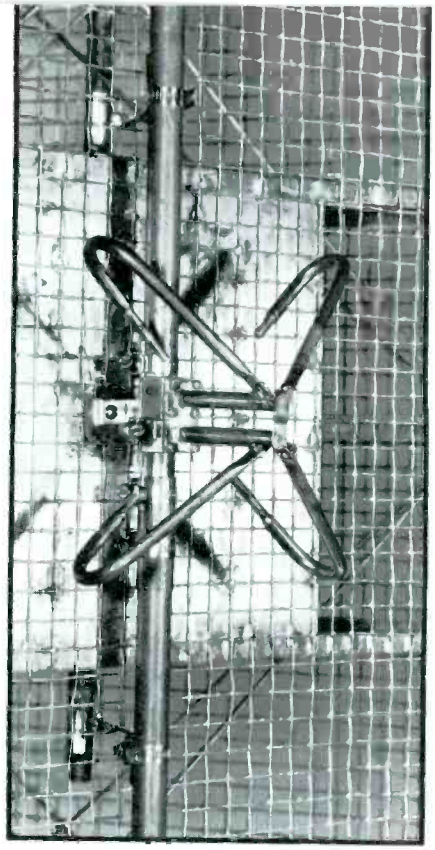
Circle (26) on Reply Card

Continued from page 34



A radiator assembly for the reduced-size antenna operating at 446MHz shows dual feed points for the two sets of arms to achieve radiation symmetry.



The final design for the radiator assembly of the reduced-size antenna shows a standard 2-post balun, tuned to 446MHz.

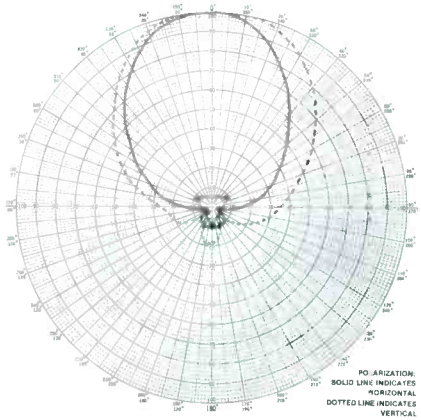


Figure 4. Pattern produced by a reduced-size antenna, using the radiator shown in the above photo, mounted on a ½"x½" wire mesh screen, at 446MHz.

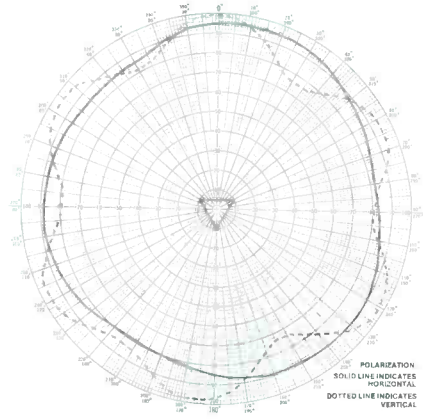


Figure 6(a). Final pattern of full-size antenna operating at 95.1MHz.

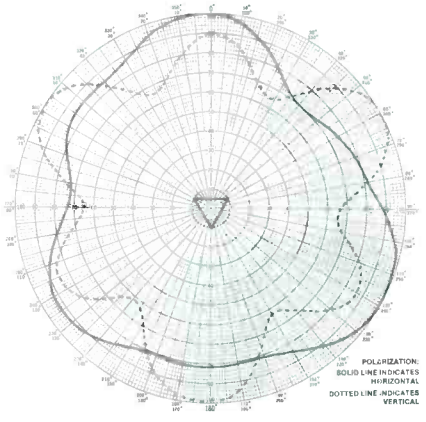


Figure 5. Pattern produced by a reduced-size antenna, using three radiators as shown in the two photos above, mounted on ½"x½" wire mesh screen, driven in phase with equal amplitude at 446MHz.

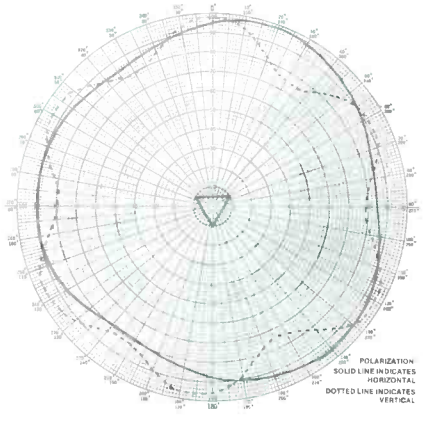


Figure 6(b). Final pattern of full-size antenna operating at 95.6MHz.

If you're a user of the current OPTIMOD-FM or OPTIMOD-TV, all it takes to optimize the available S/N of your phone lines or dual microwave STL is our new, economical Studio Accessory Chassis. By splitting the OPTIMOD system (putting the multiband compressor portion at the studio site of the STL), the Studio Accessory Chassis lets you preserve the open, transparent OPTIMOD sound — you no longer have to use a lower-performance STL protection limiter which could "fight" with your OPTIMOD and degrade your audio quality.

The Studio Accessory Chassis means convenience, too. By putting most of the setup controls at the studio, it lets you fine-tune your sound with the aid of your high-quality studio monitoring system — away from noisy blowers, and without time-wasting trips to the transmitter!

With the introduction of the Studio Accessory Chassis, we now offer a processing system — single or dual-chassis — that's ideal for *your* system. So OPTIMOD quality can work for you regardless of your STL configuration.

To find out more, see your Orban broadcast products dealer or contact us directly.

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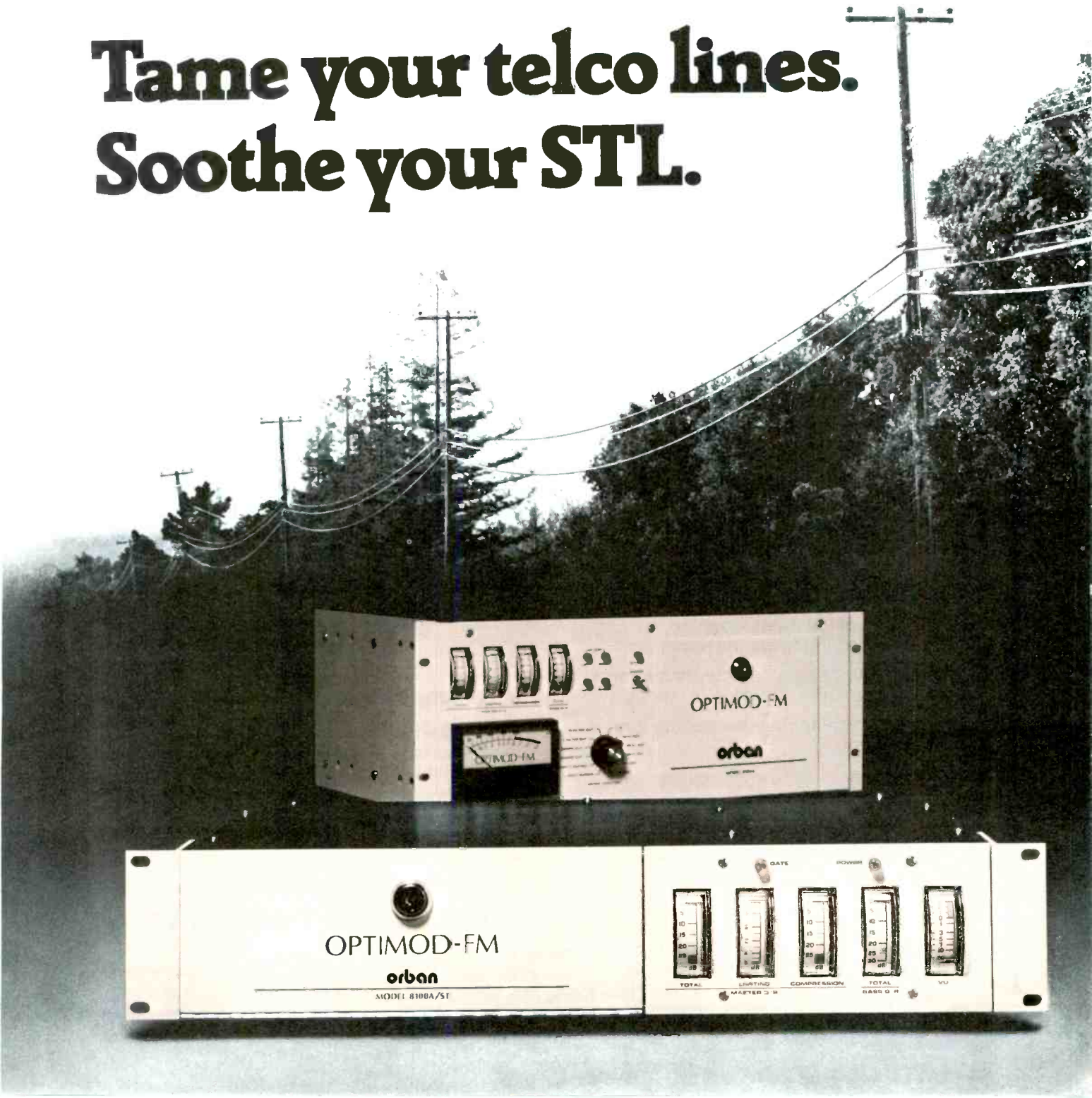

the horizontal elements, and the shorter arms as the vertical elements. Thus the vertical, tuned higher in frequency, lead the horizontal dipoles by 90° for right circular polarization. The photo also shows the feedline grounded to the panel. Without these ground connections, the feedlines would act as parasitic elements and would adversely affect the pattern.

With the final configuration of the radiator decided, the panel size was next. At early stages of the project, a solid pylon simulated the 7-foot-face tower that was already on location in North Bay. The thinking was that a tower with proper bracing would appear as a solid reflector to the radiator. If this had happened, the tower itself would have been used as the panel to achieve the required pattern. Some of the mechanical disadvantages of a panel would have been eliminated. We learned a great deal about manipulating the beam of a radiator using the solid pylon.

Because two separate components were concerned—horizontal and vertical—the panel shape was developed in two steps: first height, then width. The height of the panel was fairly easy. The question was whether the panels could be made as a continuous vertical structure, making the aperture one long panel, or whether the panels should be less than a wavelength high, making them separate units. With a pair of tin snips, the

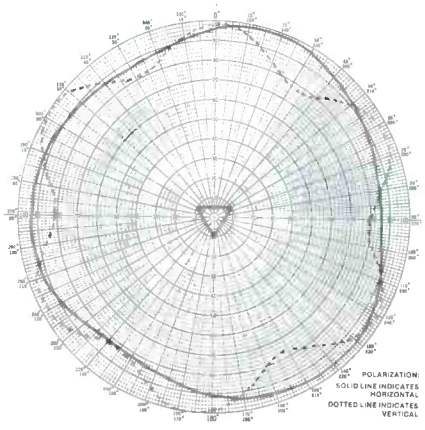

Figure 6(c). Final pattern of full-size antenna operating at 96.1MHz.

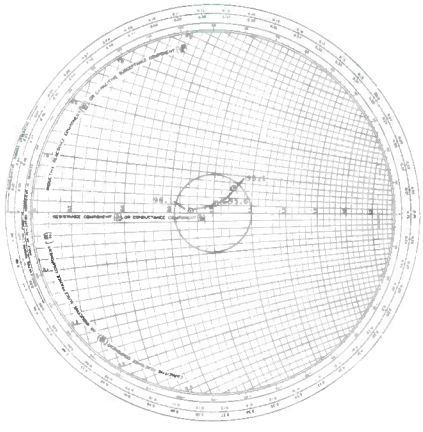

Figure 7. Input admittance plot of the full-size antenna.

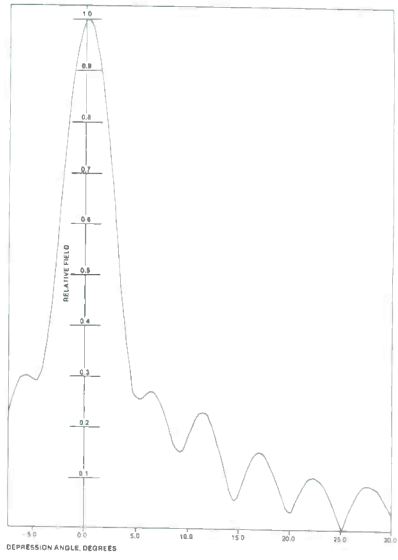

Figure 8(a). Calculated elevation field pattern of full-size antenna at 95.1MHz.

ART BIGGS ON MASTER CONTROL AUTOMATION.

In the 1950's, two broadcasting engineers in Tulsa built a small, crude, mechanical device to automate station breaks. One of those engineers, Art Biggs, is now Vice President, Engineering, Corinthian Broadcasting—and his interest in master control automation remains strong. The respected, 34-year veteran of the industry works with the engineering staffs of all six Corinthian stations, of which two—WISH-TV, Indianapolis, and KXTV, Sacramento—are now using BIAS Master Control Automation.

EVEN FORMER SKEPTICS LIKE IT

"At first, some of the engineering staff were enthusiastic, some were skeptical. But within three weeks after it was released to them, they did their first total day's operation on the MCA system. And now, even the most skeptical depend upon it."

CREATES TOGETHERNESS

"MCA brings the traffic department and technical department closer together. This makes everything go more smoothly for everyone."

GIVES MORE CONTROL

"I think some engineers are afraid that with MCA, they'll be giving control of their operation to a machine and be a robot, sitting there, watching it. Actually, the exact opposite is true. Even the most vocal of our engineers who opposed the idea have found that MCA frees them from so many nitty-gritty, demanding, split-second, button pushers, that they have more time to learn what all the machine can do and can do even more than they could before. Now, if you take it away from them for some reason, there's a lot of yelling to get it back. They've learned they didn't relinquish control—they gained a tool that gives them greater control."

WHO NEEDS IT?

"How do you know if you need MCA? If the chief engineer is constantly trouble-shooting switching errors or one engineer is a total slave to switcher buttons, MCA can certainly help. It also liberates personnel from many manual chores, such as log-keeping, to make their time more productive."

FOR BIAS OR NON-BIAS SYSTEMS

"All of our stations are on the BIAS traffic system, so by using the BIAS MCA, we're dealing with one manufacturer, one computer, and one system that embraces the master control operation, the traffic operation, the financial operation, word processing, film inventory. One source for everything."

For a free brochure on how BIAS Master Control Automation can interface with your on-air switcher and traffic system, write BIAS Marketing.

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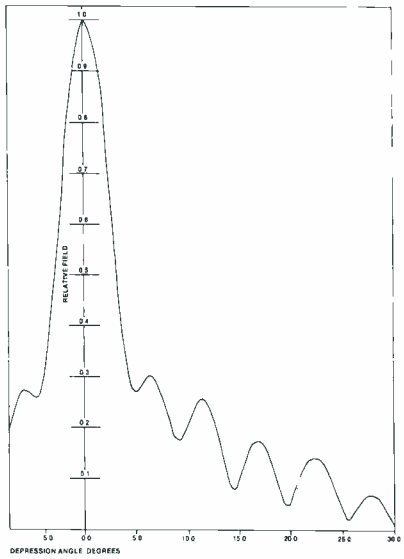


Figure 8(b). Calculated elevation field pattern of full-size antenna at 95.6MHz.

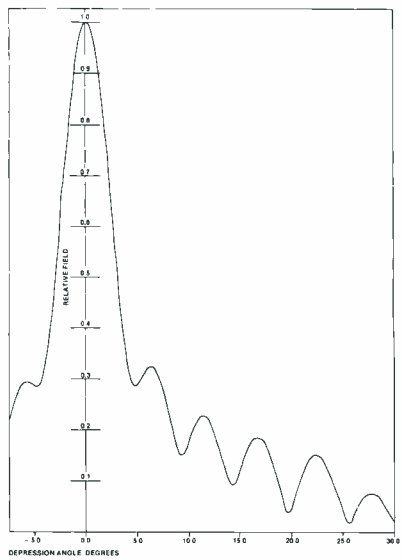


Figure 8(c). Calculated elevation field pattern of full-size antenna at 96.1MHz.

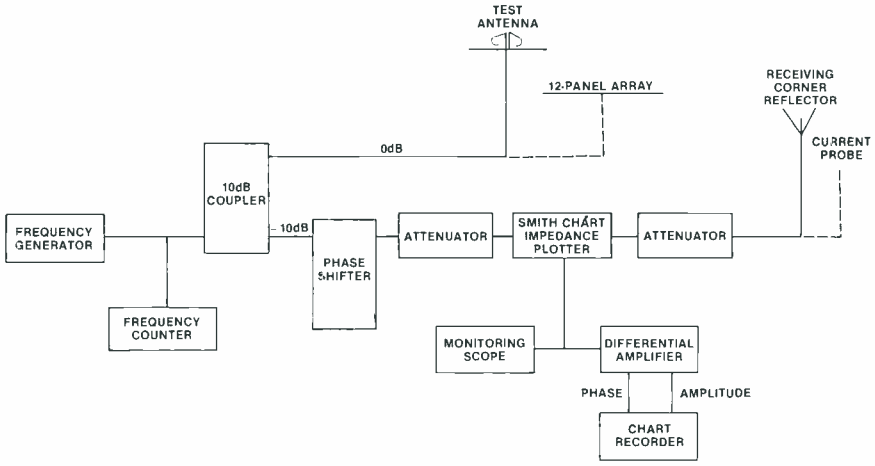


Figure 9. The equipment interconnection to measure complex range values uses a test antenna and a corner reflector antenna. For complex current measurements, the 12-panel array and current probe are used instead, as shown by dashed connections.

Table I.
Antenna sources

Panel antennas for the FM broadcast band are available from a number of manufacturers. The following directory provides a guide to manufacturers of FM broadcast antennas of *all* types, as listed in the **BE** data files. Reader Service Numbers are provided for your convenience in contacting these organizations for further information.

Alford Mfg. . . . . (485)
Bogner Bdct. Eqpt. . . . . (486)
Cetec Antennas . . . . . (487)
Comark Industries . . . . . (488)
Continental Electronics Mfg. . . . . (489)
Dielectric Communications . . (490)
Harris Corporation/Bdct. . . . . (491)
Marconi Electronics/Bdct. . . . (492)
Micro Communications . . . . . (493)
Phelps Dodge Communications . . . . . (494)
RCA Broadcast Systems . . . . (495)
Scala Electronic . . . . . (496)
Shively Laboratories . . . . . (497)
Tennaplex Systems Ltd. . . . . (498)
McMartin Industries . . . . . (499)
Kathrein Werke AG . . . . . (500)

Something really new at NAB

ANDREW debuts six products

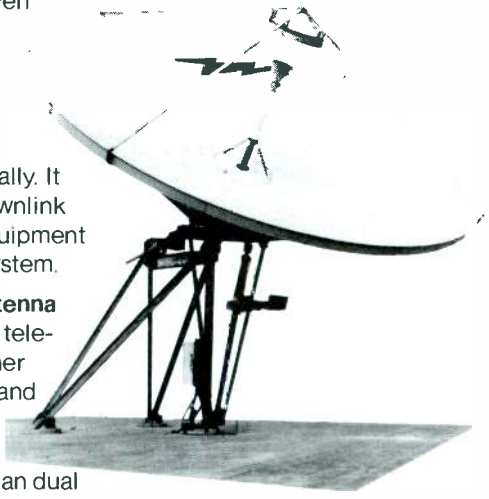
Andrew Corporation has long been an industry leader and innovator of antennas and transmission lines for telecommunications. The company's reputation rests on extensive research and development, and quality assurance for peak performance and customer satisfaction.

ESC-200 Earth Station Controller
Using advanced microprocessor technology, the ESC-200's fail-safe design minimizes operator training and reduces possible errors. Coupled with Andrew's high performance two-speed motor drive system, ESC-200 accurately positions the antenna at any given satellite coordinates, in the range of travel, within sixty seconds. Forty such positions can be preprogrammed and 200 events can be executed automatically. It also controls uplink and downlink ground communications equipment and monitors the on-line system.

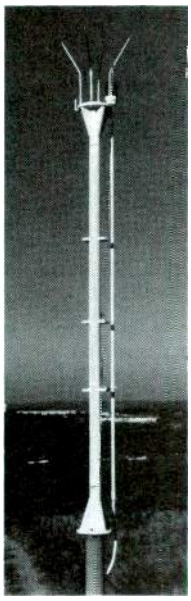
9.3 Metre Earth Station Antenna
New size from Andrew. For television broadcasters and other system operators who demand uncompromised antenna performance and flexibility. Andrew's exclusive Gregorian dual reflector system plus extremely accurate reflector panels produce a unique performance combination. Exceptional gain and closely controlled patterns—2° compliance at 4 and 6 GH_z—without sacrificing efficiency.

Long Life Broadcast Transmission Line—6⅛" Diameter
Another premium product from Andrew. Exclusive inner conductor design eliminates mechanical movement and wear caused by differential expansion. The inner conductor is supported by state-of-the-art Teflon* disc insulators. Another feature: heavy duty EIA welded flanges.

UHF-TV Circular Waveguides
Three new sizes of high power circular waveguide (13.5, 15 and 17.5 inch) employ the latest design techniques for unequalled performance. New high power mode and axial ratio filters greatly reduce ghosting, unwanted reflections and picture smear. Also an exclusive 90° bend allows a continuous run of circular waveguide from the transmitter to the antenna.



New LPTV Transmitting Antenna
Andrew's years of manufacturing experience in UHF-TV broadcasting antennas has led to the first truly affordable high performance LPTV antenna. Low-windload. Lightweight and easy to erect. Field selection of azimuth patterns allows interference problems to be dealt with directly. Available for under $5,000.



High Performance Receive-Only 3 Metre Earth Station
The traditional quality and performance of an Andrew earth station antenna with a size and price ideal for LPTV, small community and private user applications. Segmented all-metal reflector for low shipping cost, easy installation and dependable service. Assembly can be completed in a matter of hours.

Other Andrew Products on display at NAB '83: High power TRASAR™ UHF-TV transmitting and standby antennas • HELIAX® coaxial cables and elliptical waveguides • 4.5 metre mobile earth station antennas. Contact your Andrew Sales Engineer for more information Andrew Corporation, 10500 West 153rd Street, Orland Park, IL 60462. Telephone (312) 349-3300. Telex: 25-3897.

ANDREW
Our concern *is* communications

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height was reduced an inch at a cut. A section of ½-inch mesh was removed from the top and the bottom each time. This kept the radiator in the center of the panel. When the horizontal pattern changed for the worse, we stopped and backed up one cut.

The height of the panel was 20⅛ inches, reduced scale (94 inches in full size). Constant checks during this process ensured that the horizontal pattern was not affected by the height of the panel.

The width of the panel was not as easy to determine, because the edges of the panels had a significant impact on the horizontal pattern. The mounts were close to the edges of the panel. If the panel edges touched another panel, the patterns were adversely affected. On a later project, the mounts were attached just behind the solid section of the panel, and the edges had little effect on the pattern. Later an RF

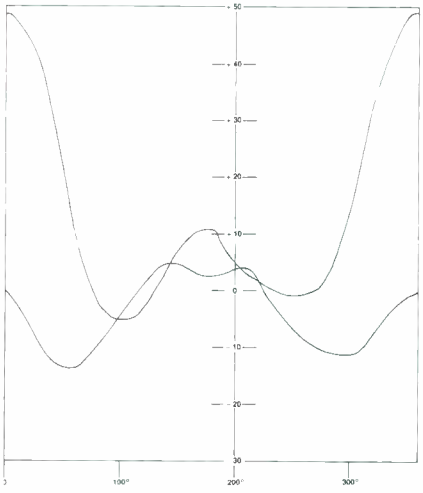

Figure 10(a). Complex range *real* and *imaginary* values of horizontal polarization component.

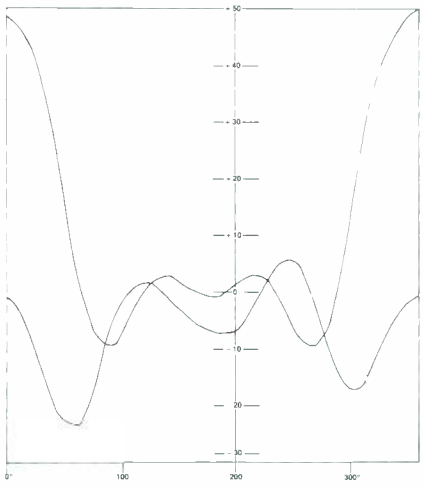

Figure 10(b). Complex range *real* and *imaginary* values of vertical polarization component.

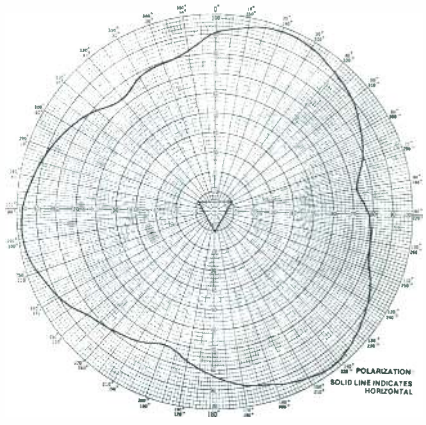

Figure 10(c). Pattern for reduced-size antenna at 446MHz, calculated from complex range *real* and *imaginary* values given in Figures 10(a) and 10(b).

The best equalizer is no equalizer.

It's Belden fiber optic cable.

Now a video signal can go two miles on a Belden optical cable with 60dB SNR and no hint of high frequency roll-off. That means a cleaner picture without equalizers, and less maintenance than alternative transmission systems—coax or microwave.

For tower installations, Belden's high-strength, all-dielectric optical cable design doesn't have the problems generally associated with coax, such as ground loops, lightning and other E.M.I. problems. Plus, it's rated for full performance from −40°C to +60°C.

Belden optical fiber cable is also thinner and up to 30% lighter than conventional cable. That makes it easier to install on transmission towers, or through underground ducts. A recent installation of Belden cable on a 1500 ft. vertical tower was accomplished in less than one day.

For remote applications, Belden optical cable is much easier to carry around the golf course, or the metropolitan sports arena. Its toughness has been proven in rapid deployment cables designed by Belden for military applications in desert terrain.

Put Belden optical fiber cables and experience to work for you. They'll put you ahead with cleaner signals, better reliability and total system economy. For information on our fiber optic line and application reports or system design guide, contact your local Belden distributor or write: Belden, Fiber Optics, 2000 S. Batavia Ave., Geneva, IL 60134. Phone: 312-232-8900.

COOPER INDUSTRIES

BELDEN

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EO-3-2A

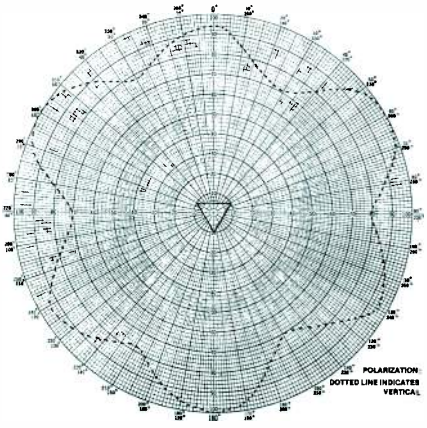


Figure 10(d). Vertical directivity is shown for the reduced-size antenna described by Figure 10(c).

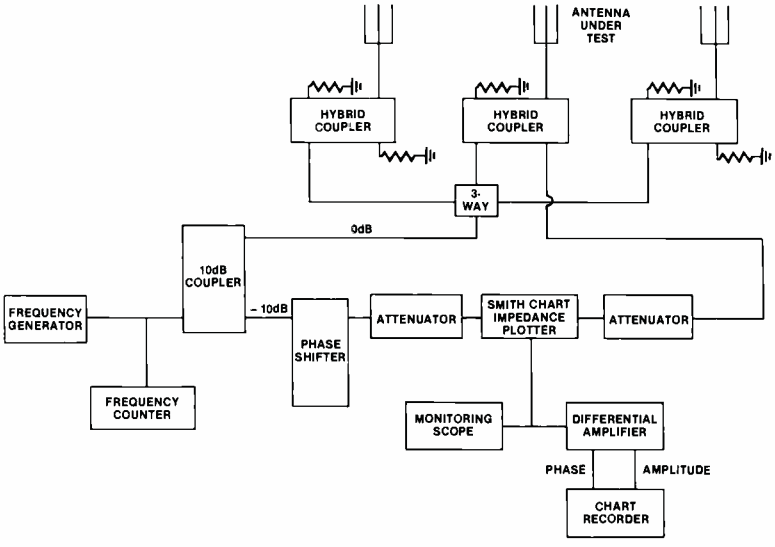
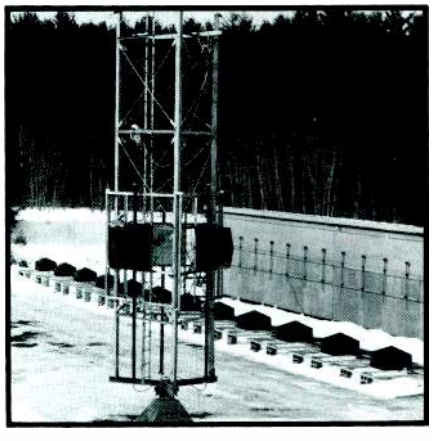


Figure 11. Equipment interconnection to measure Smith Chart impedance.



One level of a type 6015P circularly polarized FM antenna on the pattern test range.

engineer from England related the same type of effect with his panel antenna. But not knowing all of this, a great deal of time was used to define the panel width and the mounting bracket location. During the process, upper and lower frequencies were checked to determine how sensitive panel size was to frequency. It was found that patterns did change, but not enough to cause problems.

More tests were made on the overall design, but with the antenna design completed, it was time to build the full-size panel and radiator. During the model stages, all components were scaled from existing production items or were made so that the full-size could be easily built. Modifications to the final design were not desired unless absolutely necessary. When the full-size antenna was built and set up on the pattern range, the results were exactly as predicted. The transition from scale model to full-size was a success. Not only did physical construction of the antenna work out, but measuring techniques developed at the higher frequencies helped make the testing of the full-size unit easier.

The major adjustment was the amount of time needed to do anything in full-size. For example, the model was set up and taken in from the pattern range every day. A week was needed to get the full-size antenna on the rotor. Once up, the full-size design stayed on the range until final acceptance by the CBC. With the scale model, a whole series of changes could be made in a matter of hours. In full-size, the same series would take a week or more.

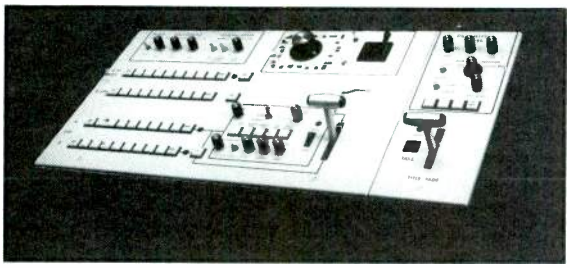
The final radiation patterns accepted by the CBC are shown in Figures 6(a), 6(b), and 6(c) on page 38. The pattern changes with frequency, but the design goal of omnidirectionality, within ± 1.5dB, holds on all three patterns. Another requirement of acceptance was minimum impedance change over the band. Figure 7 (page 40) shows that the bandwidth of the system was never a problem. To verify the elevation pattern for the CBC, phase and amplitude measurements were made on one complete face of the antenna. The photo (this page) shows the 12-panel array set out on the test rack. The data were fed into a computer and Figures 8(a), 8(b) and 8(c) resulted (page 40). Again, the pattern changes with frequency, but not enough to cause problems.

When a project of this kind is undertaken, a great deal of time and effort go into developing new test procedures and manufacturing techniques that are needed for the specific project. These techniques and procedures are also useful in the test and manufacture of standard products. One of the most important of these developments was called the *complex range*. (See Figure 9, page 42.) The complex range allows measurement of the phase and amplitude of far-field patterns of a radiating element, instead of the more common amplitude-only measurement. Figures 10(a) and 10(b) show the measured complex single-panel pattern, and Figures 10(c) and 10(d) show the patterns calculated from the measured data (page 44).

With a slight modification of the system, the near-field (complex) currents of a radiator can be measured. This allows direct calculation of the elevation pattern of an array. Addition of quadrature hybrids (See Figure 11) changed the complex range to a Smith Chart impedance network. This network was used to measure an element while driving the two adjacent elements in an array. This particular measuring technique is valuable when the mutuals coupling between bays are large enough to upset the self-impedance of a bay within an array.

Manufacturers in the United States and Europe are still producing panels they offered seven years ago. An omnidirectionality of ± 2.4dB is the best they offer for three panels per level. A project engineer from the CBC remarked that other manufacturers said the advertising of Omni ± 1.5dB was deceiving, because it was theoretically impossible to achieve. The information in Figure 6 and the fact that the CBC has three such panel antennas in operation that meet the radiating patterns of Figure 6 should eventually show that the *theoretically impossible* can be achieved with some time and effort.

Editor's note:
Portions of the material in this article were presented to the Society of Broadcast Engineers in March 1982. The concepts covered in design and performance are presented to help broadcasters better understand the equipment being used.



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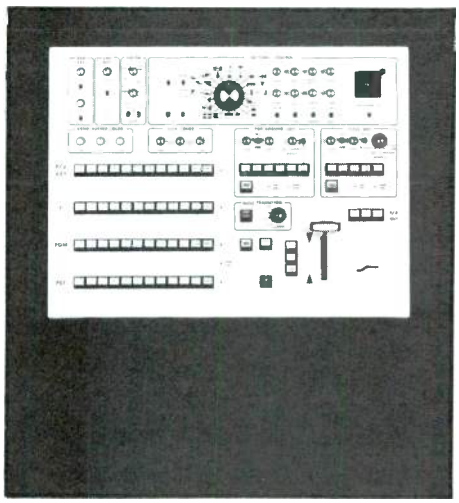

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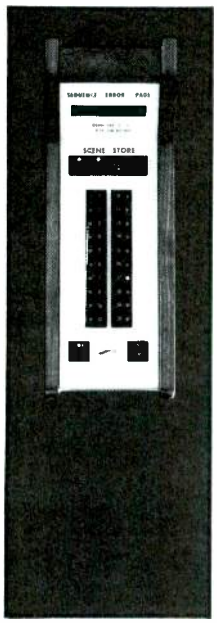

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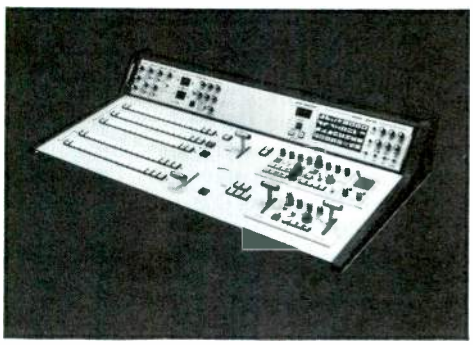

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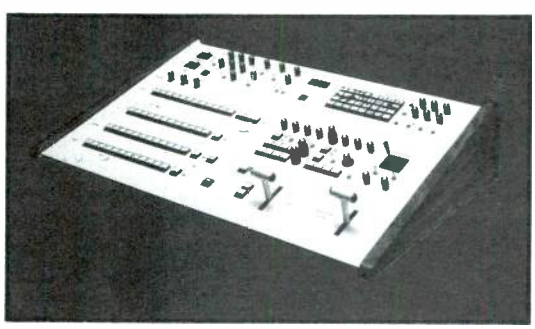

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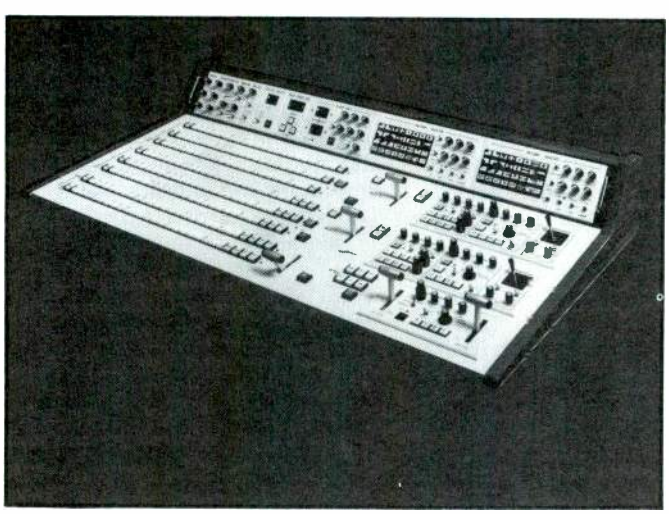

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Video timing and phasing

By Edgar Lee Howard, supervisor of special projects, WOSU-AM/FM/TV, Columbus, OH

Shortly after man invented television, he discovered timing and phasing problems. Since this discovery, he has been confused.

One of the things that creates confusion is the fact that the terminology and techniques of timing and phasing have evolved for historical reasons. As a result, when you come into the industry, you are plugged into the system as it stands, and tend to assume that all that has gone before is written in stone, and all that follows is the result of inspired reasoning. More likely, all that has gone before is a kluge, and all that follows is the result of deadline panic. The first order of business is a look at some basics.

Signal timing

The gospel, according to the Fed, with respect to composite signal timings is paragraph 73.699 of the *FCC Rules and Regulations*. A more stringent and, therefore, more useful statement is to be found in the EIA RS-170 standard, which is now in the process of becoming officially the RS-170A standard.* These standards deal with the composite video signal as though it were a never-ending stream, with no thought given to the necessity of combining different program sources into this never-ending stream. Therefore, they are of little help in a direct way.

The standards deal with the interrelation of timings of sync, blanking and color burst position—parameters that in this day and age are relatively easy to maintain within tolerance. This relative ease stems from several factors, one of which is the fact that fewer separate drive signals are used in contemporary equipment to prompt it into proper operation, compared to the amount used originally. Because each separate pulse distribution system contributes one more time delay that has to be conformed if the driven piece of equipment is to make standard signals, reducing the count of these drive signals to two (sync and subcarrier), or better yet, one (RS-170A black reference), means that the number of variables is substantially reduced. To this is added the marked increase in stability of modern solid-state design, and the popular use of a counting sync generator in each piece of equipment, which is then genlocked to the master black reference signal. Thus, it becomes more common to see equipment that produces fully standard signals with no setup adjustments, and that requires only one phasing adjustment to fully conform the equipment to system timing requirements. Less contemporary hardware may require two adjustments—one for subcarrier phase and one for sync or system timing.

So the first item of business is to determine whether each piece of equipment makes standard composite signal timings at its output and, if not, to cause it to do so. If only one video signal source was to be used on any given day, that would be all. But the industry has a discouraging tendency to deviate from the engineer's favorite programming—color bars and tone—and to combine several video sources in various plain and fancy ways into a completed program.

Let's go on with some more basics. Figure 1 (page 52) shows a hypothetical test setup that may be of some use in establishing definitions. What we have is the output end of a video DA, with its 0Ω out point being split, in this case, into four 75Ω outputs. We carefully terminate two of them, and call these terminated points A and B respectively. The points are taken through identical-value resistors to the input node of a summing amplifier. Taking this figure as symbolic, and for the moment presuming the box labeled D is not present in its path, it should be obvious that the video signal coming out of the summer is the same as the signal present on the 0Ω point of the VDA. Each 75Ω output attenuates the signal to half that of the 0Ω point and creates two identical signals at points A and B, then the summer adds them together again.

So far, all this seems to have done is use a bunch of parts; but now consider what happens if box D, a delay element, is inserted in the path from B to the summer. Now the two halves that go together to form the video signal at the output of the summer are no longer in time coincidence. There are steps on the edges of the pulses as wide as the element D is long. Also, the color burst has been rotated in phase with reference to the input video by the vector sum of the two no longer phased components, and its amplitude has been reduced. If D were to increase to 140ns, the burst vectors fed to the summer would be out of phase, and the output video burst amplitude would go to zero. Calculation of burst phase and amplitude for intermediate values of D is left as an exercise for the reader.

This leads up to a definition. Two video signals are said to be *in phase* when they can be combined additively without producing any shift in burst phase or any steps on the edges of the pulses. Conversely, if additive combining of two signals results in a shift of burst phase or in steps on the edges of pulses, then the signals are *not phased*. In our example, we have carefully split one signal into two identical signals at points A and B, then added a controlled delay to one

Continued on page 52

*For more information regarding RS-170A, see the sidebar on page 58.

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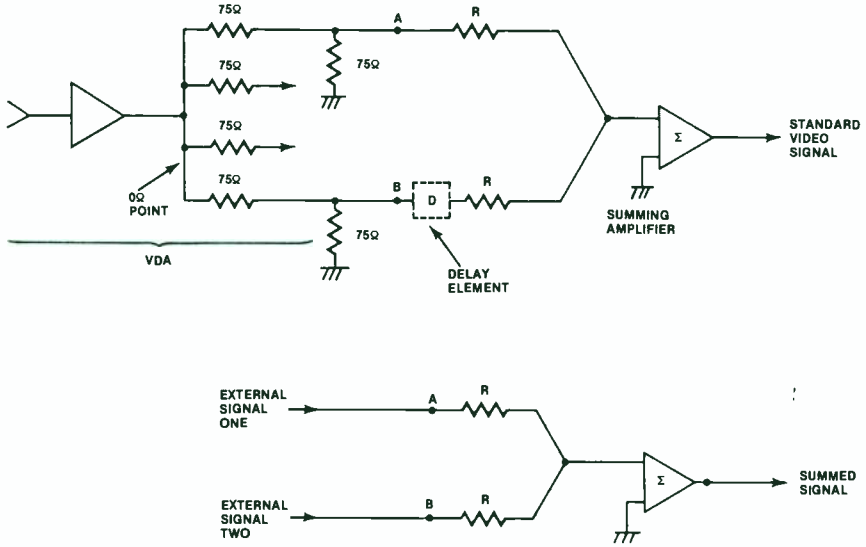

Figure 1. An illustration of phased video. A standard signal, split into two identical parts, can be recombined exactly, providing that there is no delay (D) in either path. Two external signals, if phased, can be combined in the same manner.

Continued from page 48

of the paths to the summer to synthesize a mis-phased signal.

In the real world, the delay (D) would be an unknown, located elsewhere, and two non-identical signals would be coupled to points A and B. If the two signals were phased, or in phase or time, they would combine so that the burst phase and amplitude would not be altered from standard and there would be no steps discernible in the edges of the combined pulses.

Some practical considerations are now appropriate. Our original signals at A and B were created by splitting a standard signal into two parts, so that all dimensions of the two split signals were identical. The signal can, of course, be recombined exactly. In the real world it is unlikely that any two video signals would have *exactly* the same dimensions, risetimes and so on, even if they fully conformed to RS-170A specifications. As a result, there will likely be some small artifacts produced by combining any two real signals.

The two points that are most critical are continuity of burst phase and integrity of the leading edge of sync, so the artifacts of mixing must be minimized absolutely in these areas. Steps on the trailing edge of sync indicate only that the mixed pulses are of two different widths; these generally do not matter, although good practice indicates that the pulse widths should be standardized. Similarly, widths of blanking should be standardized so that mixing does not inadvertently stretch the width of the output blanking. From this point on, standard, virtually identical dimensions will be assumed for everything contained within the blanking interval, so that properly phased signals can be combined and mixed at will within a video switcher.

The switcher

Because the video switcher is the focus of the efforts of phasing, it would do well to examine it briefly. Basically a video switcher has a number of video inputs, each of which can be selected and, in combination, passed through various mixing and switching subassemblies to the output. The first rule for video switchers requires that the time delay from any input through *any* path to the output must be exactly the same as the delay from any other input to the output. Any switcher that does not meet this requirement cannot be used successfully in the construction of a synchronous facility. Given a proper switcher, it follows that all signals arriving at inputs of the switcher with zero differential delay (*in phase*) will come out of the switcher with zero differential delay, in phase. A stream of material assembled from various sources, all with zero differential delay, cannot be told apart from a continuous signal source, except by content. And that is what is desired.

Now consider a simple system with one video switcher and a few video sources. How best to time it into the real world? Two pieces of test equipment are required to do the job easily and accurately: a TV waveform monitor and a vectorscope. Figure 2 (page 56) shows the equipment configured for this task. Station reference sync is fed to the waveform monitor and vectorscope external sync inputs. The station reference subcarrier is fed to the vectorscope as external phase reference, and the vectorscope is placed in *external phase reference* mode. Video from the switcher pro-

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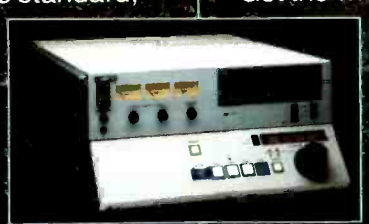

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gram output is looped through the waveform monitor and terminated at the vectorscope.

To begin with, one of the switcher input sources, say source one, is designated as the reference source, the one to which all others will be matched. It is selected to the output of the switcher, and the vectorscope phase adjustment is rotated to put the burst vector dot over its target on the vectorscope display. It is worth forming the habit of checking to be sure that the vectorscope is in *external* reference mode, which it must be for phasing adjustments. The waveform monitor should show a clear, full-bandwidth, somewhat expanded display of the horizontal sync region of the video waveform.

Now a second source is selected. The vector display is observed without altering any of its adjustments, and the system subcarrier phase adjustment on the *video source* is adjusted to place the burst vector dot once more over its target. At this point, an additive mix between sources one and two will not alter the output burst phase, because a zero differential delay situation has been established for burst signals, irrespective of cable lengths or other time delays associated with the sources.

It is necessary also to check the timing of the sync signals, because what we have done so far is a *necessary* but not *sufficient* condition for complete phasing and timing of the signal. The burst vector is intact, but there must also be no steps in the leading edge of sync. A half-and-half additive mix is selected between the reference input and the second input, and the condition of the leading edge of sync is observed on the waveform monitor. If a step is present, it must be removed.

How the step is removed depends on the type of equipment providing the signals. If the equipment is of the older, independent sync and subcarrier design, there will usually be a sync delay or sync timing adjustment that can be rotated to move all pulse timings in the video signal and, thereby, to eliminate the step at the mixed output of the switcher. If the equipment is of newer design, incorporating RS-170A outputs, there may be only one phasing adjustment, which will move both the timing of the pulses and the phase of the system subcarrier that creates burst.

If any RS-170A sources are present in the system, it is generally best to use one of them as the reference source, because it is not possible (or, for that matter, desirable) to try to conform an RS-170A output that has fixed and defined sync-to-subcarrier relationships to another signal with random sync-to-subcarrier relationships.

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Starting with RS-170A relationships for a reference means that other RS-170A sources will phase up easily and precisely, and that the process of phasing burst, then sync, of independent design sources will tend to bring them into a nearly RS-170A timing relationship.

Keep in mind that both burst vector alignment and sync leading edge alignment are needed for a properly phased system. As some of the newer systems have the capability for phasing shift through more than one horizontal line, it is wise to also check the pulse sequence of the mixed signal in the vertical interval to be sure there are not any errant mis-phased pulses. Once this is done, all other sources are phased to the selected reference in the same manner.

The video switcher probably includes some form of color black generator and color background generator, the sync and burst of which must also be phased to be compatible with the selected reference source. Again, if an RS-170A source is available, it should be chosen as the reference source against which to phase the switch internal sources.

Now that we have a single switcher phased up, let's add another switcher to the system. Presume that we have two switchers, sharing common signal sources. If the sources are phased to only one of the switchers, what should we do about the other one? Cut some cables. But it's not as bad as it sounds.

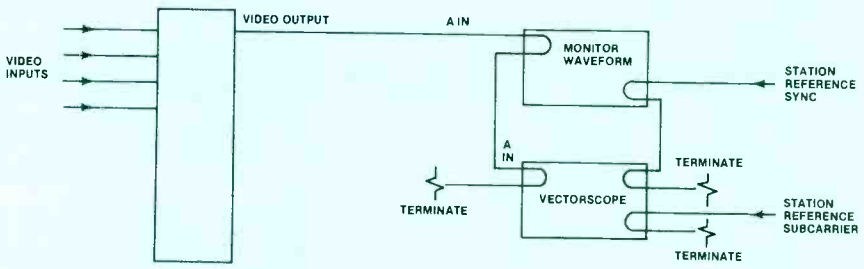

Figure 2. Test equipment should be configured in this way when used to time and phase signals to a switcher.

First, think about equipment placement. As we have said, the switcher is the crucial thing, the place where it all comes together. So, there is where we start. Almost every respectable switcher today has its electronics separate from its control panel. Thus, the control panel can be put in a control room and the electronics can be located in a technical equipment room. *Rule one* for equipment placement is to put all the electronics units for all switchers that share any commonality of inputs as close together as possible, considering cooling requirements and maintainability.

Our two switchers will each need an input from those sources that they share. A handy way to make more than one video signal out of a single video signal is with a video DA. (See Figure 3, page 60.) *Rule two* for equipment placement is that all cables from VDAs to the first switcher are to be the same length. If all cables from VDAs to the second switcher are of identical length, but not necessarily the same length as those for switcher one, then, once sources are phased to either switcher in entirety, they are automatically phased to the other switcher. Only the lengths of cable from the VDA outputs to the switcher inputs count. The lengths of cable

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RS-170A

The RS-170 standard for color transmission, based on paragraph 73.699 of the *FCC Rules and Regulations,* requires that the horizontal scanning frequency be 2/455 times the color subcarrier frequency. This precise odd harmonic mathematical relationship ensures that there is some fixed phase relationship between the position of the leading edge of sync and the zero crossings of color burst. This is necessary to provide spectral interleaving of chrominance and luminance signals, the *dot interlace.* This odd harmonic relationship also means that, between sequential odd or even fields, the phase of subcarrier signals is shifted exactly ½-cycle, or 180°, producing four sequential fields in a complete color frame.

In any videotape recorder with direct color recovery, the time base corrector (TBC) makes use of sync and subcarrier timing information and, therefore, makes the assumption that correct color field sequence will always be maintained. If it is not, the TBC becomes confused because it is presented with conflicting data. Usually subcarrier wins out over sync, and the colors come out correctly, but the picture shifts sideways 140ns, or sometimes up or down a line.

RS-170A defines the phase relationship between the midpoint on the leading edge of sync and the zero crossing of colorburst. A continuous wave subcarrier that is in phase with the colorburst is defined to have its zero crossings intersecting exactly at the midpoint of the leading edge of sync, so it is possible to examine the direction of each zero crossing. Color field one, out of four, is defined to have positive-going zero crossings at even-numbered sync pulses. From this, it is possible to determine the numbering of each field of the color field sequence so that signals can be combined in proper order.

RS-170A defined sync pulse risetimes to be 140ns, which ensures that pulses produce no energy harmonics that might fall out of the passband of video filters, be lost and, thereby, shift the perceived timing of sync, which could destroy the defined field sequence.

Burst envelope risetime is defined as 300ns, which puts all amplitude modulation sideband energy outside of the passband of chroma filters, and thereby minimizes burst phase detector errors. The standard also slightly changes some pulse widths to make them more suitable for generation by counting type sync generators.

When properly implemented, the standard allows clear determination of the color field sequence and precisely defines the sync and blanking region of the video signal. It does not, however, say anything about the picture in the active area, which is *framed* by the blanking. To ensure that no unfortunate movements of fixed picture elements take place, it is necessary to define some artifact in the active picture area (for example, the center of picture), so it can be unambiguously placed in a reproduceable location, no matter what processing is done to the signal.

Work is currently under way to amend the existing RS-170A standard with additional wording that will attempt to define this last scrap of ambiguity in the timing of the NTSC signal.

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from equipment to VDA inputs can be anything practical, as they are automatically compensated out when the sources are phased to the switcher, just as they are for a single switcher system.

Because the only lengths of cable that matter are those from VDA outputs to switcher inputs, it follows that VDAs should be mounted physically as close to the switcher electronics as possible. There is an old rule of thumb that says 6 inches of cable is just about 1° of time delay at 3.58MHz, so cables have to be cut to greater precision than 6 inches if phase uncertainty is to be kept below 1°. In practice, a 10-foot piece of cable can be made exactly 10 feet long easier than a 100-foot piece can be made exactly 100 feet long. Short cables can be measured and connectors installed more exactly; cables can then be installed without need for trial-and-error trimming. This saves money on cable, connectors and labor.

Parallel switchers

Switchers can be added in this parallel manner to whatever level of complexity is desired, because every switcher and its input harness is independent. There is, however, a practice in the industry of entering the output of one or more switchers as inputs to another switcher, along with many of the same sources as feed the first switchers. This is usually the case when one or more studio level switchers are fed to a master control switcher with some of the cameras, film chains and other sources that also feed the studio switchers (Figure 4.)

The problem with this is obvious. One source, say source A, traveling through switcher one to switcher two has an additional delay, the electrical length of switcher one, over the direct path from source A to switcher two. And the same is true for any source feeding switcher two, except, of course, for the output of another switcher. Because we cannot advance the output video of other switchers, we have no choise but to delay everything else to match it. So a whole bunch of delay lines appear, one in each of the direct paths from a source to switcher two, and their lengths are equal to the electrical length or delay of switcher one.

What is the electrical length of the switcher? This, of course, depends on the particular switcher, but it would likely be a half-cycle of subcarrier at minimum, and maybe as much as a full cycle or more. For one full cycle of subcarrier delay, a delay cable would be roughly 360° x 6 inches, or 180 feet. Even considering the quality of swept video cable, 180 feet is long enough to require equalization and level compensation if video quality is to be absolutely preserved. If the input cards or modules of switcher two do not have cable compensation provisions, then the delay cables need to be equalized with outboard cable equalizing video DAs. As an alternative to coils of wire, lumped constant delay line boxes can be used, but these are less transparent electrically than the cable and probably require equalization. Also, at least for moderate lengths of cable, the delay boxes are more costly.

So, for a 20-input switcher as switcher two, being fed from one or two studio level switchers, we are looking at 18 or 19 pieces of delay cable, each approximately 180 feet long, and 18 or 19 equalizing video DAs, added complexity and expense.

A much more electrically sound solution to this problem is simply to avoid it. Returning to the unshaded configuration of Figure 3, specify that switcher two is the master control switcher. Then add a single-row audio-and-video router, perhaps a 10-by-1 self-contained unit, configured to switch between the various studio switchers and the master control switcher and whatever test signals desired. The output of this switcher, audio following video, is presented to the network or the transmitter as the program output.

Phasing in this configuration is almost trivial. From a practical sense, because switcher three is a vertical-interval cut-only switcher, little disturbance will arise from switching between non-precisely phased inputs. To do it right, all relevant inputs, such as those from the other switchers,

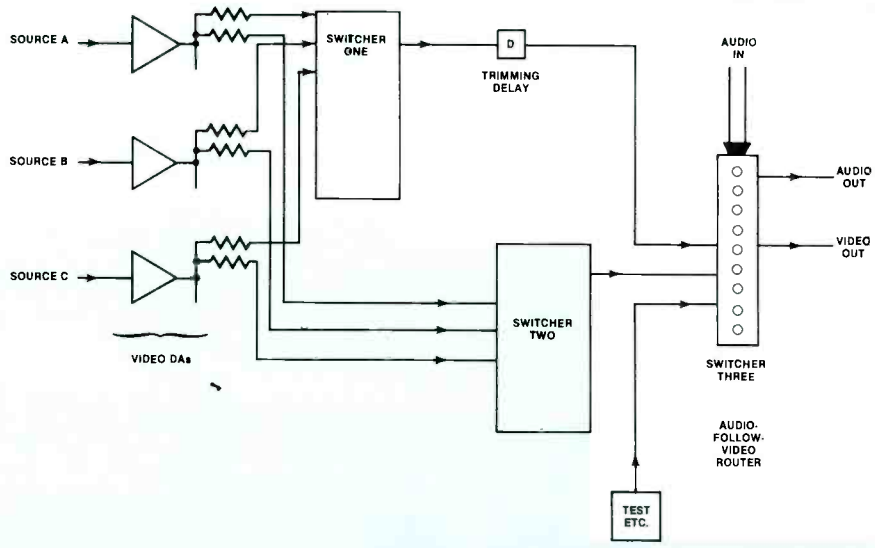

Figure 3. Switchers (shown in shaded area) can be corrected in parallel to video sources using VDAs, providing that all cables from VDAs to each switcher are the same length. Cable lengths to different switchers need not be the same. A cut-only switcher easily combines the outputs of many studio and master control switchers with only a few short trimming delay cables.

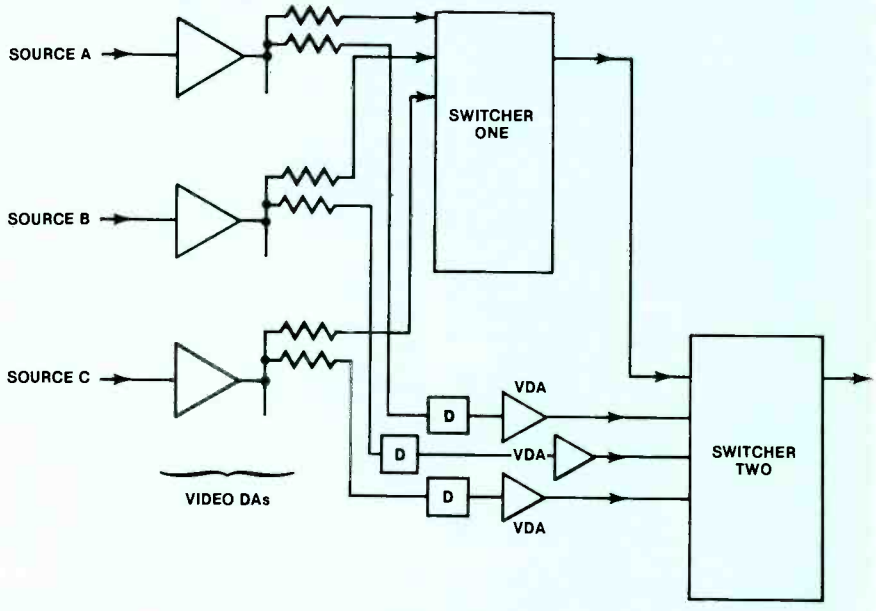

Figure 4. If switchers are connected downstream, long delay elements and, usually, cable equalization are required on all direct inputs to delay them to match the output of upstream switchers.

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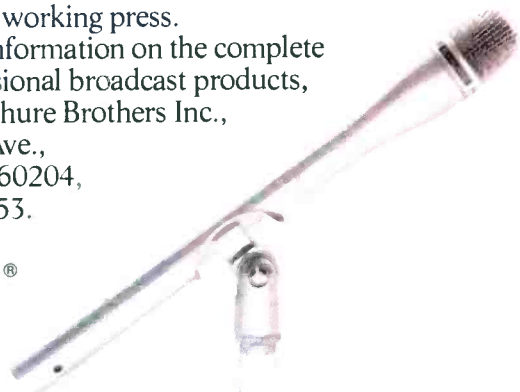

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should be phased. The number of delay cables is low, just the number of the other switchers. Also their length is short, just enough to compensate for the differential delay through the other switchers. That is, the output of the electrically shortest switcher is delayed to match the output of the electrically longest switcher.

If this is done, levels are matched precisely and matched sources are selected on appropriate switchers, it is possible to cut between switchers on switcher three without notice. If the controls for switcher three are mounted next to those for the master control switcher, they become, in effect, an extension of the master control switcher, and can be operated in that manner. It would be sensible to have color bars and whatever other test signals that might be appropriate available on switcher three—along with a panic source of network, not precisely phased, and perhaps a patchable access, audio and video. This solution is no more costly than the properly implemented delay line solution, and has the added benefits of being electrically more sound. It also provides some maintenance and emergency flexibility around the master control switcher.

The signal source

This brings us to the end of the signal chain, nicely timed and phased. There is one other item that deserves at least a brief mention: the signal source itself. Early on, we presumed standard dimension video signals coming from the sources to be phased, and we presumed these sources to be agile, that is, able to maintain the standard dimensions while at the same time being adjusted in terms of subcarrier phase and sync timing. All of the newer equipment is agile—time base correctors, tape machines and cameras—so these are no problem to configure. But there is still quite a bit of fixed video generating equipment out there. For these, the subcarrier may be adjustable through 360°, but the sync and blanking dimensions, once set for standard signals, do not move.

The only sensible way to move them is by moving the drives that feed them. There are two easy ways to do this: with pulse delaying pulse DAs, keeping in mind that all outputs of the PDA will move the same amount as the delay is varied; and with delay lines. Here is a good place to use the little lumped constant switch-programmable delay modules, because their small distortions do not matter in pulse service. Keep in mind that if sync and blanking are required, both must be delayed by exactly the same amount.

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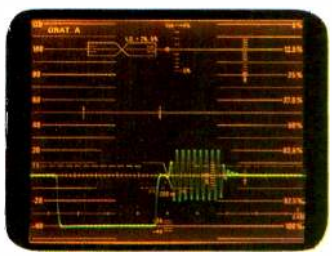

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to make the fixed sources agile by driving each of them with its own inexpensive but stable gen-locking color sync generator, and locking these generators to the station reference colorblack. This may seem extreme, but when compared to the cost of pulse distribution for a few of the old, fixed sources, it may well win out. It is also much more flexible in terms of use.

When the day comes that all pieces of equipment derive their reference by gen-locking to colorblack or any composite video, we will surely see the end of most pulse distribution systems, and that questionable apparatus, the pulse assignment switcher. This flexibility is already evident in a simple comparison of what is required to get a quad type machine to play back synchronous and phased to network vs. a 1-inch machine, which will play back synchronous and phased to its input video source, if required. The video routing switcher suddenly becomes the pulse or reference assignment switcher as well, with the addition of only a few outputs for specific equipment groups, such as each studio and its associated equipment, film cameras and so on. Comparing the cost of a few gen-locking sync generators to that of expanding or even maintaining a pulse assignment system and pulse distribution system may prove the point, especially because every new piece of equipment added to existing systems will be hungry for some colorblack for a reference and not for a bunch of nicely regenerated pulses.

There are many more details involved in designing and timing up a system, but the details become specific to the system, and therefore are cumbersome to discuss in general. I have defined and established a base of definitions and design strategy from which the details can be worked out and have provided a few clues to aid the puzzled.

Editor's note:
Portions of this paper were presented in a speech at the Second Annual WOSU Broadcast Engineering Conference held at Ohio State University in July 1982. The conference was coordinated by John Battison, director of engineering, WOSU-AM/FM/TV.

SC/H phasing

The gist of the proposed color standard RS-170A is to provide a definite statement of the time relationship between the color subcarrier and horizontal sync signals within a composite video signal. No such definite statement was provided in the original EIA RS-170 standard developed for NTSC television in the 1940s. In light of the increase in video production being done today, however, and the added requirements in editing those productions, definitions are needed.

The relationship between horizontal sync and color subcarrier, given by the equation H = (2x3579545)/455, indicates that during each line of video there are 227.5 cycles of subcarrier. In a complete frame of video (525 lines or two fields), there are 119437.5 cycles. As a result, the phase of subcarrier alternates on every line. Also, a 4-field sequence (two complete frames or one color frame), is required before a whole number of subcarrier cycles is completed in coincidence with a specific point within the sync waveform. RS-170A defines a subcarrier-to-sync phase (SC/H) relationship required for a clear identification of the 4-field sequence.

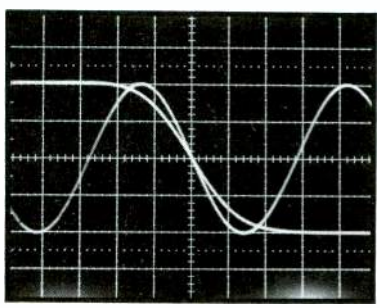


Figure 1. SC/H-phased condition (Line 11, Field 1) showing leading edge of sync and extrapolated subcarrier.

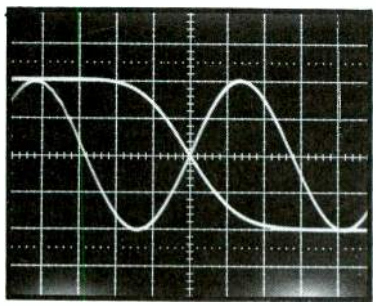


Figure 2. Sync and subcarrier 180° out of phase showing leading edge of sync and extrapolated subcarrier.

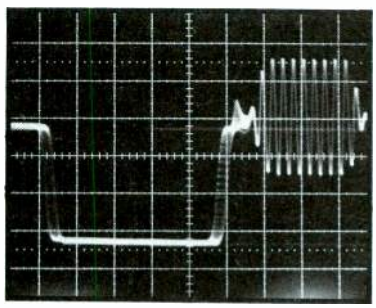


Figure 3. SC/H-phased time base error.

In accordance with RS-170A, the 50% point on the downward transition of a cycle of subcarrier and the 50% point on the leading edge of the horizontal sync pulse of Line 11, Field 1, shall coincide for the SC/H-phased condition to be achieved. (See Figure 1.) In Figure 2, the subcarrier is 180° out of phase. For the video facility to be properly phased, the Line 11, Field 1 condition has to be met at all locations.

The major difficulty within the production facility of an unphased system is found during videotape editing. A VTR in a normal synchronized playback mode first frame-locks, aligning a control track frame pulse with a frame pulse derived from house sync. Secondly, horizontal sync of the off-tape video and house sync are

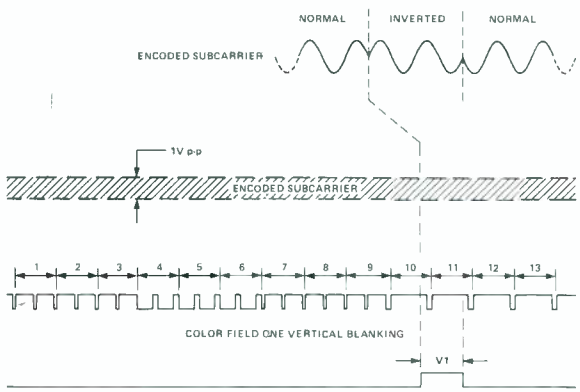
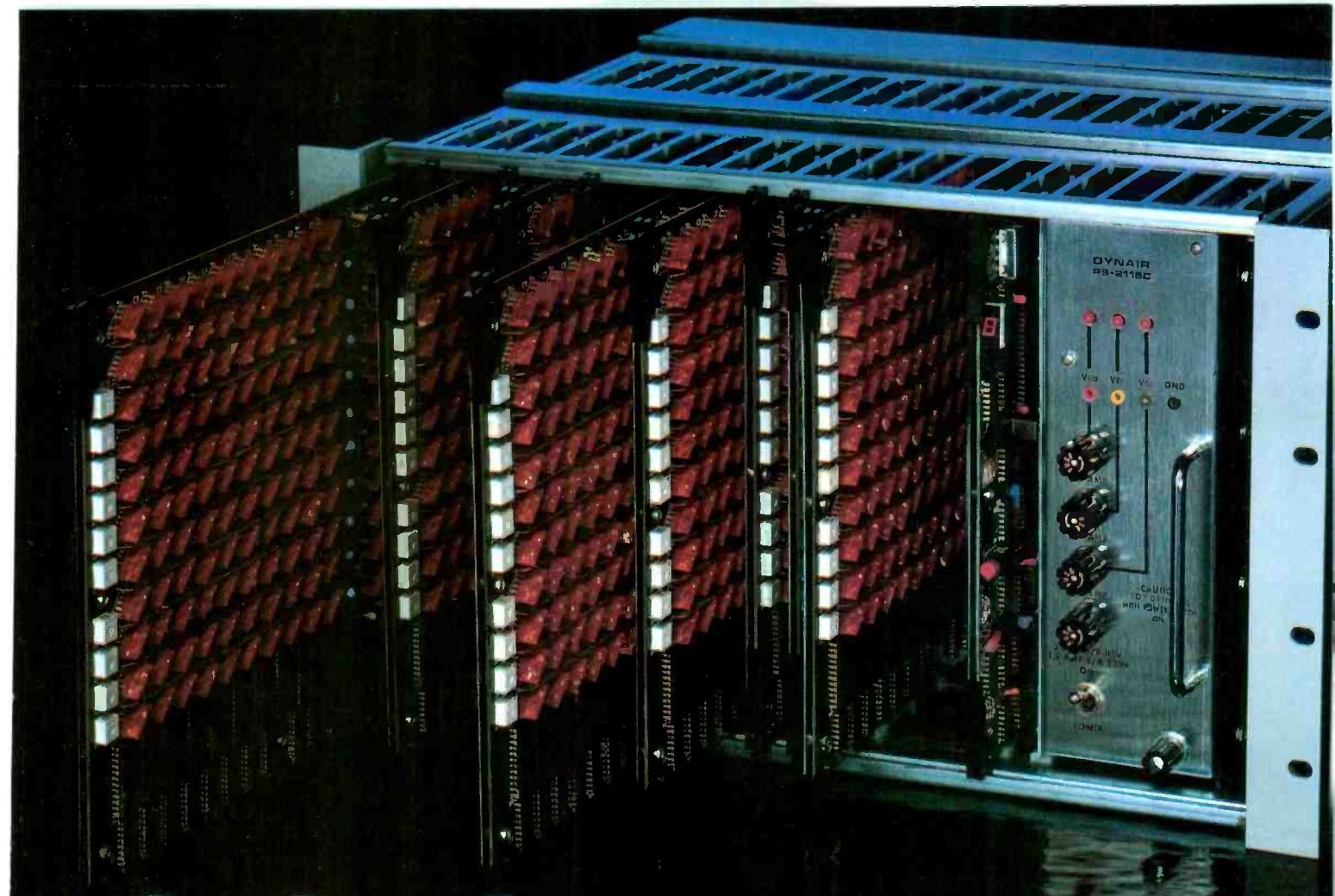


Figure 4. Color frame one reference pulse.



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made coincident. Finally, the color time base corrector locks to the house subcarrier signal. On 50% of the attempts of a VTR to lock up with house sync, statistically the subcarrier will be out of phase by 180° maximum, or a time error of about 140ns (½-cycle). When the VTR finds that such an error exists it must accomplish the 3-step sequence again, with tearing in the video occurring during the momentary unlocked state. Within an editing program, if the ½-cycle error occurs, a horizontal shift of video will be present. In pictures of similar background information, the shifting becomes obvious.

Use of a 15Hz framer is one approach to solving this problem. As video is recorded on the tape, only every other frame pulse (a color frame pulse) is recorded. If the recorded tape is moved to another VTR, the relationship between the frame pulse on the control track and the house color frame pulse is easily re-established.

Several considerations should be made if purchase of equipment is planned to accomplish an SC/H-phased plant. The sync generator, for example, should be capable of a low sync-to-subcarrier time base error (less than 5ns), a long term SC/H phase stability (less than 10ns) and a consistent SC/H phase. If multiple sync generator units are to be used, the slave generators must also meet these requirements, as well as be able to precisely color frame-lock to the master generator. Any equipment within the plant that contains a sync generator must also meet the multiple requirements.

Special requirements are placed on video processing equipment within the plant. The circuitry must provide accurate pickoff of the 50% point of sync, accurate regeneration of subcarrier and stable regeneration of sync and burst, even in the presence of hum, noise and possible phase modulation during the burst period. A properly SC/H-phased input must not be altered. The capability for applying externally referenced sync and subcarrier to video from a switcher (for example, for a constant phase relationship) must be present.

The main problems encountered with an improperly SC/H-phased studio include SC/H phase errors, phase drift, timebase errors and timing drift. The phase errors and drift can be apparent in subcarrier and horizontal phase individually. Phase errors are corrected by careful adjustment of the generating equipment, usually in conjunction with phase metering devices or systems that display the sync and subcarrier relation-

Continued on page 70

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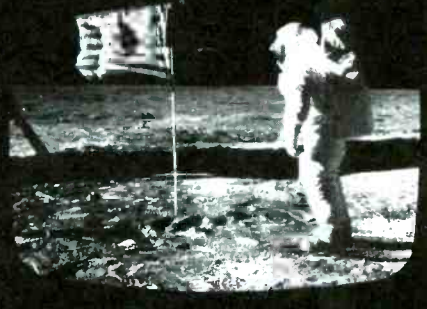

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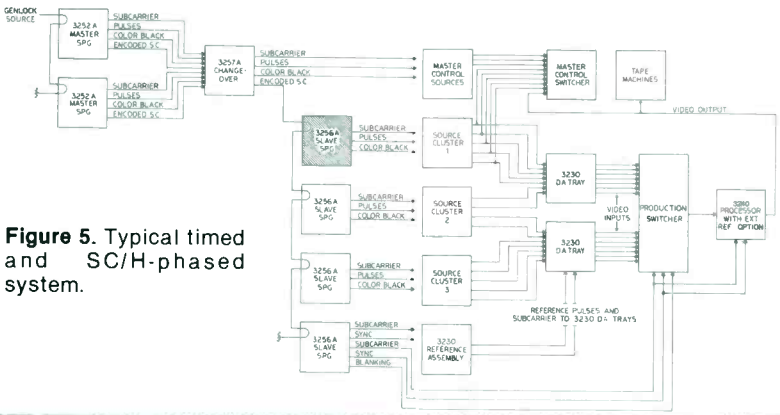

Figure 5. Typical timed and SC/H-phased system.

ship on a CRT. Phase drift is related to the generation equipment and delay variations in the timing signals as they arrive at a video source device.

The SC/H time base error differs from entire video time base errors as considered in time base correction and synchronizers. The error in the blurring of the sync pulse (shown in Figure 3) may be caused by noisy sync circuitry, regenerative and linear pulse DAs suffering from pickoff jitter or low-frequency response faults, or a processor or source equipment that affects the sync-to-subcarrier relationship.

Finally, timing drift is the delay of the entire video signal, and is caused by sources whose electrical lengths change with temperature. Coaxial cables, for example, may experience variable velocities of propagation during changes in temperature. Because subcarrier and horizontal phase drift together, a processor may then convert such a drift problem into an SC/H phase error problem.

Solutions to the problems of SC/H phase errors may be implemented through the use of specially designed equipment. An unambiguous, correctly phased color black signal is helpful. An *encoded subcarrier* (shown in Figure 4) contains two cycles of inverted subcarrier in every fourth field of the 1Vp-p signal, as a convenient drive signal for slaved sync generators. Also, automatic timing video distribution amplifiers, which accept house sync and subcarrier to derive burst sample pulses and reference subcarrier, are valuable. The auto timing DA could allow the setting of a digital phasing adjustment of a slave generator to within perhaps ± 20°, allowing the DA to make the final correction.

To achieve an SC/H-phased plant, the timing of sync becomes as important as subcarrier, and each element should be viewed in that light. An example of a phased system, shown in Figure 5, indicates GVG equipment that could be used in the implementation of SC/H phasing. Not only would video be recorded with the proper phase in such a system, but the playback machines would also be driven by properly SC/H-phased references. All aspects of the video production facility, including switching and, more importantly, videotape editing, are certified for RS-170A SC/H phase operation.

Editor's note:

This description was adapted from material presented by the staff of Grass Valley: Eileen Preston, product marketing specialist; and Jim Michener, staff engineer. A brochure, "Establishing and Maintaining SC/H Phase," is available directly from Grass Valley or can be obtained by circling (483) on our Reader Service Card.

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Video switcher update

By Carl Bentz, technical editor

When preparations for this equipment update began in early March, notices were sent to manufacturers of studio and portable production and master control video switchers. The information request specified any new products or significantly updated switcher systems presented to the industry following the NAB-'82 convention. Introductions at NAB-'83 were to be included. For many companies, the request and its pre-NAB deadline created problems.

The following update information is taken from the materials that were sent to us. Equipment listed is limited to new or updated systems, after NAB-'82, and includes only those organizations that responded. For additional information on new systems that appear at NAB-'83/Las Vegas, check the BE June wrap-up issue.

AMERICAN DATA

American Data MC 4000

MC 4000. The MC 4000 master control switcher includes input capabilities to 32 audio-follow-video circuits with eight separate audio inputs. The largest system requires only seven rack units, with microprocessors handling many functions. Some of the operating features include over/under audio mix, single-event pre-roll for 10 VTRs and two film islands, downstream key and master fade-to-black. Keying includes digital matting, background/black generators and a CCD title edger. Available for NTSC, PAL or PAL-M, the MC 4000 may optionally handle stereo audio and include a 40-event automation system.

Circle (505) on Reply Card

AMPEX CORPORATION

Ampex AVC series

AVC series of production switchers. The AVC series has undergone continuing evolutionary changes in preparation for NAB-'83. The changes

are internal to the electronics and provide improved operation.

Circle (506) on Reply Card

ASACA/SHIBASOKU

Asaca/Shibasoku ASW-50

ASW-50 video switcher. Joining the ASW-100 and ASW-200 portable production switchers is the ASW-50. With shoulder-case portability, the switcher offers cut and dissolve switch modes with variable 0.3-6s auto-dissolve. Two camera control units incorporate auto camera phase control. The unit may gen-lock to other equipment from an external blackburst signal. An audio-out selector includes tone, camera one, camera two or an external source. Although the camera-mounted VTR controls may be used for typical VTR functions, they may also be used to remotely control the switcher. LED indicators show the status of the VTR. 12Vdc operation allows a variety of powering possibilities.

Circle (507) on Reply Card

CENTRAL DYNAMICS LTD.

Series 80. The series 80 comes in models 480, 680 and 1080 with 4-, 6-and 10-bus systems. A new approach to digital effects is called "FlexiKey." Added effects power comes from dual-luminance keyers and matte generators with SuperSoft and Super Bordered wipes. A new program processor is the equivalent of an added SFX-type mix/effects amp on the program bus for sequential background/foreground transitions.

Circle (508) on Reply Card

CROSSPOINT LATCH

6139B and 6139C. The established 6139 switcher has been updated into two models. The 6139B handles 16 inputs, while the 6139C accepts 24 inputs, both into 6-bus systems. Three separate mix/effects amps include individual pattern generators, positioners, keyers and controls for border width, luminance and soft edges. Quad splits, pattern mixing and double re-entry on each M/E amp allow a composite of five signals displayed at once, along with downstream keying. The Crosspoint Latch auto-drive editor control may be interfaced.

Additional new models from the company include the 6109 8-input, 3-bus production switcher with an editor interface; the 6116 3-level switcher; and a 6179 computer-controlled switcher system for 24-input production needs.

Circle (509) on Reply Card

GRASS VALLEY GROUP

Series 300 and 1600. Both the series 300 and 1600 switchers have had enhancements incorporated into their

electronic systems. The 300 series includes new internal options to allow effects dissolves, sequencing and operation with the E-disc equipment. Older model 300 series units may be retrofitted in order to update the systems to the equivalent of the 300s shown at NAB-'83/Las Vegas.

The 1600 series, first introduced in prototype at NAB-'82, has also received circuitry updates for enhanced operation. The changes are the result of industry comments received by GVG.

Circle (510) on Reply Card

IMAGE VIDEO LTD.

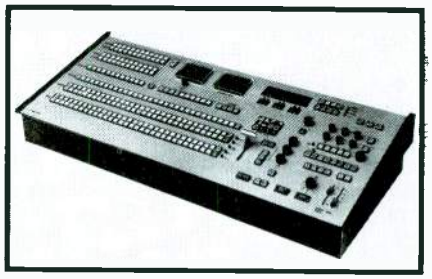


Image Video 8200

8200 master control switcher. The model 8200 is available in standard or custom configurations. Microprocessor control handles many of the functions. Auto pre-roll of equipment, four A/V transition rates, programmable take and audio modes and optional stereo operation are featured. Up to 30 inputs include black and backgrounds. Five inputs may be selected into the luminance and downstream keyers. Other features include borders with mattes, outlines or dropshadows; emergency fade-to-black with silence; self-diagnostic software; peripheral interfaces; and 12 separate audio inputs, each including pre-listen and continuously variable over/under ratio and level control.

For PAL systems, a pattern generator with 12 selections combines with an RGB keyer. In custom configurations, multiple pattern selection, foreground generation and a 20-event semiautomatic operation mode are featured.

Circle (511) on Reply Card

INDUSTRIAL SCIENCES INC./ISI

Model 903 video production switcher. This switcher uses a microprocessor in the control panel to make it a smart terminal, relative to the microprocessor-controlled electronics. Program and preview phantom bus switching allow cut or mix from one mix/effects amp to the other, as well as re-entry. A blanking processor with fade-to-black is standard. The shared 14-pattern generator supplies dual-M/E amps with circle, square, corner, diagonal and diamond shapes, with soft, hard and bordered edges. Self-test diagnostics are included in the 10-input, 4-bus equipment, which also offers preset-to-program bus variable mix and cut. An RS232 editor interface is one option.

Circle (512) on Reply Card

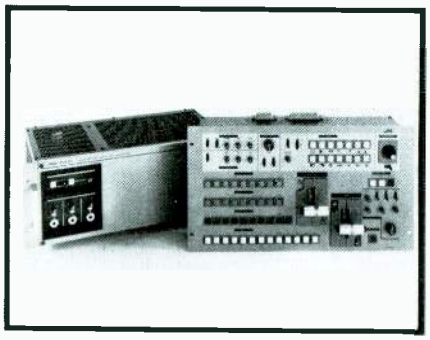
640 downstream key edger. The 640 provides normal external key, as well as outline, drop-shadow and border edging. The key source may be a character generator output, which allows individually colored characters. A programmable 4-input key selector enables each source an assignment to normal or bordered keys.

Circle (513) on Reply Card

899 master control switcher. From 15 to 40 inputs are possible with the 899. Recently updated, it combines with the ISI 1100 routing switcher matrix for added flexibility. Both pre-roll and real time control is possible. Additional features include a 4-input downstream keyer/edger/colorizer and the 980 fade-to-black unit.

Circle (514) on Reply Card

JVC COMPANY/PROFESSIONAL VIDEO DIV.



JVC KM-2000

KM-2000 special effects generator. The KM-2000 is a new 8-input generator with three switching buses and preview. The small format system, ideal for limited size studios or remote van applications, includes 13 patterns for use with input video or the internal background generator. Transitions may use hard or soft edges, while downstream keying offers edging color controls. An RGB keyer is switchable to external key sources. The system may gen-lock from composite video, color black or sync drives and provides combined sync, H-drive and V-drive outputs for other equipment.

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PRIMUS is a division of Ramko Research, Inc. 11355-A Folsom Blvd., Rancho Cordova, California 95670 (916) 635-3600

Circle (68) on Reply Card

LANG VIDEO SYSTEMS

One Shot. Enhancements to the One Shot have been provided, making it a totally plug-in system for mobile and helicopter ENG production. Four line or mic audio inputs and four video inputs may use straight cut or optional vertical interval switching. A color bar/ID feature now includes SMPTE reverse bars as an option and may be purchased in the PAL standard format. Four outputs from the switcher are standard, and a 1-inch video monitor is an optional feature.

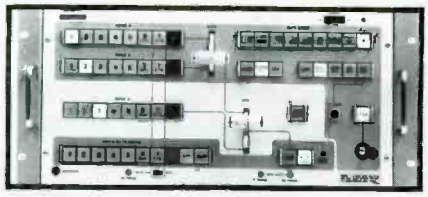
Circle (516) on Reply Card

McCURDY RADIO INDUSTRIES LTD.

MCS-1004. MCS-1004 designates a small format video switcher from McCurdy Radio Industries. Ideally suited to small studio operations or portable production units, the 10-input, 4-bus unit fits into an 19"x7"x3.5" control panel. Standard features include mix and key functions, on-air tallies, momentary push-button control, auto mix/auto key with adjustable rate and color background generator.

Circle (517) on Reply Card

PANASONIC AUDIO-VIDEO SYSTEMS



Panasonic WJ-5500B

WJ-4600B/WJ-5500B. The WJ-4600A/WJ-5500A switcher/effects generator systems have been upgraded to the WJ-4600B/WJ-5500B systems. Added features include a built-in audio amp for the intercom with level control for carbon mic headsets and additional blackburst outputs on BNC connectors. The 4600B provides six inputs and six effects wipe patterns. The 5500B has eight inputs and nine patterns. Both are compact systems for mobile/portable or studio operation.

Circle (518) on Reply Card

AS-6100. The 5-bus AS-6100 production system offers 10-input capability with spotlighting, downstream keying and a 14-pattern generator. Two inputs may be selected for the keyer. Color background matting and effects positioning controls are provided. Completing the 6100 system is the AS-2000 chroma-key generator and the AS-100 color sync generator, forming a system that backs Panasonic's new thrust into the broadcast realm.

Circle (519) on Reply Card

ROSS VIDEO LTD.

Ross Video Ltd. RVS-524

RVS-524. Answering a demand for full-featured, low cost switching in small studios, Ross presents the RVS-524. Many features of previous models are incorporated: Multi-Level Effects (MLE) for up to four sources without locking up the switcher; preview transition viewing; Scene Store memory; analog key borders; and a variety of interfacing for digital effects units. Nine rotary wipes add to traditional ones, with RGB and encoded chroma-keying, foreground/

title keying, pattern positioning and modulation. Auto-transition times of 0.3s, 0.5s and 1s may be selected.

Circle (520) on Reply Card

Ultra-key chroma-keyer. Capable of incorporation into any Ross switcher system is the UltraKey. It will function with any color and is said to eliminate any background color spill. It may be used with up to eight chroma-key cameras.

Circle (521) on Reply Card

SHINTRON

Model 390. Shintron's model 390 switcher is designed to handle component video signals. The 3-channel system for Y, I and Q video handles not only simple switching, but also special effects. The switcher is designed around extensive use of microprocessors. Interconnection directly to the Y-I/Q outputs of studio ½-inch VRC-compatible VCRs is possible.

Circle (522) on Reply Card

UTAH SCIENTIFIC

Master control switchers. Added to the Utah Scientific line are 2- and 3-bus systems that provide 28 direct inputs with two additionally assignable from the control panel. These software-oriented systems include an all digital interconnect through RS-422 lines and machine control for two telecines and 10 VTRs. Single-button execution of presets is possible, with edge, shadow, outline and color matte effects. The audio portion is stereo-ready, requiring only the matrix and one card. One separate 8x3 audio-only matrix is included, with full audio over/under capability. Monitoring is provided with four large LED VU meter displays. The systems are available with or without the new matching automation system.

Circle (523) on Reply Card

VITAL INDUSTRIES

250P/N. For studio or remote use, the updated 250P/N is an economical, yet versatile, 16-input system. Black and background signals are included on the four switching buses. Thirty-two patterns are available for use with positioning, modulation, multiplier and spin controls. Three keyers offer mask or inverter with edger, shadow and outline modes. Transitions may be mix, wipe, cut or non-additive types. An automation memory handles up to 100 transition configurations with storage and recall capabilities. Dual chroma-keyers add to production possibilities.

Options for the 250P/N include an editor access port for serial RS232 or SMPTE standard communication. A composite video chroma-keyer is available. For use with remote control panels, an auxiliary switching matrix may be included. Interfacing to the SqueeZoom effects equipment is also possible. This new edition of the 250P/N comes with a remote control panel to operate rack-mounted electronics.

Also from Vital are updated products that include the fourth generation SAM automation system, designed to operate with the VIX 115 series master control switchers; the SANDI serial machine control system using SMPTE communications; and the PSAS II+ production switcher automation system. The PSAS II+ includes an updated non-volatile memory system allowing up to 256 build-your-own patterns for use with the SqueeZoom effects package and other improved features.

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HARRIS

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The evolution of TV production switching

By Craig Birkmaier and Donald Lambert, Production Systems Marketing Group, Grass Valley Group, Grass Valley, CA

The video production switcher is one of the most complex electronic devices in the TV production system, yet it is usually operated by a person whose primary concern is not the quality of the waveform, but rather the content of the program that is being created. The evolution of the switcher (or vision mixer) into a production system has been guided primarily by the operators of the system and by program producers, who determine the manner in which special effects are used.

With respect to the electronics at the other end of the control cables, the guiding force has remained basically unchanged over the years..."I want transparent video performance and I never want to tweak it." Maintaining the balance between more features and less maintenance has thrust the development of production systems into a perpetual race at the leading edge of technology.

Little activity took place in switcher development in the early years of television, while the camera, transmitter and receiver were reaching acceptable quality for commercialization. With the start of commercial broadcasting, the need for programming gave birth to the first mixer: two rows of mechanical switches selecting video inputs, their output feeding a 75Ω pot to mix between the rows. Mechanical switches gave way to relays, and the 75Ω pot was replaced with a tube mixer. The tube mixer allowed the first special effects: luminance keying and simple wipes.

Early special effects generators were separate units. But then the special effects generator was integrated into the switcher, where two buses feed signals into special effects circuitry, which subsequently feed a signal into the mixer buses. Large switchers also had program and preset/preview buses, and the output of the special effects generator and the mixer were re-entered into these buses.

By now, videotape had become a reality, and the switcher started to grow in the number of inputs. Also the advent of color created a world of problems in the design of the production switcher. Suddenly system timing became critical, and random switching, acceptable in black-and-white, was unacceptable for color. The solution was found in timing the switch between inputs, so that the *glitch* occurred in the vertical interval, safely out of view. In order to achieve the degree of control and speed of switching necessary to correctly time the switch, the relay gave way to a new device that has revolutionized our lives—the transistor. Although the transistor was a major breakthrough in switching, some time went by before the tube gave way completely to solid-state devices in the video mix amplifier and control processor.

The advent of color made a new special effect possible: chroma-keying. Instead of detecting a video level threshold in encoded video signal (as in luminance-keying), the keyer detected a threshold in one channel of the camera RGB outputs. The first chroma-keyers used the blue output, because the blue channel was least responsive in areas of flesh tones. A person, standing in front of a blue wall, could be matted into another picture.

Nearly simultaneously with chroma-keying, *electronic videotape editing* became possible, foreshadowing a new set of demands on the production switching system.

Keying grew in importance as a method of adding graphics and matting signals together. The keyer usually used one of the two mixer inputs to create a control signal, which was applied to the mix amplifier. The result was a self-key with the same video, which "cut the hole," then filled the hole. Also the keyer could create the hole with a chroma-key input or external video inputs. Inverting the control signal allowed keying black graphics onto a white background.

Solid-state mixers provided another major advancement in switcher design. A third input was added to the video mixer for a matte signal. The hole, created by the key signal, could be filled by one of the video inputs or matte. Wipe transitions were created by applying another control signal to the video mixer, similar to the key signal. The wipe control signal resulted from moving a pickoff point along an electrically generated waveform. From a second pickoff point, the wipe border was generated by inserting the matte signal during the time between the two control signals. The need for more effects led to more switchers in the form of the two mix/effects units with a cascading re-entry system. Because of color tim-

Continued on page 84

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IKEGAMI'S NEW HL-79E THE HEIR TO THE THRONE

Ikegami's latest technological triumph, the HL-79E, heralds a new generation of hand-held broadcast camera excellence.

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In the fiercely competitive video market where others hope to be as good as the HL-79D, Ikegami is the unquestioned leader. And the HL-79E will soon ascend to a loftier throne as King of the Jungle. Only by seeing this remarkable camera in action can it be fully appreciated.

How great a camera is it? To begin with, it is smaller and lighter than the world's standard for comparison, the Ikegami HL-79D Series. And it has features as yet unknown to even sophisticated camera users: Dynamic Detail Correction, Chroma Aperture Correction, Highlight Aperture Correction and Auto Contrast Compression. Plus the HL-79E offers improvements in contrast range, S/N ratio, registration, accuracy, resolution viewfinder performance and more.

Optional accessories include the ADC-79E Auto Set-Up Digital Control, the RDC-79E Remote Digital Control and the VF 45-3 Large Viewfinder. The HL-79E is compatible for use with existing HL-79A and HL-79D lenses, power supplies, VTR cables, and other accessories. Plus, it can be adapted to the MA-79 Multicore Base Station and TA-79/79C Triax Base Station.

ADC-79E Auto Set-Up Digital Control

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Ikegami HL-79E

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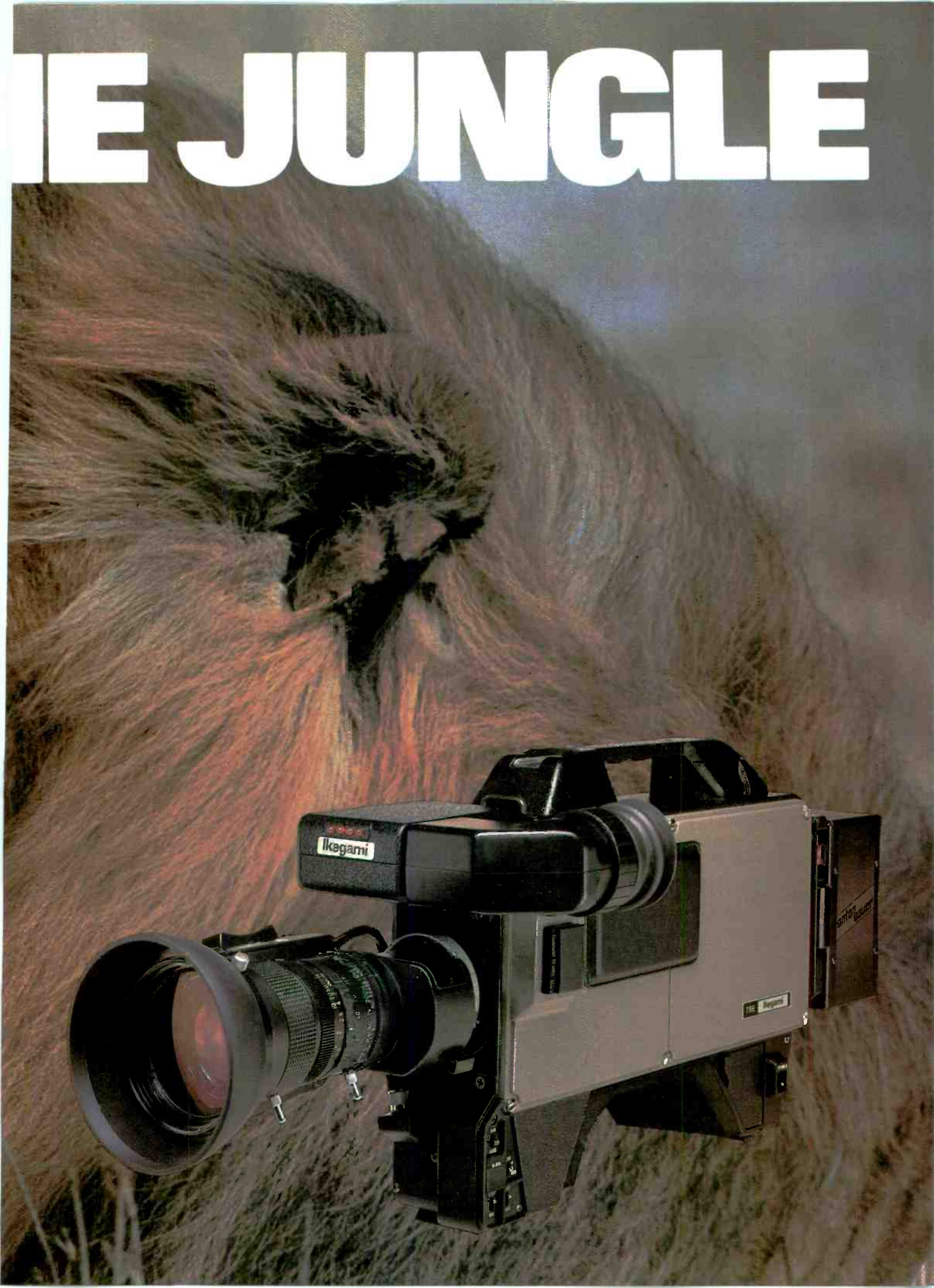
IE JUNGLE



Continued from page 80

ing requirements, the re-entry amplifiers required video delays and equalization amplifiers. These amplifiers, in series with the bus output and video mixing amplifiers, caused the switcher path length to grow—to the limits of acceptable video performance.

The readability of keyed graphics often suffered because of the similarity in some portions of the picture between color or luminance levels of background and keyed inserts. By delaying the key control signal through two delay lines, each with one horizontal line delay, it was possible to anticipate key transition changes and process them to create a wider key hole. The hole was filled partially with matte corresponding to the original key signal. The resulting Borderline generator allowed a 1-line black border or 2-line drop shadow to be placed around the key. Using the difference of the control signals, a color outline of the key could also be generated.

By now computer control of video-tape editing was possible, and crude control of the switcher through a parallel interface of the computer and switcher electronics was attempted. Switcher limitations, which had never been noticed in live productions, became apparent in post-production. If the levels of switching bus and mix amplifier outputs were not identical, shifts were noticed in match frame edits. Switcher alignment became a critical factor. The problem was aggravated by increased demands on the production switching system.

Improvements in video mixer technology made it possible to adjust the rise time of control signal changes. These shaped control signals improved key transitions, allowing another new effect, the soft wipe. Along with performance enhancements, another milestone was reached in switcher design. It was possible to combine control signals to the mix amplifier for transitions such as a mix or wipe to a keyed insert or preset pattern (pattern limit). The need for re-entry to create many effects was reduced, but program producers pushed for more. Continuing work in amplifier design permitted extending the switcher's path lengths again, and soon production switchers with three mix/effects systems were available. The control panel was becoming so complex that qualified operators were virtually guaranteed job security.

To lend the operator a hand, the computer was brought to the aid of the operator. As with equipment from other manufacturers, the GVG E-MEM effects memory system could *learn* control panel configurations and store them in memory registers for use during productions. The capability for storing analog control information opened the door for another significant capability, effects dissolves. The operator could store a beginning group of analog settings, and an ending group of settings; the computer determined the information in-between. Thus smooth transitions of analog controls, such as the pattern positioner, could be programmed at any rate the operator desired. Later sequences could be created by linking mix/effects registers together, combining panel setup changes and effects dissolves for complete production sequences. This capability was extremely attractive for computer-assisted post-production. To provide the editing computer with more control of the production switcher, a serial interface was developed for the E-MEM system and others.

The computer rapidly appeared in other production devices, such as character generators and in a revolutionary device, the digital video effects system. Now pictures could be

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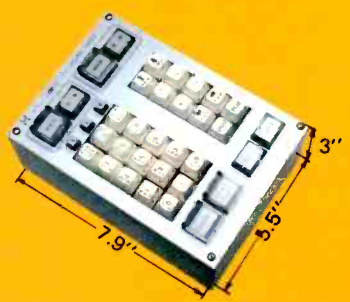

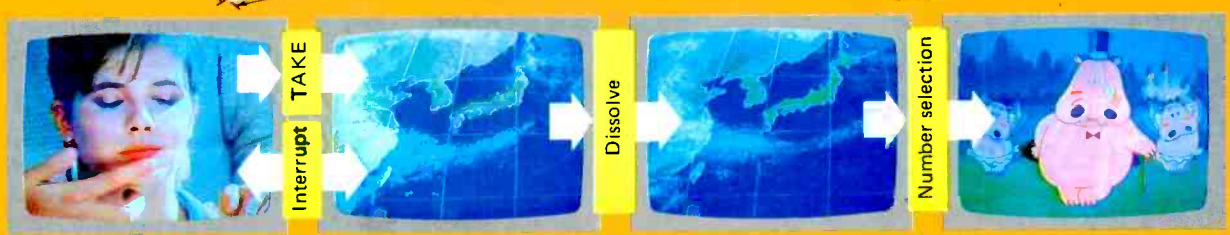

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     Operate with the on-air image output and next preview output with comment connected to the on-air monitor and next monitor respectively.
  3. Operate with the on-air image output, next preview output and comment output connected respectively to the on-air monitor, next monitor and monochrome monitor.
- The operation panel is small enough (1/2 letter size) to be installed anywhere.
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- The switch section of the operation panel can be removed and used up to 3 m away through an extension cable. Therefore, the operation board can be freely designed by installing the switches at the desired desk and connecting them to the operation panel with this extension cable.
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manipulated in size, flipped and tumbled. These new production devices placed a great deal of strain on existing switchers. There were never enough keyers, and an entire mix/effects bank was consumed to provide the input to the DVE. Most units offered a separate key signal from the video, so the DVE could track the picture size and character generators could pass edging information.

The industry responded in a variety of ways: One approach placed bus keyers over each switching bus input to the mix amplifier, allowing three keys on a single mix/effects system. Another approach added key inputs to the mix amplifier allowing a background transition behind two keying levels. Both systems are currently available. The system with two keys over a background transition seems to be more popular, due largely to the operating technique. These systems employ non-directional transition levers and preview capabilities. The operator chooses which levels (background, key 1, key 2) are to be changed, and the preview system shows the result of the next level transition. This system virtually eliminates the lock-up that could occur in operating earlier systems.

Along with the new switcher architecture came other new capabilities: soft-bordered wipes; vastly expanded pattern generators with wipe rotation and matrix wipes; multiple latch keyers, which could key several inputs simultaneously, such as two channels from a character generator; and separate key mask generators. Additional provisions were made for digital video effects generators, such as auxiliary switching buses, talley implementation and with some systems, integration into the switcher control panel.

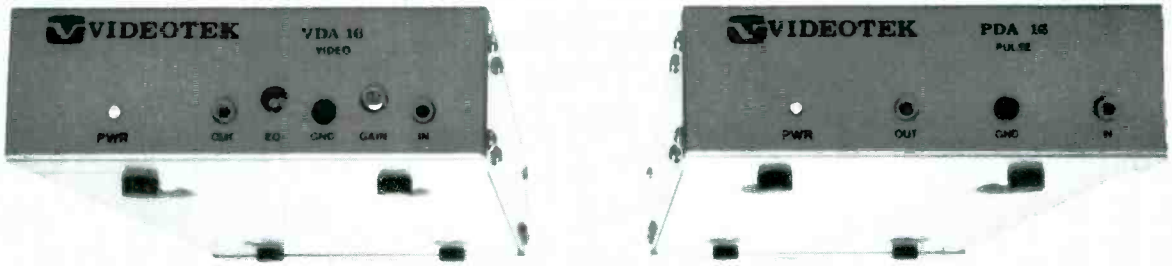
Thus we have arrived at the production switching systems of today. Today's equipment is *intelligent*, communicating with other devices in the system, such as computerized editors, frame stores and character generators. The system provides virtually transparent performance and greatly reduced maintenance. And yet, it is still changing, to meet the demands of the next new technology.

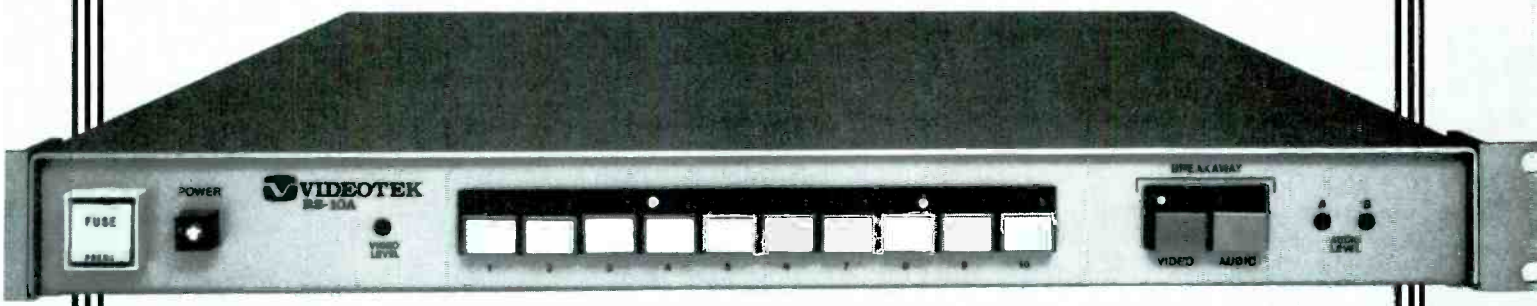
Editor's note:

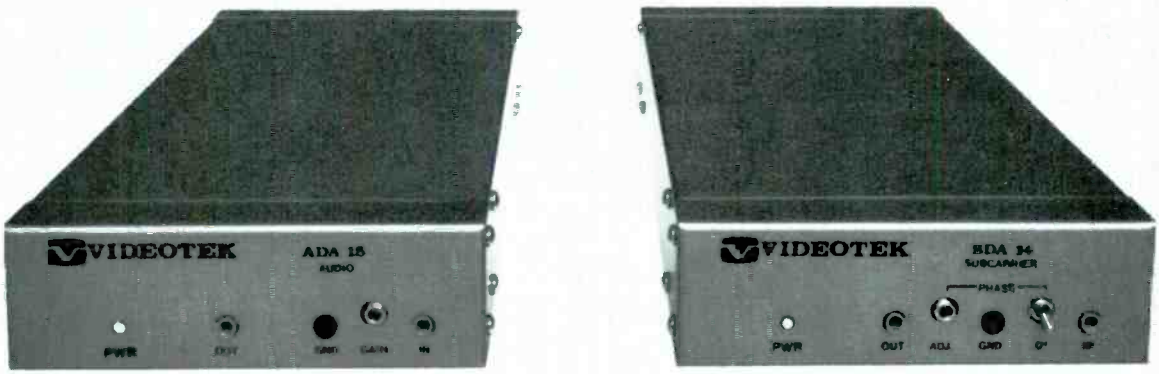
In putting together this issue of **BE**, we planned to insert into the "Video Switcher Update" article a sidebar that pinpointed milestones in the history of the systems' development. However, the people at Grass Valley thought that they could shed some light on this evolution in switcher equipment provided we would not pin them down on specific dates.

This article is the author's narrative presentation (omitting dates) of historical landmarks in switcher development. Readers who think that other highlights should be pinpointed are welcome to submit letters detailing points for inclusion in a future update on this topic.

PROGRESS







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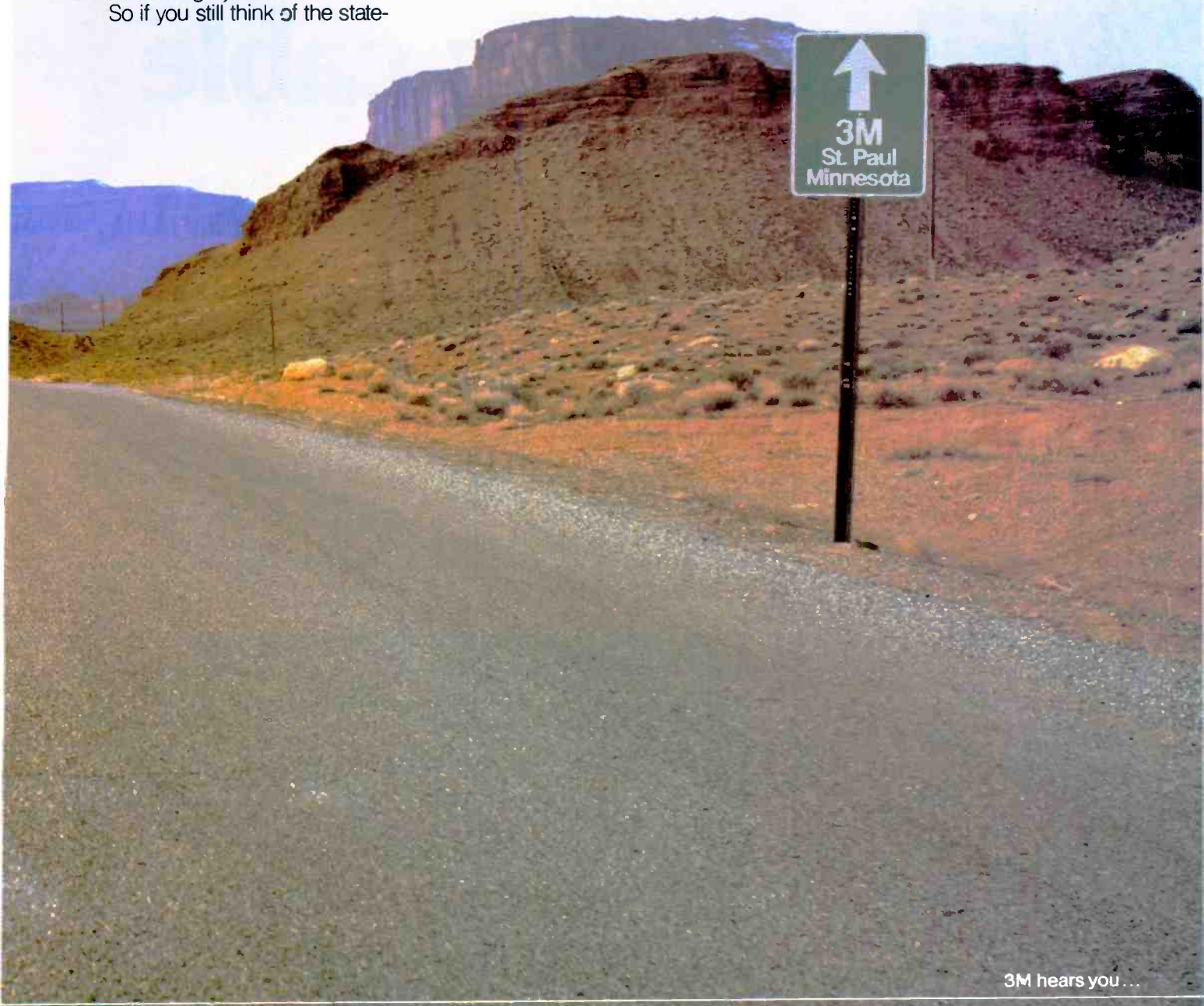

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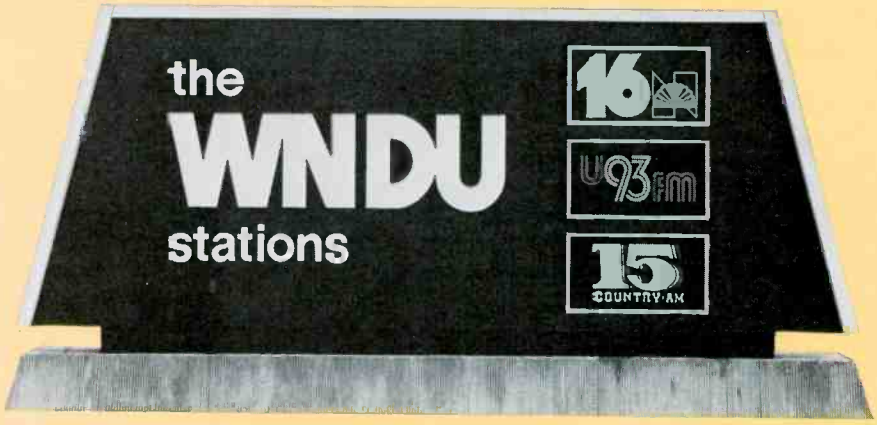
Case study:



Fiber-optic cable at Notre Dame

WNDU-TV, South Bend, IN, an NBC affiliate owned by the University of Notre Dame, has installed fiber-optic cable* to link its new studios with the university's sports facilities and Center for Continuing Education (CCE).

The fiber-optic cable, with video and audio capabilities, replaces conventional coaxial cables used in the old studio. The new cables, which use pulses of light instead of electrical signals, travel approximately 6900 feet through conduit in steam tunnels beneath the Notre Dame campus. These cables tie TV cameras or any other video and audio source in the CCE, football stadium and hockey and basketball arenas of the Athletic & Convocation Center (ACC) with the WNDU-TV studios and satellite station.

Gregory J. Giczi, WNDU-TV promotion manager, said that the fiber-optic cables will facilitate the station's broadcasts of Notre Dame seminars, sporting events and concerts, providing a high quality link with its satellite receiver-transmitter for nationwide satellite broadcasts.

This heavy-duty standard cable (Belden 229802) is a 6-fiber cable with a stranded steel strength member. Each 50-micron graded index fiber is protected by a 2mm diameter buffer tube. The buffer tube is helically wrapped around the strength member with an external jacket of black polyethylene. The overall diameter of the cable is 8mm and normal attenuation is 4dB/km or less at 850nm.

The two cables between the ACC and WNDU-TV are each approximately 6692 feet long; the cable from the football stadium is 5708 feet long; and the one from the CCE is 4855 feet long.

"We bought miles of cable for our new studios," Russell Summerville, WNDU-TV chief engineer, said. "WNDU-TV had used coaxial cable in the past to link the football stadium to the old station, but had run into many problems. Owing to frequency tilt, we had to install equalizers and amplifiers on our equipment, and this degraded the signal. Fiber-optic cable is state-of-the-art. In the future, we'll be able to hook it up easily to new, advanced equipment."

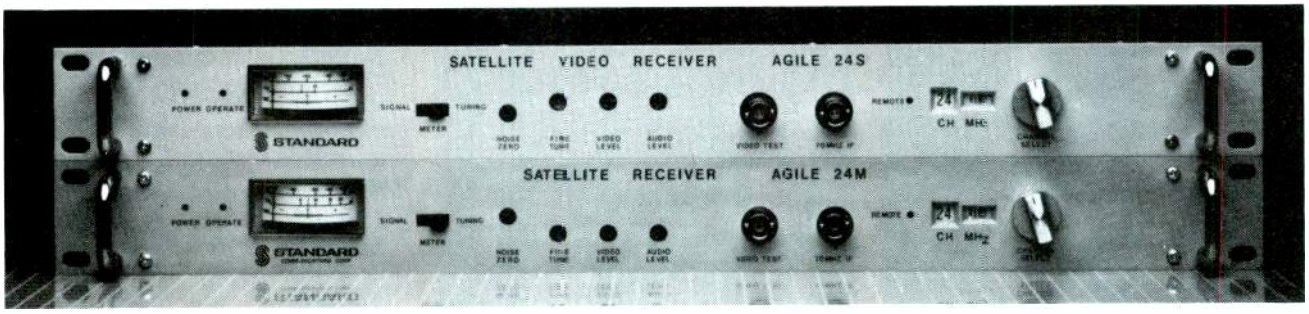
There is, in fact, the potential to hook up 4-5 cameras to each fiber instead of one, as at present.

This project illustrated the advantage of working with a manufacturer.

Aerial view of Notre Dame campus. Shown (from left) are the Center for Continuing Education, the football stadium and the Athletic and Convocation Center.

*Belden Corporation fiber-optic cable was installed. Belden provided the input data and photographs for this report.

Component for component, Standard still offers the best TVRO system for its price in the industry.



Agile 24M-S Satellite Receiver-Slave

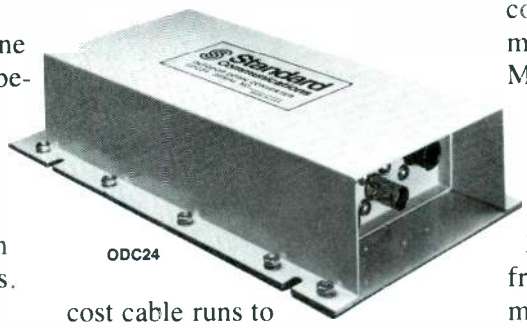
There are a lot of firms offering so-called "complete" TVRO systems. Only Standard Communications has a full product line TVRO system backed with competitive pricing, immediate availability, free demonstration program, and the kind of field service/engineering team with more than a dozen years' experience in high technology communications.

Take our proven, reliable Agile 24 stand-alone receiver system. It features loop-through design capable of driving up to 100 slaves at a lower cost per channel

LNBC24

than an equivalent number of masters, dual conversion circuitry that converts the signal down twice, and 16 dB converter gain.

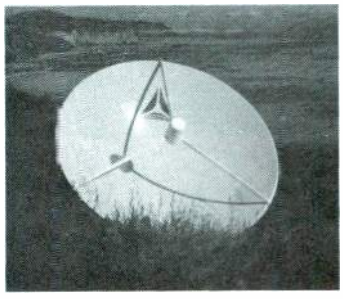
Our LNBC24 Low Noise Amplifier/Block Down Converter features GaAs FET technology, 100°K noise temperature, 1.5 dB noise figure, 55 dB gain. It mounts directly on the earth station antenna permitting use of low cost cable runs to the satellite receiver.



ODC24

Use our ODC24 Outdoor Down Converter with our Agile 24S slave receiver to block downconvert microwave signals from 3.7 to 4.2 GHz to 760 to 1260 MHz. By mounting the ODC24 on the LNA, longer cable runs to the receiver using low cost cable are possible. The ODC24 also features 16 dB conversion gain, and a weather resistant housing and built-in heater for all weather operation.

Earth Station Antenna



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Our earth station antennas are unit-molded to assure precision contour for increased gain and minimal RMS surface deviations. Models are offered in 3.7, 4.6 and 5.0 meters with polar, computer-controlled azimuth drive or fixed mounts.

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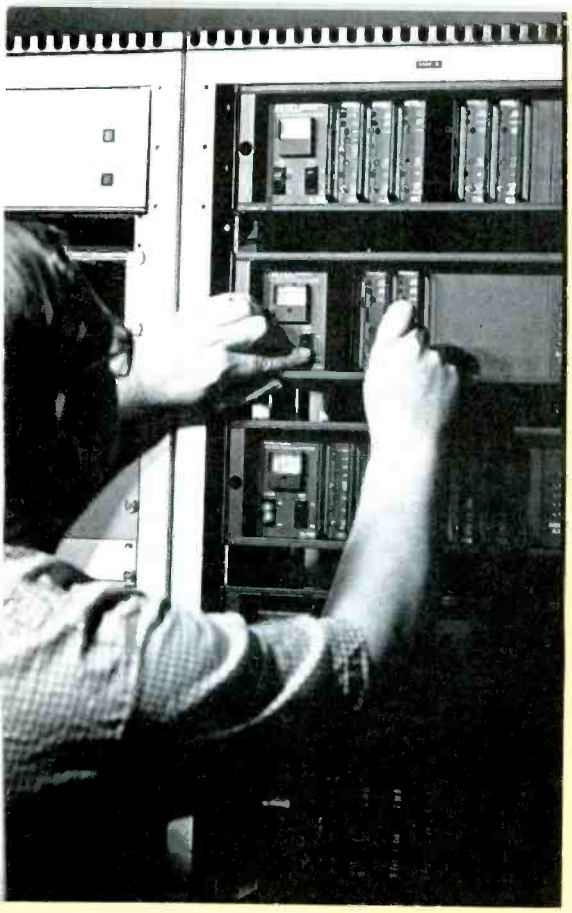
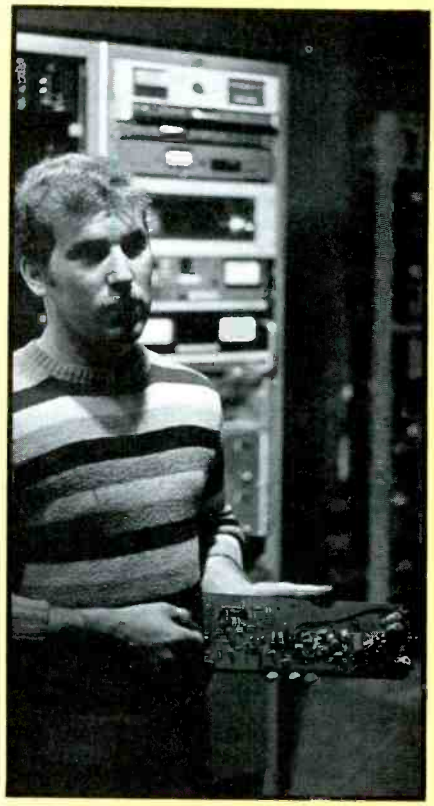


Melvin Dzialak, engineering supervisor, monitors equipment in the WNDU-TV control room.



Ed Washak, Belden sales applications engineer, explains how a video transmitter converts an electrical signal into an optical signal.

Ed Washak, a Belden sales application engineer, said that it would be necessary to install six coaxial cables to approach the capabilities of one 6-fiber fiber-optic cable, and even then the coaxial cables would not perform as well. He said that to use a coaxial cable system at Notre Dame, they would also have to put in at least three equalizing amplifiers, which would degrade the signal. And there would not be the same frequency response as with fiber-optic cable.

Washak said that fiber-optic cable has other advantages over coaxial cable. "It's easier to install, it has better video and audio quality, there is virtually no noise interference, and it's capable of 2-way feeds. Other advantages of fiber-optic cable are its small size and light weight, flexibility and high strength, large bandwidth, and immunity from electromagnetic interference, lightning and electrical discharges. There are also no electrical ground loops or short circuit problems."

Eight technicians from Great Lakes Electric in South Bend, IN, pulled the cable through 2-inch conduits inside steam tunnels beneath the campus. With the temperature in some of those tunnels reaching 120°F, it was not an easy pull. But the technicians reported

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Amazing the performance some people make out of telling the time.

It's a frightening fact that a large number of otherwise up-to-date T.V. stations devote as many resources to broadcasting a clock as they do to, say, a news flash.

So to correct the balance, at GEC McMichael we've produced an electronic generator to do all the work.

Once programmed, it will produce a high resolution graphic image and an analogue clock face.

(Incidentally, it's possible to programme the generator to produce as elaborate a logo as you like. You can even choose your own clock face).

Naturally, the clock is super-accurate. It works with a one second pulse or a sync. and blanking signal, so there can be no mistake.

There's no hassle either.

Because all the main functions can be controlled either through the front panel, or by remote control from the console.

Which thankfully is a far cry from the song and dance needed for the alternatives.

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A Great Lakes Electric technician feeds cables into conduit.

that they did not face any serious problems.

The team pulled the fiber-optic cables through conduit along with a ½-inch diameter 24-pair telephone cable. This complicated the pull because the telephone cable was thicker and stiffer than the fiber-optic cables, and at times required jerks around 90° turns. Although the cables were well-greased with Polywater and Yellow 77 lubricant, they were probably subjected to more than 300 pounds of force during the pull. However, the fiber-optic cable selected was constructed to withstand 500 pounds of tension during installation. Because the last 800 feet did not include the telephone cable, that section of the pull was easier.

The installation

The dispensing reels were first set up in a steam tunnel near the CCE. Starting at a breakout box located in the center of the run, the cables were pulled through the conduit to WNDU-TV, where Washak connected them to Artel video receiver modules with Amphenol connectors. The Artel video modules convert the electrical signals transmitted from the TV cameras into light signals to be sent over the fiber-optic cable. At the receiving end, the optical signal is reconverted into an electric signal that can be broadcast by the station.

Next, the workers pulled the cables in the opposite direction toward the Continuing Education Building, football stadium and basketball and hockey facilities at the ACC. At these points, the cables were connected to Artel video transmitter modules, which were then linked up to TV cameras.

A total of 48 fiber-optic connectors were installed (six on each end of the four 6-fiber cables). The breakout, with connectors attached, takes about 20 minutes per fiber. Washak used Belden multifiber cable breakout kits

Russ Summerville, chief engineer, shown in the control room at WNDU-TV.

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AUTO-DUB. For safety copies of your source tapes or edited masters, all you need is IVES' one-button Auto-Dub command. A direct dub from the play VTR to the record VTR, or vice versa, is that simple, and both VTRs automatically rewind before dubbing.

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In addition to all this, the IVES contains its own *internal NTSC sync and video black generators* and *dual internal SMPTE time code generator/reader* for the record and play VTRs. And IVES offers variable rate video fade to/from black, split audio/video edit capability, output to a printer and a non-volatile memory.

IVES, the Intelligent Video Editing System from EECO. It has no competition. For more information write or call, Video Products Marketing Group, EECO Incorporated, 1601 E. Chestnut Avenue, P.O. Box 659, Santa Ana, CA 92702-0659, 714/835-6000.

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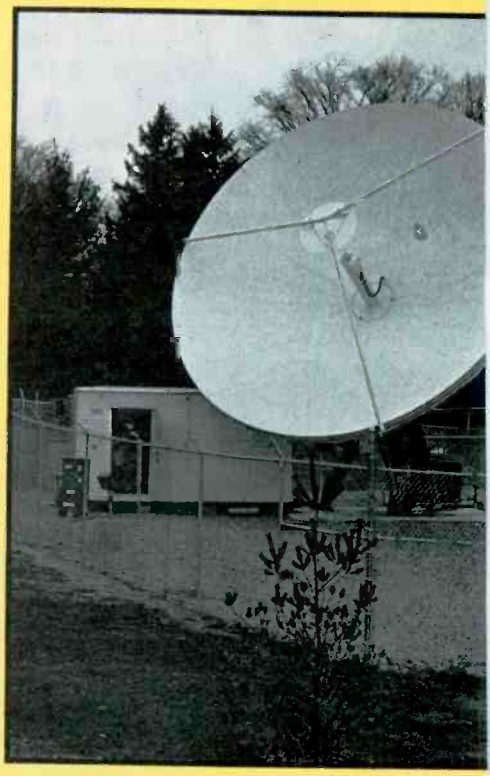
WNDU-TV's facilities.



WNDU-TV satellite communications earth station.

to install the connectors. With these kits, it is possible to install single fiber-optic connectors on multifiber cables containing 2-18 fibers. The breakout unit permits the separation and protection of individual fiber elements in multifiber cables so that they can be routed to individual equipment locations.

After the breakout unit had been installed, the fibers were terminated using standard connectors, the same as used on an equivalent single-fiber cable. The basic steps were as follows:

- Prepare the cable by stripping the jacket and trimming the internal Kevlar yarn strength members.
- Prepare the fiber by removing the

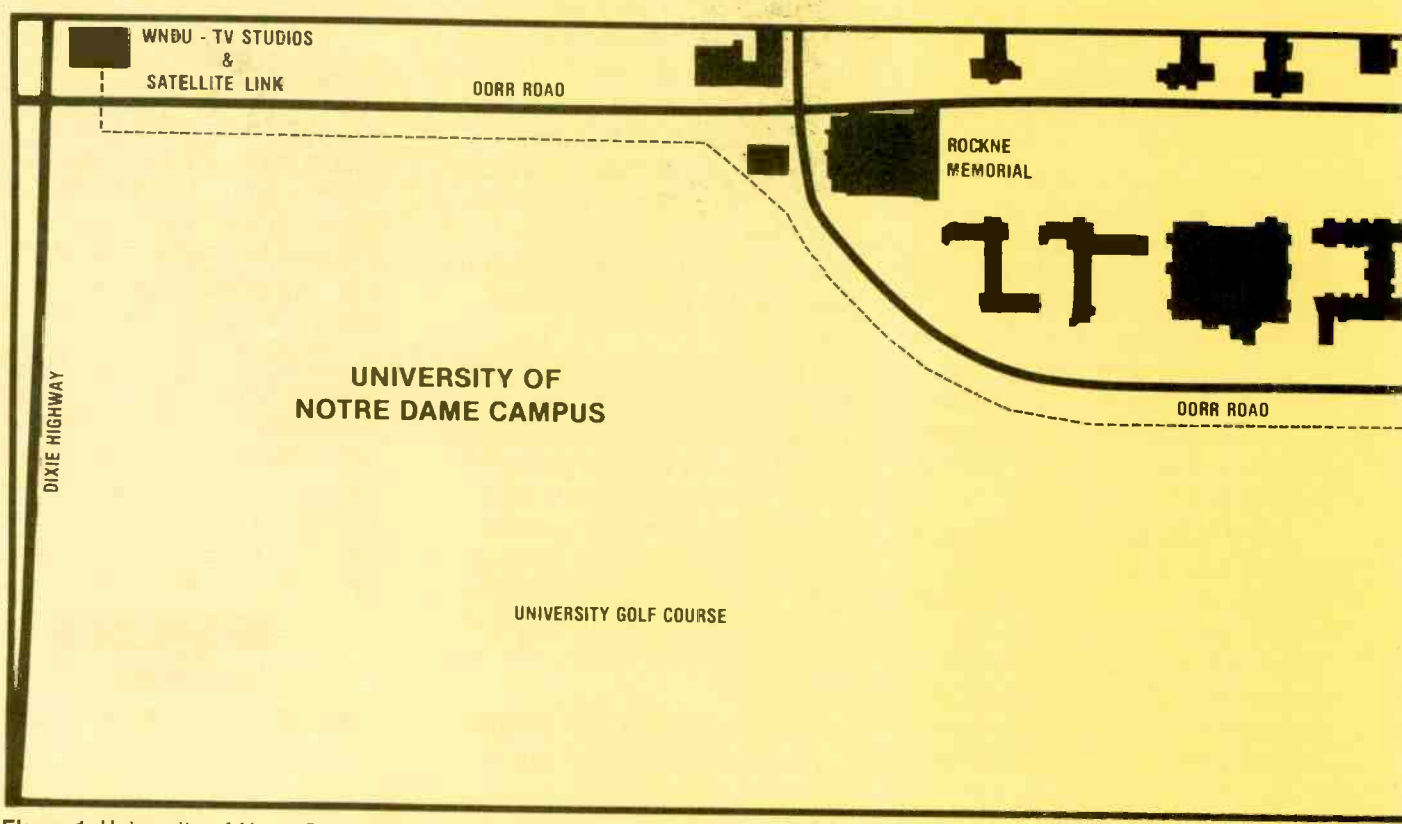
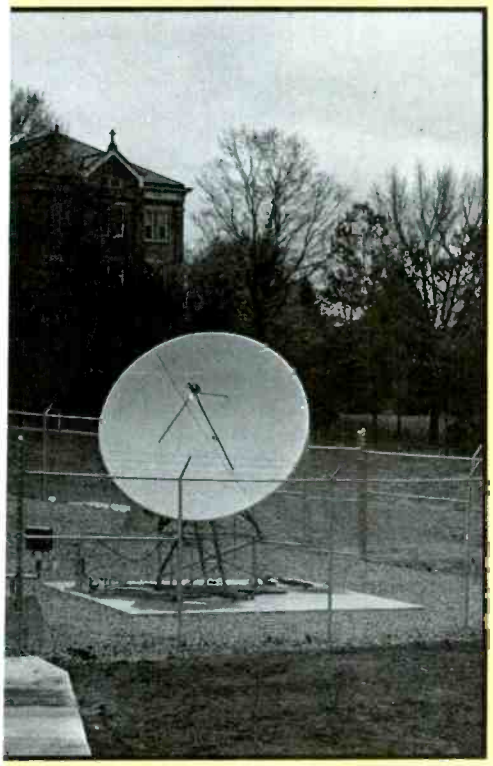


Figure 1. University of Notre Dame campus. Route of fiber-optic cable is shown by dotted line.



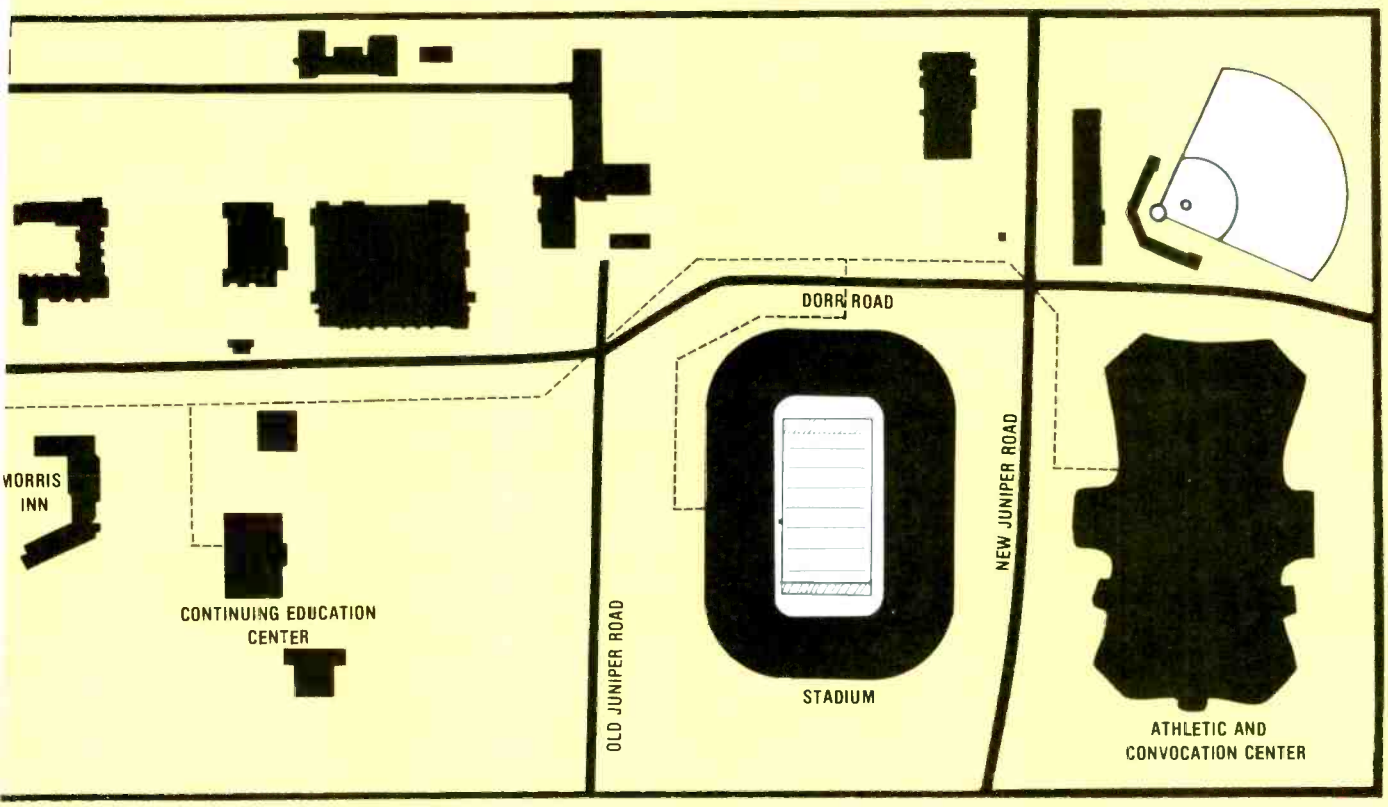
The Center for Continuing Education (CCE).

Athletic and Convocation Center (ACC).

plastic protective coating.

- Fill the connector body with epoxy and insert the fiber into the connector.
- Crimp the connector body around the Kevlar strength members, similar to the way a shield is crimped to a BNC connector.
- Wet-polish the end of the connector after the epoxy cures.

The fiber-optic cables were inaugurated at the Notre Dame/UCLA basketball game. "We received bright, sharp pictures, with great color," Summerville said. "The audio and video reception is outstanding. And the quality is superior to coaxial cable."



Field report:

Shure M267 mixer

By Brad Dick, chief engineer, KANU, Lawrence, KS

Someone at Shure Brothers must have wondered how to invent a better mousetrap. Surely some engineer told the design team that it would be a waste of time to try to improve the good ole M67 mixer. No doubt there must be thousands of the little M67 rascals out in the field. However, there is now an even better M67 mixer, termed the M267.

The M267 mixer, introduced about two years ago, does not seem to have achieved wide acceptance in some quarters, perhaps because it is more expensive than the M67 (which is still available). However, take it from a skeptic, the additional features make the price difference worth it.

General specifications

The mixer was received in the shop some weeks before the football season, and I left it next to my desk until the first KU game. Before the game, the standard series of audio tests were conducted: frequency response, noise and distortion. These were followed by a variety of mechanical tests.

The quality came through with flying colors. The results of the audio performance tests are shown in Figure 1 (page 100). The M267 shows flat frequency response and low noise and distortion characteristics.

Front and rear views of the M267 mixer.

Low-cut filters

The low-frequency filters, termed low-cutoff filters by Shure, provide a margin of safety when the operator is faced with unwanted low-frequency components (below 60Hz). The filters can be inserted from the front panel, a convenient feature during a broadcast or recording session. The new switches for the low-frequency filters and microphone or line input selection are small raised buttons, a design that makes it impossible to turn them on unless you really want to.

New tone oscillator circuit

The Channel 1 fader has a front-panel switch to turn on the oscillator. This front-panel design is a marked convenience over a rear-panel design, which is hard to reach. Also, the new slate tone circuit is an oscillator that is capable of producing a low distortion tone. The tone also starts *every time*, which was not always the case with the older circuit.

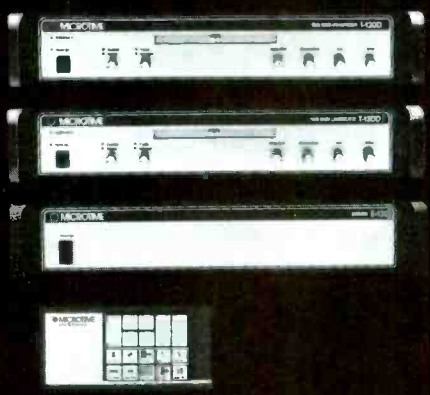
Among the other operating functions are the front-panel headphone jack and volume control. The rear panel contains a switch for selection of either line or amplifier feeds for the front-panel headphone jack. The primary advantage of the switch is that low impedance headphones can now be driven directly from the amplifier output of the mixer and still be of sufficient level to override any crowd noise. The line position allows the operator to hear cues sent back down the line from the studio. The front-panel mounting of the headphone jack and volume control makes it easier to plug in a pair of headphones and adjust the levels without the chance of upsetting any connections or the audio levels.

Limiter circuit

Perhaps the most beneficial feature of the whole mixer is the built-in limiter circuit. I must admit that I was a bit skeptical of the performance capabilities of the simple limiter circuit in this mixer. However, it took the coverage of only one football game to convince me that the added benefits from the limiter make the additional cost of the M267 unimportant.

The limiter function is controlled by a front-panel switch and indicating

Two standalone Time Base Correctors (T-120D), an Effects Processor (E-120) and an Effects Control for a remarkably low price.



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Effects such as push off, push on, pull off. Square wipe, corner wipe, horizontal wipe, vertical wipe. Dissolves and fade to black. All effect rates are selectable by push-button. All wipe transitions have controlled rise and fall times to minimize ringing. And the system features a hand-held effects control with a 75-foot cable for convenient placement.

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__ 8 bit 4x subcarrier digital design for high reliability and transparent performance.
__ DT* operation with SONY* BVU-820 U-MATIC*, VTR plug compatible.
__ Operates with all ½" and ¾" heterodyne VTR formats, with or *without* 3.58 subcarrier feedback.
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T²E-120 Digital Effects System.
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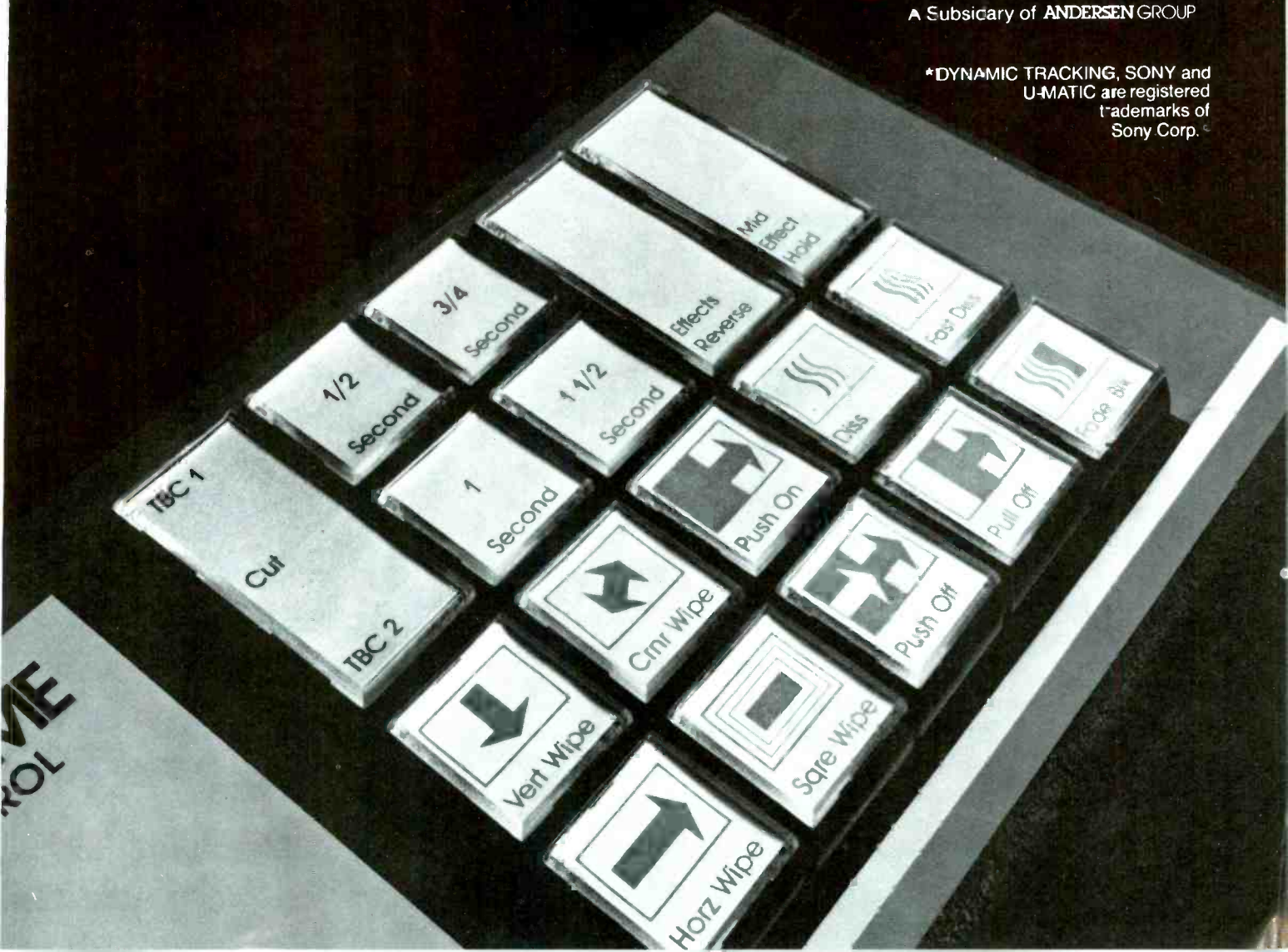


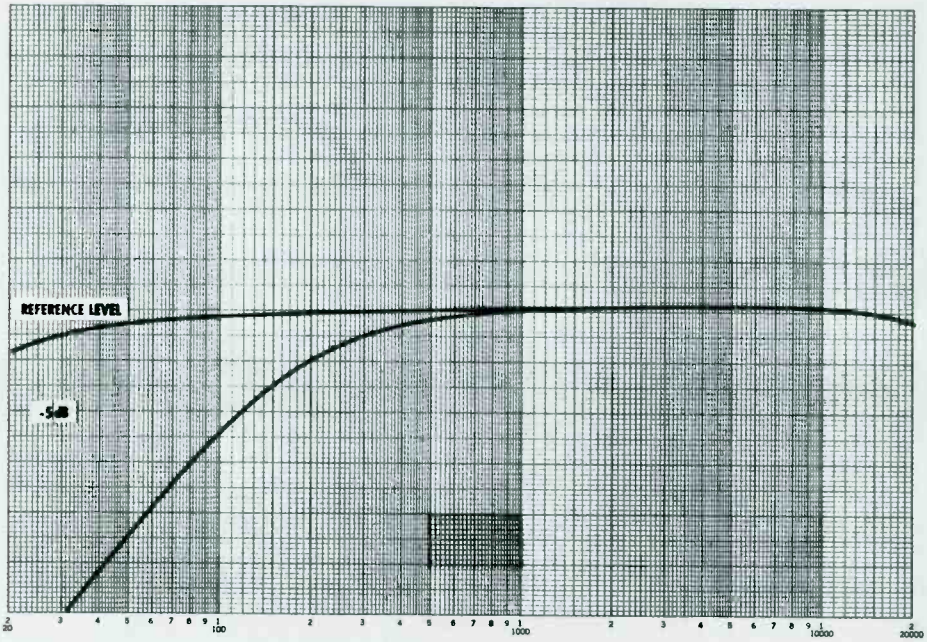
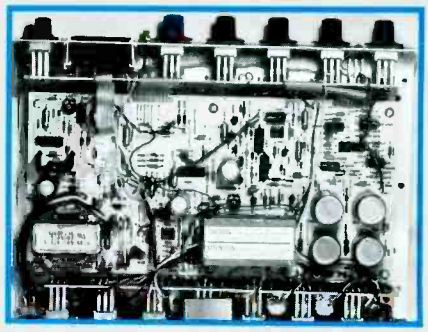


Figure 1. Audio performance of the M267.



Layout of the M267 mixer.

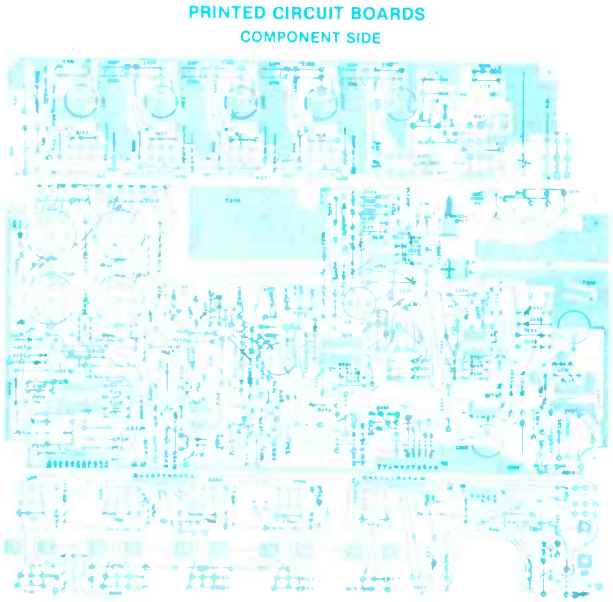
LED. The LED shows when the audio has reached a level where the limiter is capable of taking effect. Turning on the limiter switch places the limiter in the feedback loop of the buffer amplifier, and an effective form of audio limiting takes place. No distortion, no pumping, no noticeable degradation of quality results, just smoothly limited audio comes from the mixer.

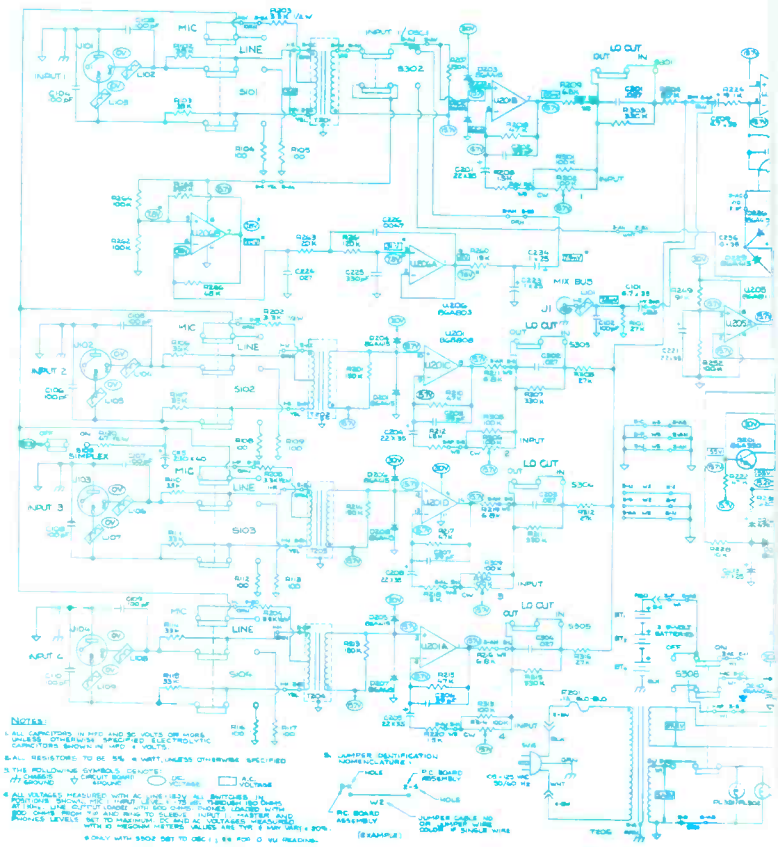
The limiter has the additional capability for monitoring the power supply and lowering the limiter threshold as the battery or ac voltage levels drop. This keeps the output audio clean even if the batteries are dying or the ac supply voltage varies.

I knew that the levels were exactly where I wanted them throughout the game. Even when the "Squawk of the Hawks" came unglued about the score, the audio remained properly controlled and level. For those engineers having to deal with sportscasters who run the gamut from loud to superloud or sportcasters who must run their own mixers, the M267 is the answer to a prayer.

General construction

The mixer is similar to the M67 in





The data sheet for the M267 comes with PC board layout and circuit diagrams.

layout and construction. A major electrical improvement is in the quality of semiconductors. The mixer uses RC4559NB and RC4156DB integrated circuits for most of the low level signals, thereby providing low noise and superior performance over previous designs. All inputs are transformer-balanced and well-shielded from RF interference. In those instances in which RF has been a problem with other mixers, the M267 may provide an extra margin of safety.

The input XLR connectors no longer have the captive latch common to most XLR inputs. However, this fact is actually a benefit to the user. The inputs will not accidentally come unplugged in most cases; even without the captive latches the fitting is secure. It is now easier to unplug the connectors.

The mixer has XLR and banana output connectors. The XLR output is switch-selectable to microphone or line levels. This feature allows an operator to standardize on cables, all with XLR fittings. The mixer also provides two transformer-isolated line-level outputs, with output levels selectable to either +4dBm or +8dBm via a rear-panel switch.

The M267 no longer requires an external battery supply because there is

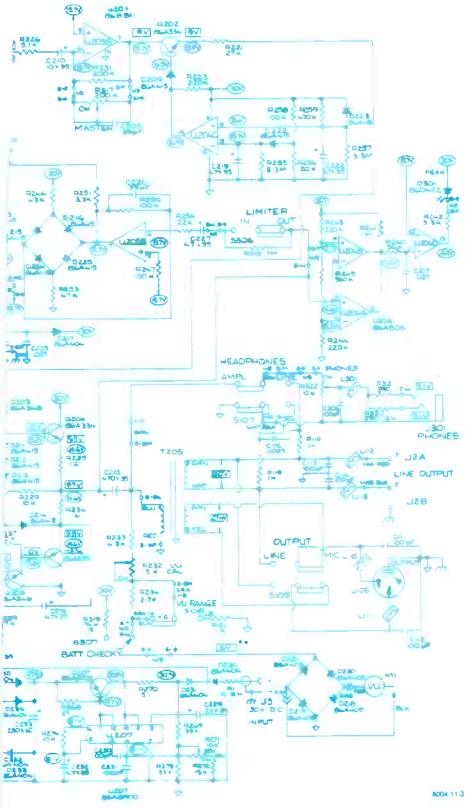


Table I.
Measured specifications
Frequency response (30-20,000Hz): ± 2dB
Hum and noise at + 15dBm: – 62.5dB

Distortion at	100Hz,	+ 15dBm	0.08%	(line input)
Distortion at	1000Hz,	+ 15dBm	0.08%	(line input)
Distortion at	10kHz,	+ 15dBm	0.08%	(line input)
Distortion at	100Hz,	+ 15dBm	0.08%	(mic input)
Distortion at	1000Hz,	+ 15dBm	0.10%	(mic input)
Distortion at	10kHz,	+ 15dBm	0.08%	(mic input)

room within the mixer case for backup batteries. The mixer uses standard 9V batteries. (It does not have a charging circuit, which could have been useful.) The batteries can be changed by the simple removal of an access panel on the bottom of the mixer, and the condition of the batteries can be checked from the front panel by depressing a switch next to the VU meter.

The outer case, no longer metal, is a rugged form of abrasion-resistant plastic. The front-panel knobs are protected from damage by small rails extending on both sides of the mixer. The smaller knobs increase the spacing between the pots so that larger fingers can more easily control the levels. Mixing on the unit was pleasurable and easy.

Simplex-powered mic inputs

The microphone inputs can be simplex-powered from the mixer to allow the use of condenser microphones. With the rear-panel switch on *Simplex*, and the rear-panel switches in the *Mic* position, 30Vdc is applied to pins two and three of each input connector through a series-limiting resistor of 3.3kΩ. Considering the number of condenser microphones now available at a reasonable cost, this feature may be useful in many applications. Shure notes in the instruction manual that the simplex power can even be used to power its line-level microphones, thereby eliminating the need for batteries.

The M267 microphone mixer comes from a long line of high quality audio products. Combining features, operating convenience and low cost, Shure has brought to the market a mixer that is difficult to equal. The mixer provides almost every feature a remote broadcast could need, while also providing studio quality performance. This mixer should be considered a standard of any engineer's remote kit.

Editor's note:

The field report is an exclusive **BE** feature for broadcasters. Each will be prepared by the staff of a broadcast station, production facility or consulting firm. The intent is to have the equipment tested on-site. The author is at liberty to discuss his research with industry leaders and to visit other broadcasters and/or the manufacturer to track down pertinent facts.

In each field report, the author will discuss the full applicability of the equipment to broadcasting, including personal opinions on good features and serious limitations – if any.

In essence, these field reports are prepared *by* the industry and *for* the industry. Manufacturer's support will be limited to providing loan equipment and to aiding the author if support is requested in some area.

It is the responsibility of **Broadcast Engineering** to publish the results of any piece tested, whether positive or negative. No report should be considered an endorsement by **Broadcast Engineering** for or against a product.

The equipment for this report was shipped to **BE** by Shure Brothers and was loaned to the author for analysis and reporting. Data on the equipment is available from Shure Brothers, 222 Hartrey Ave., Evanston, IL 60204.

New Gould portable video monitor/ oscilloscope lets you select by number any line of composite video.

Meet our new OS3350/5. It's the first-ever NTSC 525-line waveform monitor, complete picture monitor, and 40 MHz oscilloscope combined in a single, portable package.

Through an onboard time-base generator, it lets you examine each of the composite video signal's 525 lines—one at a time. PAL plug-in available.

Or you can display complete pictures, highlighting any line selected for inspection to show the relationship between waveform and picture.

And finally, our OS3350/5 functions as a general-purpose 40 MHz, 5mV/cm dual-trace scope.

Our compact monitor/oscilloscope is suited for testing and troubleshooting TV, CATV, CCTV, video recorder/playback and other equipment in mobile TV, microwave repeater, broadcast station, institutional, military, plant and production-line applications.

For more information, contact Gould Inc., Instruments Division, 35129 Curtis Boulevard, Eastlake, OH 44094. Phone 800/321-3035.

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Electronics & Electrical Products

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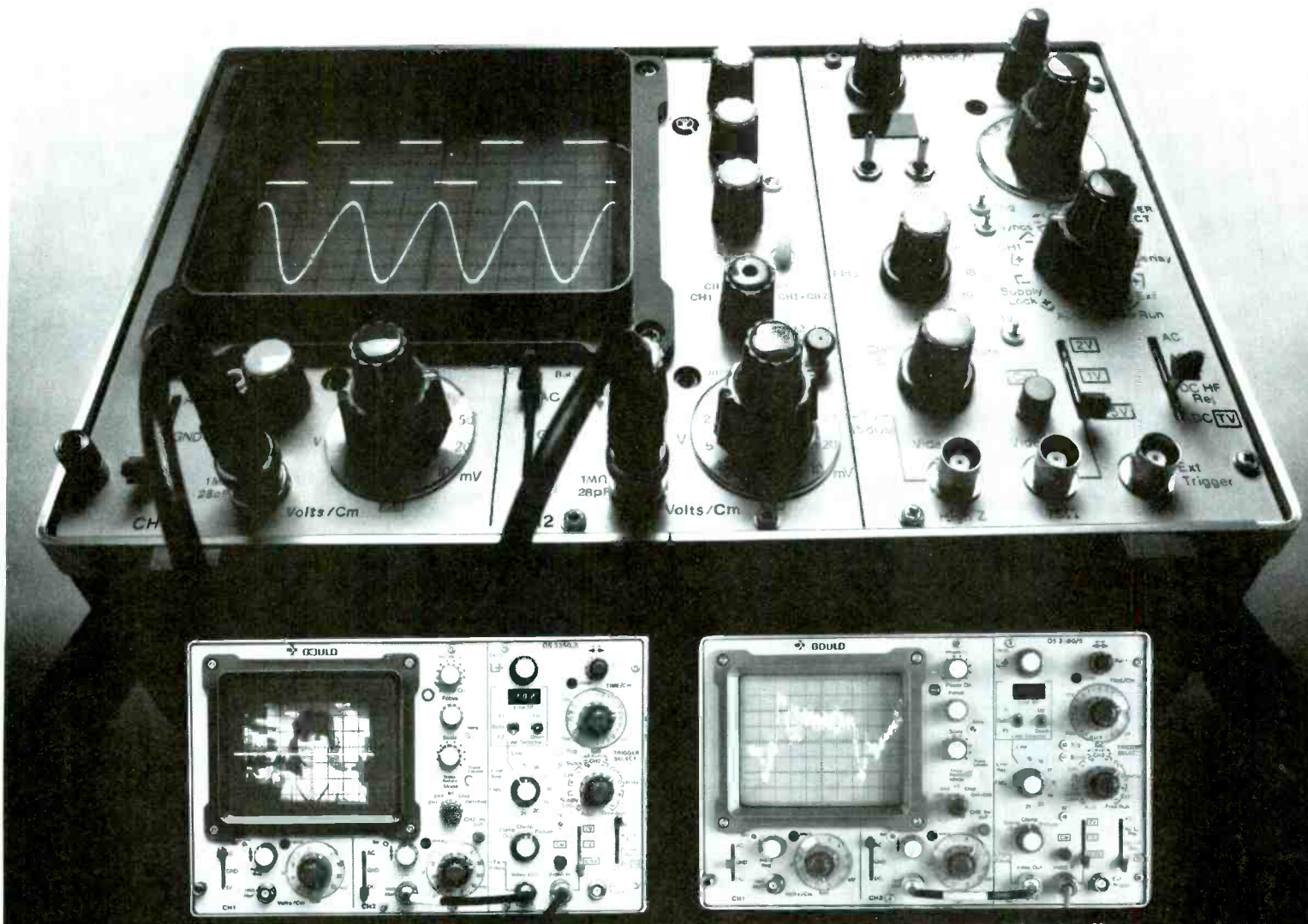
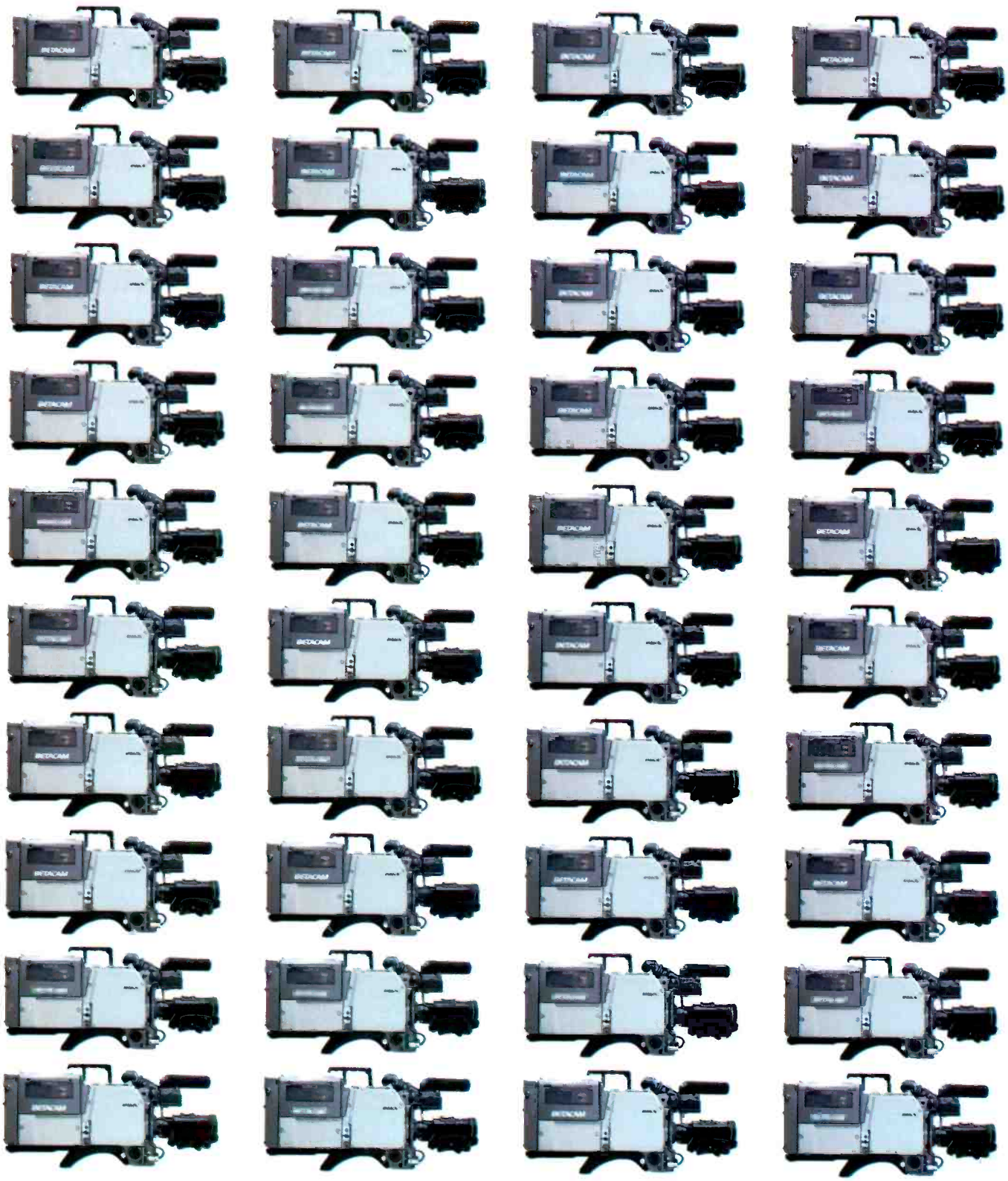


Gould's monitor/oscilloscope can display a complete picture with a bright line indicating the line under examination.

Or it can look at a video signal line-by-line.

"TO RELIEVE MY CAMERAMEN'S BACKACHES AND MY



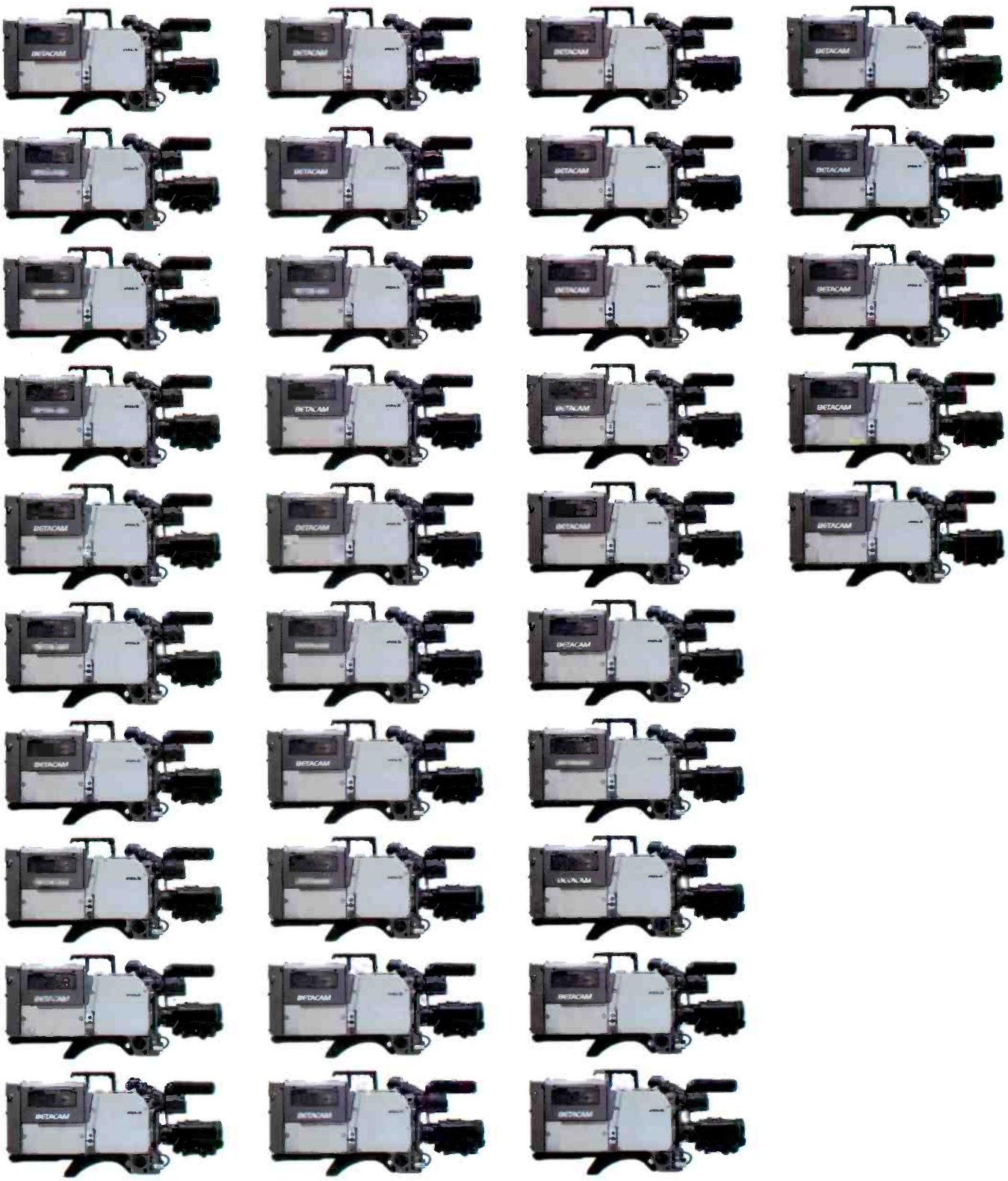
Art Biggs coordinates major engineering purchases for the six Corinthian stations. After careful evaluation of all the ½-inch camera/recorders on the market, he made a multi-million-dollar purchase of the Sony Betacam™ system.

"Betacam has several pluses. The most obvious of them are size and weight. We have one-man camera crews at all our stations. The camera/recorder that they take into the field is right at 54½ pounds. Betacam will reduce this load by more than half—a significant reduction.

"As for quality of playback, you can see the difference with the naked eye. Its superiority is most apparent in scenes of fully saturated colors, particularly reds. It's cleaner. It doesn't have quite as much of the heavy, stringy-type noise we've grown to tolerate over the years.

CONTROLLERS' HEADACHES, I TOOK ALL OF THESE."

—Art Biggs, Vice President, Engineering, Corinthian Broadcasting Corporation



"Another Betacam plus is that it's not a patchwork approach. It's a total Sony system developed from the camera to the recorder to the player.

"Then there's the bottom line. Betacam is at a very attractive price. It would have cost me hundreds of thousands of dollars more to get the same amount of camera/recorders that even approach this kind of quality from someone else.

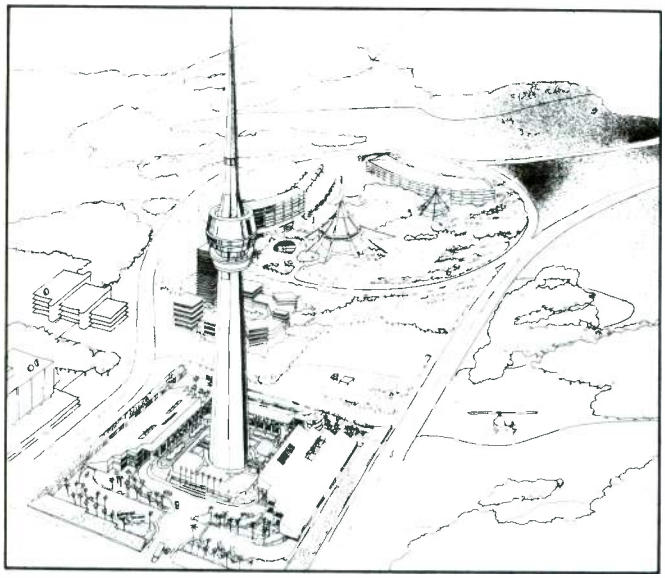
"I'll definitely be back for more."

For more information on the Sony Betacam system, and there's a lot more to know, contact Sony Broadcast in New York/New Jersey at (201) 368-5085; in Chicago at (312) 860-7800; in Los Angeles at (213) 841-8711; in Atlanta at (404) 451-7671; or in Dallas at (214) 659-3600.

SONY. Broadcast.

Case study:

The Abuja Tower



Artist's sketch of the Abuja Tower.

By Edward R. Baldwin, architect, Toronto, Ontario, Canada

One of the world's major tower projects is a combination broadcasting facility and national monument for Abuja, the new capital of Nigeria. This 327m structure will be third highest in the world and tallest in Africa.

The broadcast facilities

The Nigerian Television Authority (NTA) will operate four 10kW VHF and eight 25kW UHF TV transmitters that will be served by an 80m broadband antenna through two combiners. The Federal Radio Corporation of Nigeria (FCRN) will operate four 20kW FM transmitters through one combiner with provision for four future 10kW units.

Among a multitude of communications users are Nigeria External Telecommunications (NET) and Ministry of Communications P&T, which will have extensive microwave installations on two levels approximately 200m above ground. The antenna gallery is proposed to be enclosed for maintenance safety and aesthetic reasons, using a compound curved stressed glass fiber fabric.

Public accommodations include a revolving restaurant and observation gallery, as well as a banquet floor for special functions. At the tower base extensive office space for technical users will be situated, plus a major theater, exhibition gallery and restaurant complex.

Design challenges

Foremost among the many challenges to designers of tall towers are the problems of integrating a vast number of services within a confined space and eliminating physical and electrical interference. In addition to avoiding these problems, they must also take into consideration relative fire hazards and prevention systems, separations in the event of fire, security and the type of personnel to be given access to each area.

At the Abuja Tower, as at the CN Tower in Toronto, the general public will be given access to substantial portions of the tower. These areas require backup maintenance areas. At the CN Tower, the service areas are available to all staff members, whether their jobs relate to serving the public or to the broadcast and communications users' operations. An attempt has been made at the Abuja Tower to segregate support staff throughout so that the broadcast and communications users have complete control over their allocated premises. This should be a more successful arrangement.

At Abuja, the tower configuration provides for numerous equipment spaces within the relatively low cost volume of the structure itself. In this way, floor areas within the higher cost upper accommodation are minimized. The *bracket* structures that occur on four faces of the octagonal shaft are capable of accommodating transformer vaults, elevator motor generator sets, high voltage switchgear and generous cableways for antenna feedlines, etc.

Also featured are the void areas between each upper accommodation support bracket. These areas allow wall penetrations for louvers and windows that would otherwise detract from the external appearance of the tower itself. This is a big improvement over the CN Tower for those that must work in the broadcast and kitchen areas. Makeup air for transmitter heat

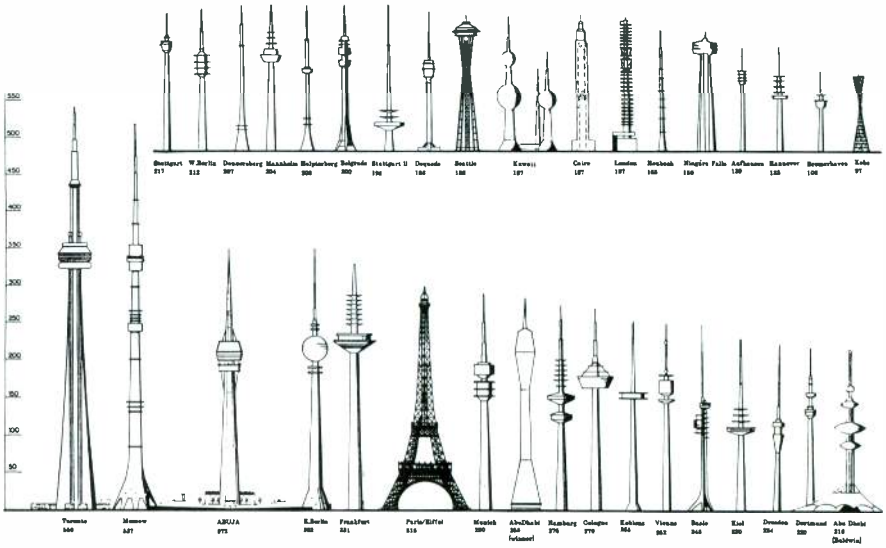
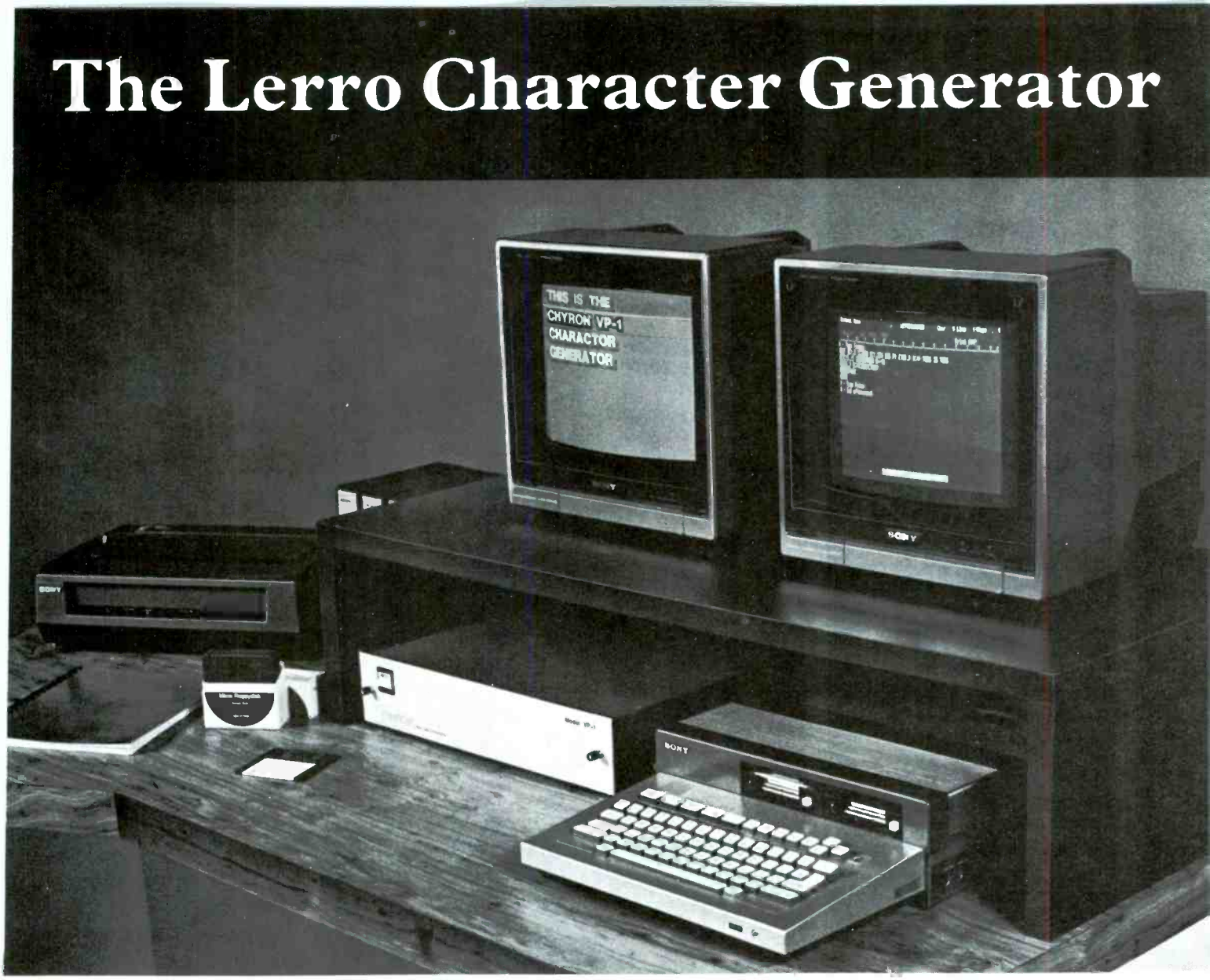


Figure 1. Heights of towers in the world.

The Lerro Character Generator



Complete System as shown $11,730

No, we're not building our own character generator, but we are putting together a system using the CHYRON VP-1 video generator and the SONY SMC-70 microcomputer.

The VP-1 provides features previously available only with costly and elaborate studio units. Like a 64 color palette, selection of 44 fonts from the CHYRON library, plus a full range of command and edit functions. There is also a downstream keyer for character insertion over genlockable video inputs.

The SONY SMC-70 microcomputer includes the software needed to format and execute commands to the VP-1, and of course when you're not generating CHYRON screens, the SMC-70 can be used for program scheduling and billing, keeping track of your tape library, or customer mail lists, plus many other uses.

We have also included monitors, a custom desk, and a printer for hard copies of your data files.

For more information, call Ed Zwicker at 215-223-8200.

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COMMUNICATIONS SYSTEM DIVISION
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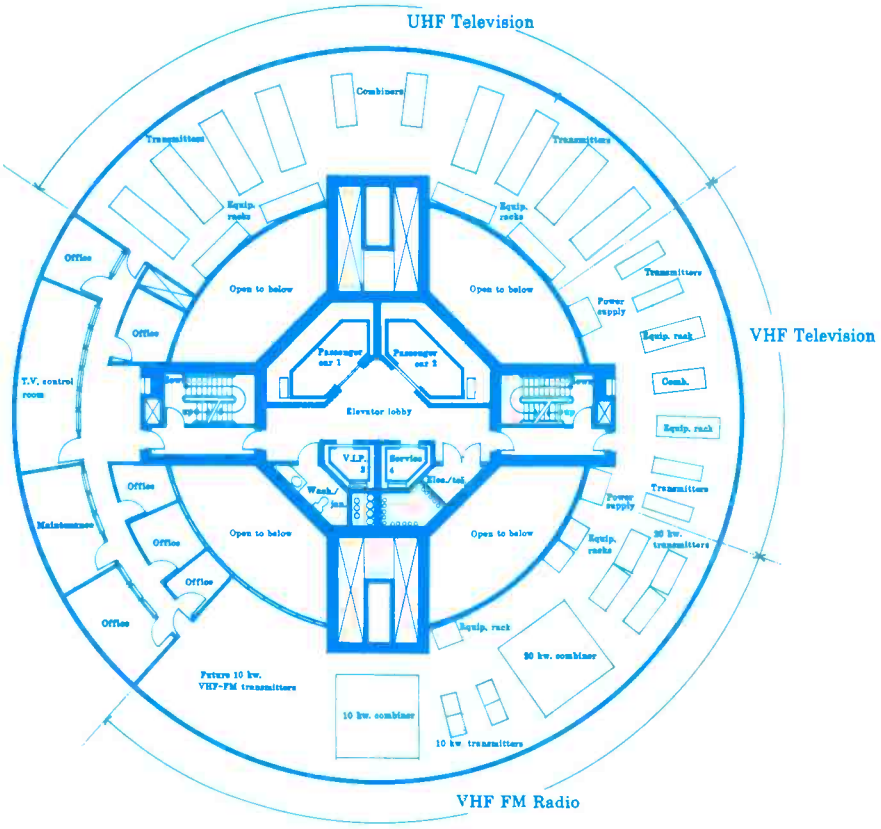

Figure 2. Cross-sectional plan for Level 228.

exchangers can be drawn directly in and exhausted vertically to the roof, where lower pressures will always exist, regardless of wind conditions. In this way, transmitter cooling systems need not overcome what would otherwise be severe pressure differentials under high wind loads.

Due to remote monitoring and switching of all broadcasting and communications equipment from within the substantial office and control room areas at the tower base, it has not been deemed necessary to partition individual users from each other on the broadcast floor. Transmitter units are compartmented in such a way that the Halon gas fire protection system can be economically zoned, but no other separations are required, because all personnel allowed on this level are of a similar security clearance rating. A skeleton staff will be on duty at all times, and access will be highly controlled via a sophisticated keying system.

Antenna protection via the use of radomes to ease maintenance is also a high priority for aesthetic reasons. At Abuja a foam sandwich GRP structure for long wavelength antennas and stressed teflon-coated fiber glass fabric for short wavelength ones has been

The brightness you need to show it big

General Electric Professional Large Screen Video Projection

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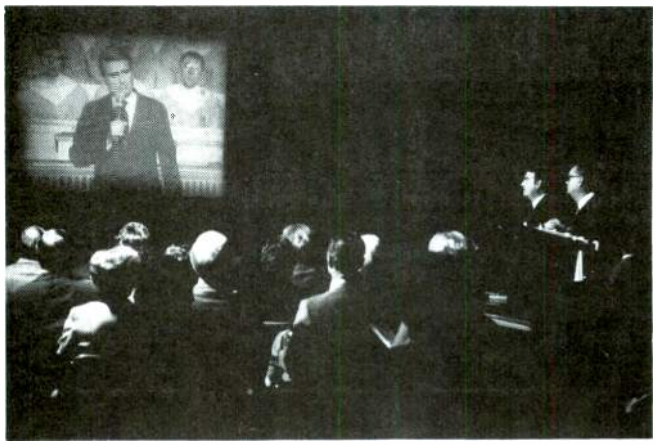
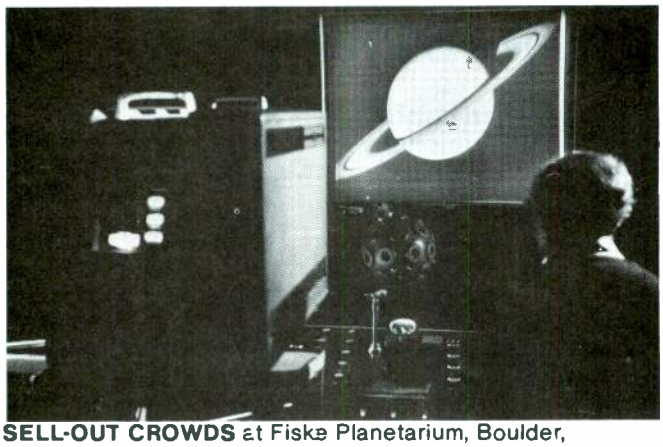


VIDEOTAPE of Ben Haden's message during a Sunday service is projected for a crowd in a 500-seat fellowship room.



SELL-OUT CROWDS at Fiske Planetarium, Boulder, watched live NASA transmission presented by General Electric projector.

GE Professional Large Screen Television Projector Specifications

COLOR PROJECTORS

Model	Light Output in Lumens			Resolution* in TV Lines per Picture Height		Input Power Req.		Scan Standards***	Video Input**
	Open Gate Min.	Modulated TV, Min.	Modulated TV, Typ.	Min. Horiz.	Min. Vert.	Max. Watts	Max. Volt-Amps		
PJ 5000	500	250	325	750	300	900	1350	525 li./60 fps; 625 li./50 fps	(1)
PJ 5050	1000	500	650	750	300	1100	1550	525 li./60 fps; 625 li./50 fps	(1)
PJ 5055△	2000	1000	1300	750	300	1750	2600	525 li./60 fps; 625 li./50 fps	(1)
PJ 5800	500	250	300	750	600	900	1350	875 lines/60 fps	(2)
PJ 5850	1000	500	600	750	600	1100	1550	875 lines/60 fps	(2)
PJ 5855△	2000	1000	1200	750	600	1750	2600	875 lines/60 fps	(2)
PJ 5100	500	250	300	750	650	900	1350	1023 lines/60 fps	(2)
PJ 5150	1000	500	600	750	650	1100	1550	1023 lines/60 fps	(2)
PJ 5155△	2000	1000	1200	750	650	1750	2600	1023 lines/60 fps	(2)
MONOCHROME PROJECTORS									
PJ 7000	900	600	750	800	400	900	1350	525 li./60 fps; 625 li./50 fps	(3)
PJ 7050	1500	1000	1250	800	400	900	1350	525 li./60 fps; 625 li./50 fps	(3)
PJ 7055	3000	2000	2400	800	475	1100	1550	525 li./60 fps; 625 li./50 fps	(3)
PJ 7800	900	600	750	800	650	900	1350	875 lines, 60 fps	(3)
PJ 7850	1500	1000	1250	800	650	900	1350	875 lines, 60 fps	(3)
PJ 7855	3000	2000	2400	800	650	1100	1550	875 lines, 60 fps	(3)
PJ 7100	900	600	750	800	750	900	1350	1023 lines, 60 fps	(3)
PJ 7150	1500	1000	1250	800	750	900	1350	1023 lines, 60 fps	(3)
PJ 7155	3000	2000	2400	800	750	1100	1550	1023 lines, 60 fps	(3)

*Resolution measurements made with wide-band monochrome video input. **Video Input Key (1) NTSC or RGB Standard, NTSC/PAL/SECAM Switchable as Option, (2) RGB, (3) Wide-Band monochrome. ***For use at other scanning rates, contact General Electric Projection Display Equipment Operation for special application/model information. Projector line voltage 105 to 132v or 190 to 260 volts 50/60 Hz except those marked (△) above, which are 190 to 260 volts 50/60 Hz only.

GENERAL ELECTRIC

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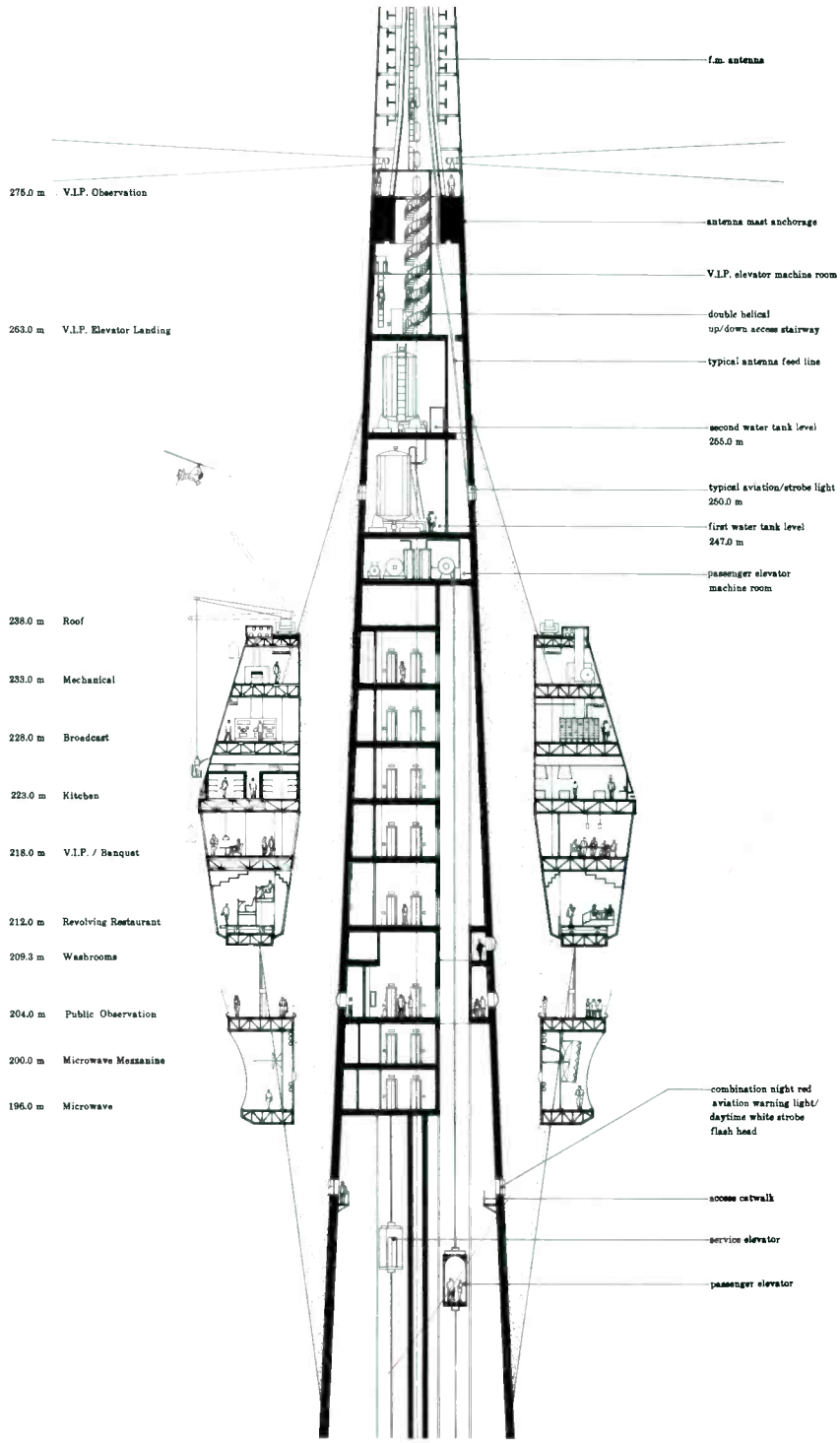


Figure 3. Sectional design through elevated accommodations.

proposed. The latter is to be fabricated in a compound curve shape so that it retains its rigidity under windload.

At Toronto, introduction of future dish antennas without deflation of the air-supported radome was allowed at great cost. This proved to be a waste, because each additional dish added since completion has been assembled in place. Thus, at Abuja, only excellent elevator access to the antennas gallery will be provided, assuming that future units will be transported in small components.

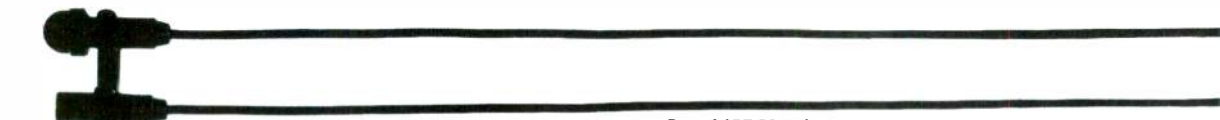
Abuja represents amalgamation of a major national and civic public monument with a highly sophisticated broadcasting and communications center. I am confident that it will be a successful integration of these two diverse functions. It will, without question, be a state-of-the-art broadcasting facility when complete. I:-(-)))]

Acknowledgements

The author is an architect for the Abuja Tower project. Structural engineers are Nicolet, Chartrand, Knoll Associates of Montreal. Mechanical and electrical engineers are Air et Chaleur S.A. of Brussels, Belgium.

Why Beyer mics represent a viable alternative to the usual choices in Broadcast.

Beyer MCM Condenser System



Beyer MCE 5 Lavalier

Beyer M 260

Now there's another high-tech German condenser system.

Until recently, film and broadcast engineers thought only Sennheiser and Neumann made high-quality condenser microphone systems. Now the Beyer MCM Series offers the same German excellence in design and construction, the same kinds of accessories (windscreens, pistol grips, shock mounts) and facilities for 12V and 48V "phantom" powering.

And since the MCM Series studio condenser mic is part of a system which combines power modules and different mic capsules (long shotgun, short shotgun, unidirectional, omni-directional and figure eight), you get more microphone potential for dollar output.

Like all Beyer microphones, the MCM Series is a truly professional instrument system suited to the widest range of applications in Broadcast/Film and Video post-production.

With lavalier mics, small is not enough.

Electret condenser lavalier mics like SONY's ECM-50 have proven useful for on-camera miking situations because of their reduced size. And while many of these mics offer good performance in a compact size, the Beyer MCE5 also provides extended frequency response (20 to 20,000 Hz) and durability in an even smaller format (diameter: 7 mm / length: 23 mm).

To optimize its compatibility with a variety of broadcast and film applications, the tiny black MCE5 is available in different configurations for powering interface and includes a system with accessories like windscreens, expansion mounts etc.

At Beyer Dynamic's ultra-modern manufacturing facility in West Germany, we hand-build virtually all of our microphones in the most evolved state of fine German engineering.

There's more than one way to bring out the warmth in an announcer's voice.

Broadcast engineers choose the E-V RE20 for many vocal announcing situations because of its wide frequency response (45-18,000 Hz)* and smooth sound. Beyer Dynamic's M 260 also provides the extended frequency response (50-18,000 Hz) and warmth required for critical vocal applications with one distinct advantage: its reduced size. Its compact and efficient ribbon element captures the warmth traditionally provided by this type of mic. And because it is considerably smaller than a mic with a large moving-coil diaphragm, the M 260 provides a natural, balanced sound image in a portable format that won't obscure copy or take up valuable space in the studio.

The Beyer M 260 has its own custom-designed ribbon element to optimize the mic's performance based on its Broadcast applications.

The Dynamic Decision

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*Extracted from competitive promotional literature or advertising.
*Documentation supporting specific comparative claims available upon request.

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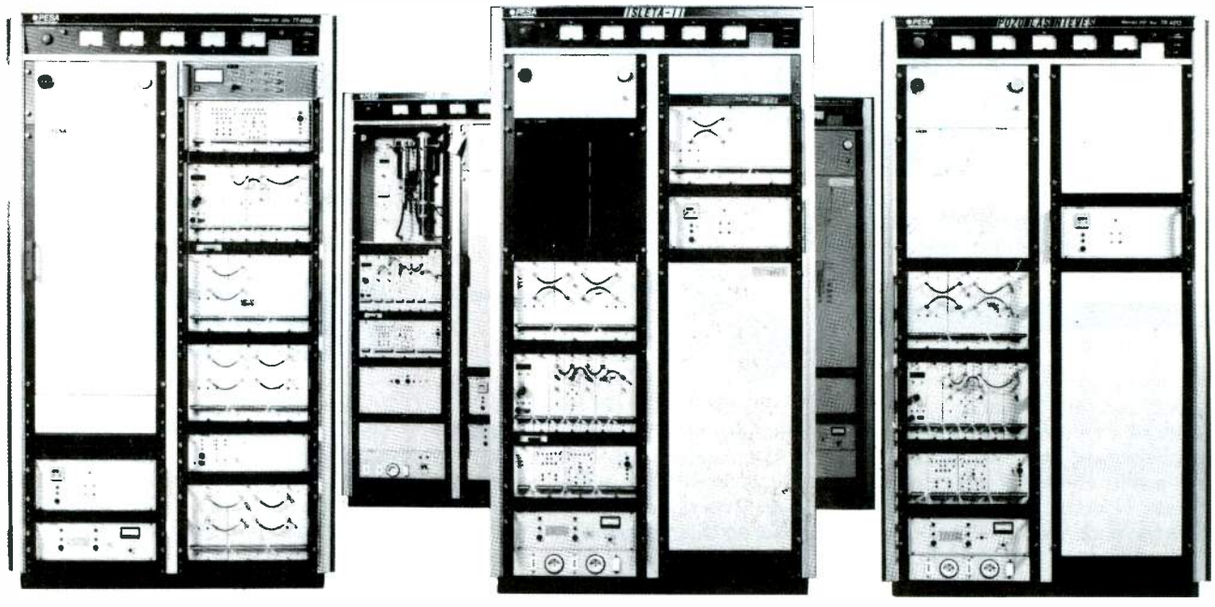

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We offer. 1 • 5 • 10 • 20 • 50 • 100 • 200 • 500 • 1000 • 2000 and 5000 Watts of power output, for VHF and UHF band, performing the international specifications of the CCIR.

Some of the advantages of this new line of translators are its modular construction (Plug-in modules), use of broadband amplifiers, double conversion, programmable frequency synthesizer and S. A. W. filter in I. F. for any standard.

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FM multipath & distortion reduction through RF amplifier optimization

By Edward A. Schober, AFCEE, Radiotechniques, Haddon Heights, NJ

FM broadcasting was invented by Maj. Edwin Howard Armstrong as a method of overcoming the noise inherent in AM broadcasting, and as a means to economically achieve low distortion and wide frequency response. He predicted the limiting effect of *multipath interference* on the ultimate quality of the signal received in the field.

The FM stereo system in use today, along with SCA operations at 67kHz in the composite spectrum, make today's FM operations much more susceptible to the effects of multipath distortion. This distortion is caused when an FM tuner receives the signals from both a *direct* path and a *reflected* path, or by several reflected paths. The path differences are seen by the receiver as time delays between the received signals. If the transmitter were unmodulated, this would set up an interference pattern wherein the direct and reflected waves would add and cancel as the phase of the signals dictate. This standing wave pattern could be as fine as 5 feet for peak-to-trough values of field intensity.

The classic example of multipath interference occurs when an FM station, located on a mountain, has only a marginal line-of-sight path from the transmitter to a densely populated valley below. Because of obstructions, the transmitter signal is weaker than the distance would indicate, particularly on the near side of the valley, to the foot of the mountain. The mountains on the other side of the valley, strongly illuminated by the main lobe of the transmitting antenna, reflect a signal nearly as strong as the direct signal to the shadowed area.

When a listener drives a car through this area, the radio will pass through areas of stronger and weaker signal as close as every 5 feet. If the signal strength drops below the receiver sensitivity, the receiver will fail to limit the signal, producing bursts of noise. If the transmitter is modulated and the field intensity is high enough, the receiver will detect the signal, but there will be distortion. In stereo systems, there will be loss of separation; in SCA, crosstalk. These effects are predicted in theory, and cannot be magically removed.

Minimizing the problem

Careful systems engineering and siting of the transmitter are required to minimize the effects of multipath. I have found, however, that many FM transmitting plants have defects that aggravate the effects of multipath interference, especially as detected on poorer quality automotive receivers.

The theory of multipath interference is based on the following: a *direct* wave of the form given by Equation (1); and a *reflected* wave of the form given by Equation (2). When these two signals combine, it can be shown[1] that the instantaneous frequency is given by Equation (3). This can be illustrated by the vector diagram in Figure 1 (page 114).

These distortion components are predicted by theory and may be observed in the laboratory. An additional level of complexity occurs when amplitude modulation is added to the transmitted FM signal before it leaves the transmitter. AM *incidental modulation* is a parameter that must be at a minimum in order to achieve optimal multipath performance. In my experience, I have never entered a station that has been properly instrumented for this critical measurement. As a result I have never found much difference in apparent multipath performance with indicated changes in AM incidental modulation, because minimum meter indication usually does not occur at optimal tuning. Improper sampling, and the fact that a meter cannot tell the whole story, cause a false indication of the incidental AM modulation.

Optimizing tuning

Before getting into AM incidental modulation measurements and the implications they carry, we should discuss a prerequisite to optimizing the tuning of any transmitter. Antenna VSWR is a critical requirement for FM stations, particularly those with long coaxial feed lines. As most TV engineers know, a VSWR into the antenna feeder of more than 1.04:1 will start to degrade picture quality, particularly with a long line. The reflection down the line from the mismatch at the antenna, in addition to disrupting the performance of the transmitter output stage, causes multipath distortion within the transmission line itself. The actual amount of distortion produced in an FM system depends on the modulating frequency, index of modulation and phase rela-

[1]"Reference Data for Radio Engineers," Sixth Edition, Howard W. Sams Company, Indianapolis, IN, page 23-10, 1981.

$$e_1(t) = \cos\Psi_1(t) = \cos[\omega_c(t - t_1) + \beta\sin\omega(t - t_1)] \quad (1)$$

$$e_2(t) = \sigma\cos\Psi_2(t) = \sigma\cos[\omega_c(t - t_2) + \beta\sin\omega(t - t_2) + \phi_0] \quad (2)$$

Where:
t_1 = time delay for direct wave
t_2 = time delay for reflected wave
ϕ_0 = angle of reflection
β = index of modulation
σ = reflection ratio

$$\omega_r(t) = d\phi(t)/dt = \omega_c + A\omega\cos\omega(t - t_1) + (d/dt)\tan^{-1}(\sigma\sin\Psi(t)/1 + \sigma\cos\Psi(t)) \quad (3)$$

Carrier | Modulation signal | Harmonic distortion components

tionship of the reflected wave within a Bessel function; it is exponentially related to the reflection coefficient.

Consider a situation in which an antenna reflects some incidental power; some of that power echos down the line, reflects off the transmitter (which is not matched for reflected power) and returns to the antenna to be radiated, with the delay of the propagation through the transmission line. The portion not radiated is reflected, echos and returns with still more delay. In such a case, a station can have built-in multipath distortion before the signal leaves the antenna. An example of the relationship of this problem to VSWR follows. For a situation in which the combination of modulating frequencies, index of modulation and phase angle of the reflection, etc., produce a harmonic distortion of 1.6% due to line reflection multipath for a 1.5:1 VSWR, this distortion would reduce to 0.7% for 1.22:1 and would increase to 2.5% at 1.87:1. A 3:1 VSWR would produce almost 5% distortion.

It is fortunate that many FM stations operate with reasonably short transmission lines. The severity of multipath distortion is related to the length of the delay in relation to the bandwidth of the transmitted signal. If the delay is short in relation to the modulating frequency, the major harmonic distortion components fall outside the received bandwidth and do not disrupt reception. To put the amount of delay in perspective, it is helpful to imagine that a signal arriving with a modulating signal phase of 0°, combining at the receiver with a signal arriving with a modulating signal phase of 180°, would cancel. This is partially the case, although the result also includes distortion components because FM is not a linear modulation system. In order to acheive this 180° phase shift, the time delay must equal half of the period of the modulating wave. These conditions are shown in Table I (below) for 38kHz and 76kHz modulating frequencies.

We may evaluate the disruption of the frequency response of the composite baseband and ignore other distortion components. Assume use of a 3-inch semiflexible cable, and that the transmitter reflects all power back

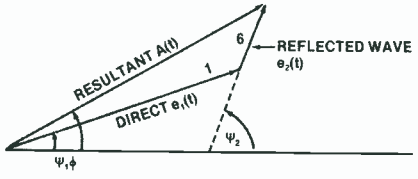

Figure 1. Vector diagram for combining direct and reflected signals.

Table I.
Conditions for 180° phase shift

Line length (feet) / Reflections at modulating frequency	38kHz	76kHz
3000	Second	First
1500	Fourth	Second
1000	Sixth	Third
760	Eighth	Fourth

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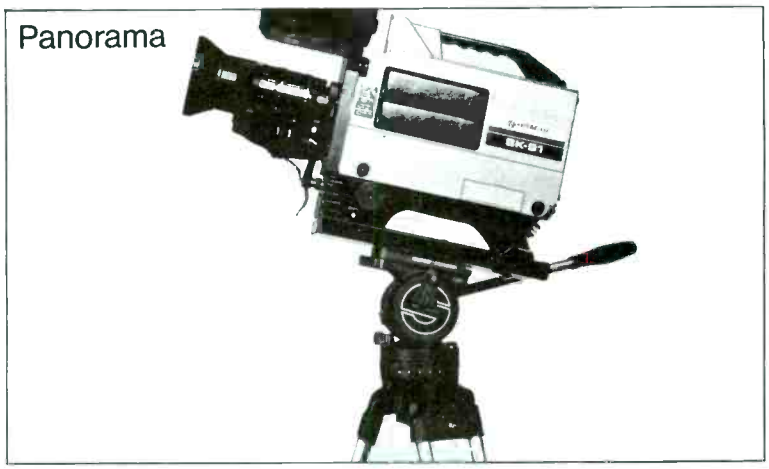

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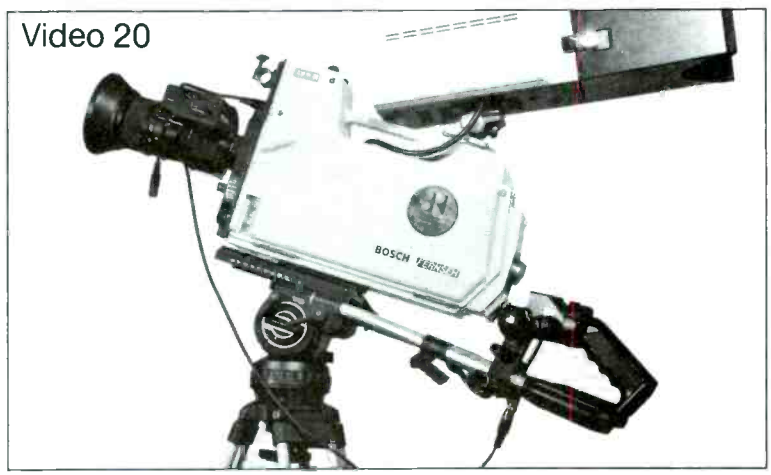

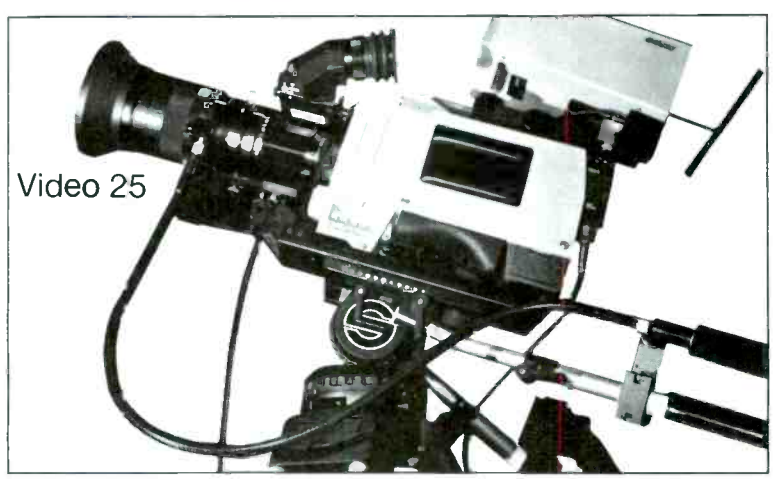

toward the antenna. Then a 2:1 VSWR antenna across the channel bandwidth (flat) on a 1500' line will produce a 0.4dB notch at 76kHz, and a 0.03dB notch at 38kHz; a 3:1 VSWR will produce a 1dB notch at 76kHz and a 0.2dB notch at 38kHz. On a 760' cable, 2:1 produces a 0.05dB notch at 76kHz and 3:1 VSWR increases the notch to 0.3dB.

High quality stereo and SCA operation require composite baseband frequency response within +0.1dB through 75kHz. Because the RF effect can exceed this value, it is clear that a low VSWR is required on long transmission lines.

Incidental AM modulation, the variation of the carrier amplitude of the FM transmitter with FM modulation, is a characteristic of transmitters that is not specified in transmitter data sheets. There are stations whose AM incidental modulation is measured at only 30dB below 100% who claim to be competitive, while many engineers will tune and tweak to try to achieve values of 55dB below 100% modulation. In areas with multipath-free signal coverage and strong field intensity, a good FM receiver will reproduce high fidelity sound without fail, regardless of AM incidental modulation. This is not the case in the presence of multipath propagation or in the case of low signal strength areas, or where the receiver has a soft limiting curve and some AM susceptibility.

When the receiver is not fully limiting, a number of distortion components can enter. Quadrature detectors and discriminators and, to a lesser extent, ratio detectors, will produce an audio output proportional to the amplitude of the output of the limiter. Therefore, any AM getting through the limiter will appear on the audio output. Because AM incidental modulation is often caused by narrowbanding in the transmitter or antenna and tuning for efficiency generally causes the transmitter to be tuned slightly to one side of center frequency, the received AM consists of even and odd distortion products of the modulating signal. When a limiter state fails to limit, it may also have its operating values change with the AM component of the received signal. This will cause the input and output impedances of the transistor limiter to change, modulating the phase response of the receiver's IF filter, adding another source of distortion to the audio output.

Incidental AM modulation makes the problems of multipath distortion much more significant than theory predicts. Referring to Equations (1) and (2), each equation must be multiplied by the factor in Equation (4).

$$1 + A\cos\omega_m(t - t_n) + A_2\cos 2\omega_m(t - t_n) + \ldots \quad (4)$$

Where:
A = modulation factor
ω_m = modulating frequency
t_n = time delay for direct or reflected wave

The expansion of a signal of this form is even more cumbersome than the simplified version used in basic multipath analysis. However, a simplistic approach yields some insight into the problem. If one ignores the non-linear distortion relationships in multipath problems and looks only at the noise situation, the evils of incidental AM become apparent.

Referring to the performance of a wideband FM receiver, it may be noted that for carrier-to-noise (C/N) ratios greater than 12dB, FM provides a substantial noise reduction over linear modulation schemes. For high modulation-index values, for C/N ratios less than 9dB, the noise per-

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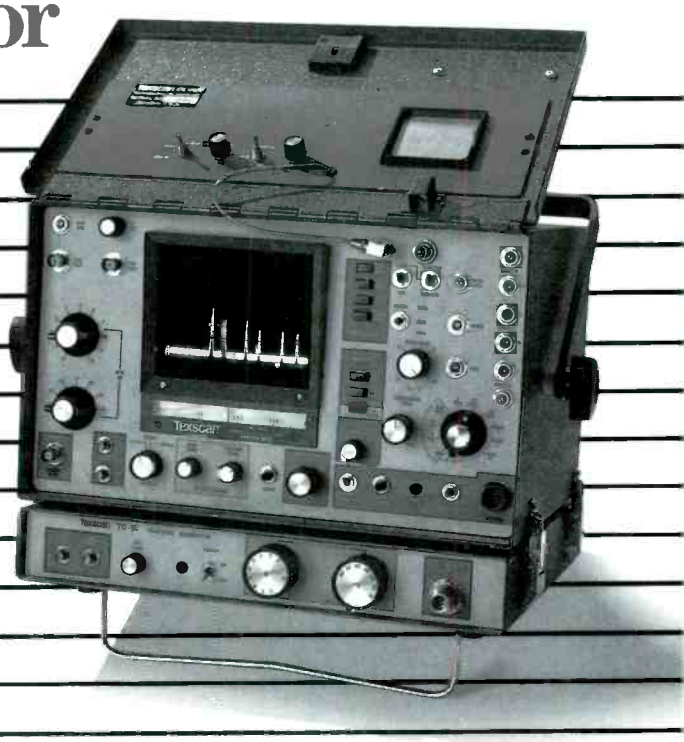

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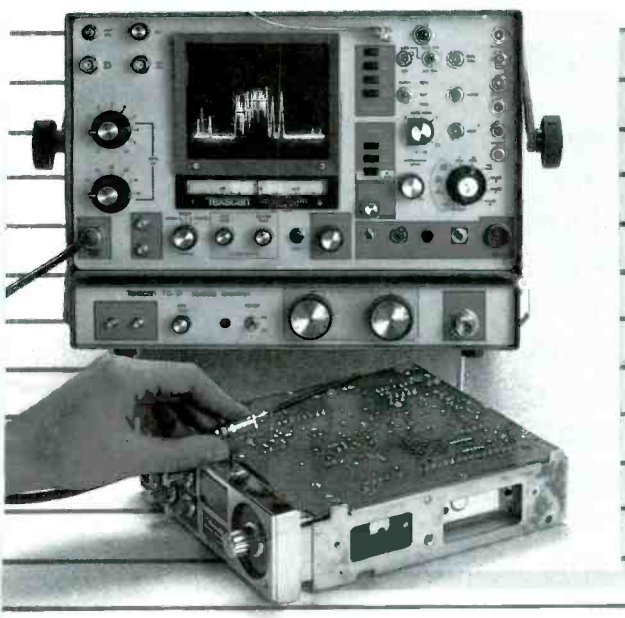

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formance is noticeably poorer. Disruption of limiter operation in the receiver also causes the signal-to-noise (S/N) ratio of the detected audio to be degraded more. For a varying field strength applied to the antenna of a receiver, the S/N ratio will vary nearly linearly with signal strength until a C/N ratio of 12dB is reached. For signal reduction below that, the noise performance degrades at a much higher rate.

A simulated case

When traveling with a car radio in an FM field with multipath, the receiver seems to pulse with noise. The locations where the noise occurs remain relatively stationary, but sometimes are larger or smaller in physical area. Generally, the larger the noisy area, the worse the distortion—but not always.

A hypothetical case for direct/reflected FM reception is depicted in Figure 2 (page 120). Figure 3 on page 122 is a plot of the field intensity for this situation, in which the strength of the direct wave is constant at a level of 10, the reflected wave is constant at a level of nine, and the change in path length of the *reflected* path is 1.5 times the change in *direct* path length.

As expected, the two waves add and subtract to produce a varying field intensity with distance. There are places where the field changes sign and areas of decreased signal strength. It is easy to visualize the pattern of noise and distortion from the radio as it is moved around this territory.

When the signal is contaminated with incidental AM, the direct signal may be instantaneously downward AM-modulated, while the reflected wave may be simultaneously upward AM-modulated due to the difference in delay. When the two waves cancel each other, this results in a modulation signal equal to twice the percentage modulation of the transmitted signal. When the cancellation is nearly complete, the net received AM component may be great, in excess of 100% of the received signal.

In the example shown on the chart, for incidental AM of −30dB (approximately 3% modulation), the net amplitude variation is 6% of the direct signal level. When the two signals are canceling each other to 10% of the direct signal, the net modulation percentage is 60%. When the canceling is complete, the AM modulation is infinite.

Measuring AM incidental modulation

AM incidental modulation is typically measured at FM stations using a type-accepted modulation monitor. These instruments detect a

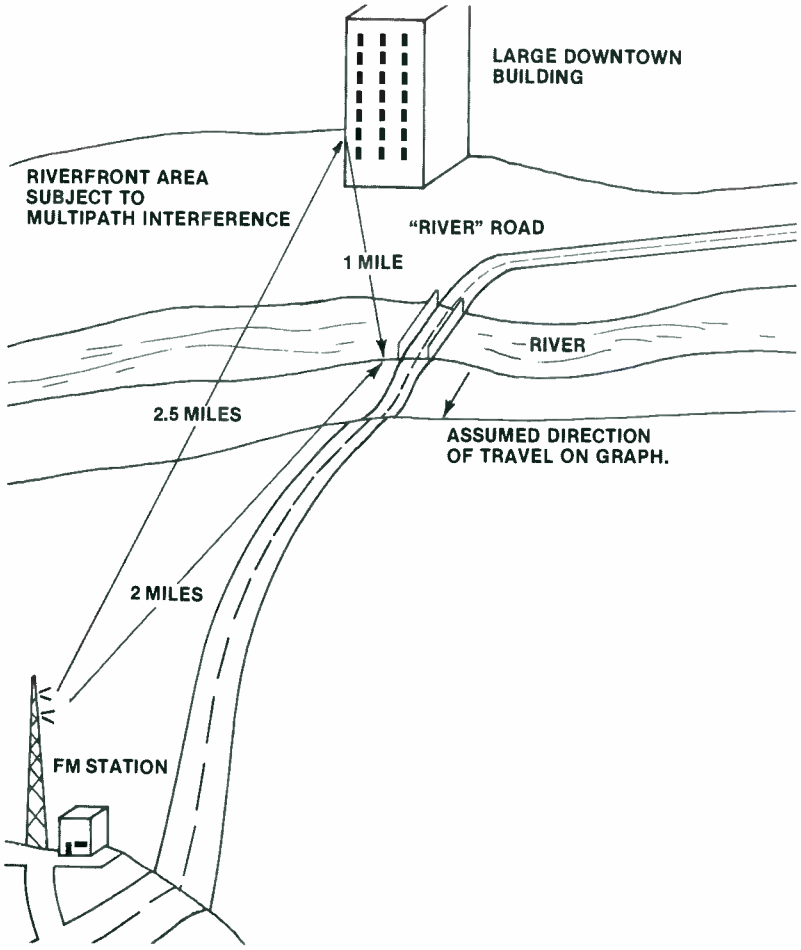

Figure 2. Hypothetical case of a situation generating field strength variations.

sample of the RF output of the transmitter with an envelope detector and indicate the percentage modulation on an peak-reading meter. De-emphasis is not applied for AM incidental measurements, because the actual depth of modulation is to be measured, not the audio output of a receiver (as with AM noise). Many stations connect the monitor to Point A shown in Figure 4 (page 124). This is a simple link output in the final power amplifier, as recommended by many transmitter manufacturers. This arrangement cannot reliably indicate optimal tuning conditions for AM incidental.

The output from a link in the power amplifier compartment will only show circulating currents in the PA tank. These are generally not related to the output power, and are highly contaminated with RF harmonics. Also, this sample has no discrimination between signals generated by the transmitter and those returning from the antenna.

An envelope detector will provide a good indication of the depth of modulation for low modulation percentages, and a peak reading meter will indicate useful data in adjusting for minimum AM. However, it gives no indication of whether the tuning is

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best or only a local *minimum*. In order to optimize, you must see a picture of the bandpass of the transmitter, because there are many degrees of freedom in the adjustment of a transmitter: PA tuning, PA loading, IPA tuning, IPA loading, Drive levels, IPA grid and PA bias levels.

The optimal way to tune a transmitter would be to use a spectrum analyzer and tracking generator with a dummy load and sampler. Assuming the antenna is identical to the load, the tracking generator is connected in place of the exciter; the spectrum analyzer is connected to the sampler and set to scan several hundred kilohertz about the station frequency; and the system is tuned for flattest response. It is even possible to plot the phase response through the system and to optimize this parameter also. Unfortunately, the antenna is never identical to the load, and the FCC takes a dim view of full-power sweeping into an antenna.

Because every turn of a control, change in weather or change in line voltage can cause a drift from the optimal tuning conditions, this parameter should be monitored. The simplest way to improve monitoring for incidental AM is to ensure that the modulation monitor is connected to a point that will properly represent the output of the transmitter. To remove RF harmonics it is necessary tc sample after the harmonic filter. Sampling this far toward the antenna also ensures that the effect of all tuned circuits in the transmitter are included in the readings. Because the desired level of AM incidental modulation is -45dB to -55dB below carrier, signals received by the transmitting antenna can be a problem. An inter-

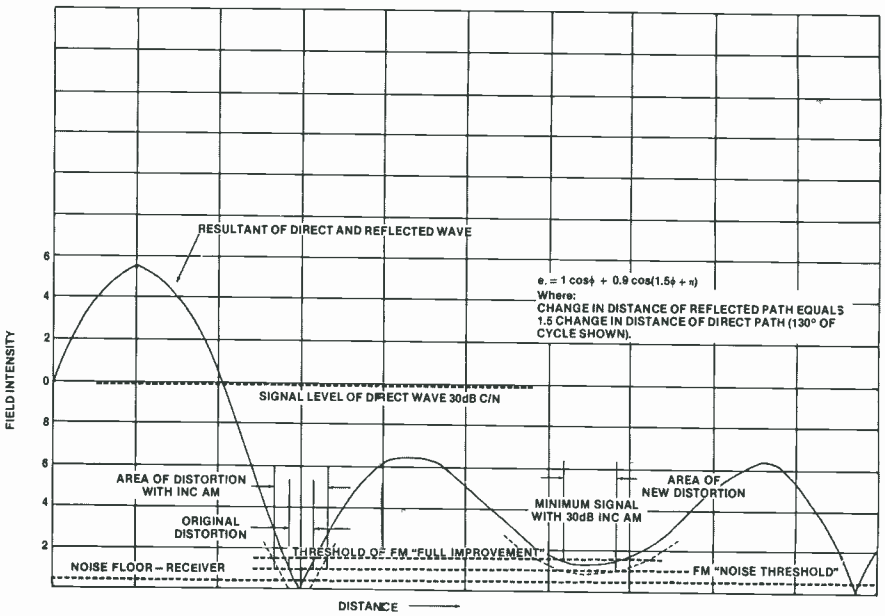

Figure 3. Field intensity vs. distance for two interfering signals, assumed in the situation shown in Figure 2, page 120.

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fering signal of 1W on the transmission line can contaminate the indications of a peak reading meter when monitoring a 10kW transmitter. An extra 10dB of isolation can generally be obtained from interfering signals if the monitor sample is taken with a directional coupler sampling the forward power.

Using a monitor as the indicating device will suffice for general tuning where there are no interface sources and the antenna is broadbanded. For serious optimization, it is necessary to provide a clearer view of band limiting and visual feedback on the effect of each control on the transmitter.

Connecting the vertical input of a high frequency scope to the output of an RF detector fed from a directional coupler and connecting the high frequency horizontal input of the scope to the composite audio driving the exciter will provide a swept display of the AM incidental modulation of a transmitter. The display appears much like the multipath display on many high quality FM receivers with scopes. (Note: The vertical channel is ac-coupled and set at a high enough gain to show curvature under modulation.)

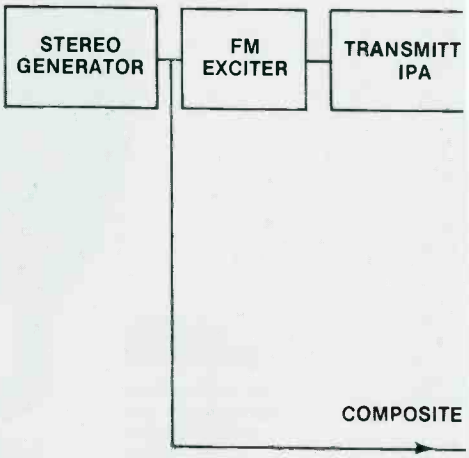
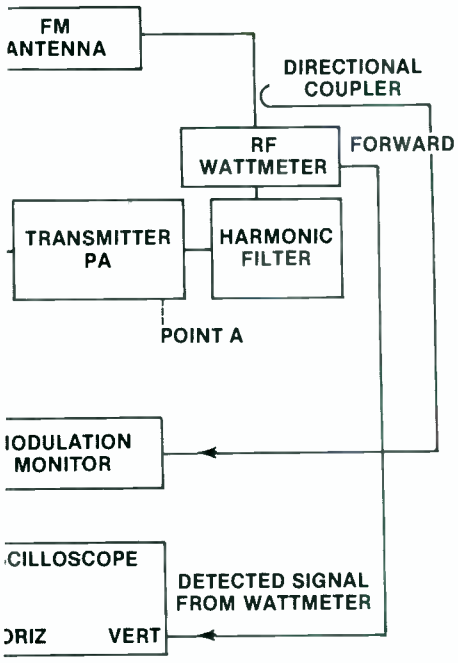


Figure 4. Equipment connection diagram for basic incidental AM modulation measurements.

A numerical relationship between the carrier level and the amount of AM modulation may be obtained by determining the dc level output of the RF detector when the scope is dc-coupled; switching to ac-coupling; adding 20dB for each 10X sensitivity increase with range changes; and taking the ratio of trace height to the original dc value. This represents the value of the AM noise and AM incidental plus interference.

For most applications, the station plug-in RF wattmeter provides a combination directional coupler and RF detector. Field experience indicates that simply connecting a high impedance scope input across the meter movement gives adequate results when there is no interference.

The driving signal for this display deserves some consideration. The audio input to the exciter provides the sweeping action. For best and clearest representation, a triangle wave of about 100Hz will give the transmitter a relatively slow and even sweep to the legal extent of ±75kHz. This results in an evenly illuminated trace, with a minimum of *fuzz* or apparent noise and phase shift through the system that causes a broadening of the trace. As a practical matter, many stations do not permit breaks in programming, even overnight, to apply such a signal to the transmission system. Fortunately, highly processed stereo composite signals also give reasonably clean traces. This permits the AM incidental characteristics of the station



to be monitored at any time during programming.

Field Testing

Field testing of these techniques was undertaken at KEBC, Oklahoma City, with the assistance of Randy Mullinax, chief engineer. The transmitter, a popular 20kW unit, was first tuned to approximate the design figures. This generally corresponds to the point of best efficiency. An area known to have severe multipath interferences was monitored using a pickup truck with a standard FM radio. As we traveled through the area, we found locations extending 20-40 feet along the road where the station program was lost. We traveled the same route again, noting the location and extent of loss of usable signal.

Returning to the station, we re-tuned the transmitter, using the techniques presented here, and repeated the field survey. The areas of distortion and noise magically disappeared or were drastically reduced. Picket fencing was still detachable, but nowhere did the signal distort for more than two or three feet.

We returned to the station again and re-tuned for lowest indicated AM incidental with the modulation monitor connected to the link on the power amplifier. Field surveys showed an intermediate amount of interference, with loss of signal over areas of 10-15 feet along the road.

AM incidental modulation contaminates an FM broadcaster's signal in a particularly unfortunate way. Substantial areas of listenership may be lost due to a worsening of the effects of multipath interference in depth and affected areas. Multipath interference also occurs most commonly within the high signal strength coverage of a station. The sources of multipath affect the densely populated downtown areas with high buildings and river valleys that do not have line-of-sight viewing of the transmitter.

AM incidental modulation is generally not detected at the studio of a station that uses good monitoring equipment and employs a good multipath-free signal for studio monitoring. Conventional methods of indicating AM incidental modulation are inadequate for adjusting transmission systems to the levels of AM incidental that will not compound the problems of multipath interference.

The methods outlined here are a step in the direction of ensuring that stations will be able to reach as many of their listeners as the transmitter siting and facilities allow. There are refinements of these techniques to extend their usefulness to stations with narrowband antennas, diplexed stations and stations with large amounts of RF received by the station antenna.

WFAA is reported to be the first local station using the Hitachi SK-110 auto setup camera. The author tells about his experience with the system.

Field report: Hitachi SK-110 camera at WFAA-TV 8

By Charlie Martin, chief engineer, WFAA-TV 8, Dallas, TX*

Almost a year ago WFAA-TV, the ABC affiliate in Dallas, owned by Belo Broadcasting, decided to replace its six GE studio cameras purchased in the 1960s. Many cameras were considered, and two trips were made to Japan to inspect the factories of different manufacturers. Questions were put to the technical support staff involved in camera design and manufacturing. It was the Hitachi SK-110 camera that was ultimately chosen. The following is an account of how those cameras are being used, the modifications that were needed to meet the needs of WFAA, the maintenance required, plus a general evaluation of the SK-110 and the decision to purchase it.

WFAA was the first local TV station in the country to purchase the SK-110 auto setup camera. WFAA personnel had first seen an early version of the camera at the 1981 Texas Association of Broadcasters (TAB) exhibit in Dallas and later went to CBS to see the final version in operation. Even though WFAA was to use the cameras in a seemingly similar situation to CBS—as studio cameras—there was a great deal of difference between its operational requirements for a camera and those of a network. But, one thing was certain—the camera produced the best picture we had ever seen.

*As told to Bebe McClain, president, B.F. McClain Productions.

Camera operation

After months of consideration, our station purchased six SK-110s. When they arrived, Tony Delp of Hitachi

The author, shown at WFAA-TV.

conducted a week-long training school at out station for operators and maintenance personnel. It only took a day or so to learn how to use the camera, set it up etc., but the longer the technical staff was around the camera, the more they learned. Bob Cardenas, WFAA studio supervisor, said, "The camera is small, well-balanced and laid out comfortably. The computer aspects of it are user-friendly." WFAA ordered the cameras with Vinten Fulmar gas-operated pedestals, Canon 18:1 fully servo lens systems and 30mm EEV Leddicons.

WFAA has three studios that use the SK-110 cameras. There is one common holding area adjacent to all three studios where the camera cables originate. Because the cameras have 175-foot cables and the station has equalized video distribution and a system of timing, we can use all six cameras or any combination of cameras in any studio without having to disconnect cables. Only tallys and communications have to be assigned through delegation.

By using the SK-110 we have been able to operate in 50% lower light and we still have a better picture. A side benefit has been a decrease in the use of air conditioning. With our old cameras, we had high light requirements, plus we had to operate nearly wide open on the cameras with prompters. Now we operate with 200fc (although we have a good picture at 150fc). We are now able to select the setting for the depth of field we desire. Our news department wanted a subtle defocused image of the large transparencies on the wall behind the announcers. Now we can do that. Also there is no discernible difference between cameras with and without prompters even though we lose half an f/stop with the prompters. We do not have to provide video to the prompters on a special cable, but rather we can feed them using the existing camera cable.

The audio aspects of our studio production have been improved because the SK-110s do not have blowers in the camera heads. The efficiency and design of the cameras is such that they do not need the usual blowers that can

Frank Davis, director of engineering, Belo Broadcasting.

present an audio problem when mics have to be used close to the cameras (as is done in the newsroom).

Another advantage of not having a blower in the head is that the camera head system and its optics stay much cleaner and there is no blower filter to change or clean.

A feature that we have found useful is the swivel viewfinder. If an operator stands between the two cameras and turns each viewfinder sideways toward him, he can operate two cameras at once. Although this would rarely be needed during live production, it is helpful when taping segments, preparing graphics, etc. In all, the camera delivers a 100% better picture for us.

The RCU

Although we put all the cameras through the auto setup daily, I believe that we could operate them for a month and not find any serious drift. They are stable and reliable. The cameras are always left on with the beam off when not in operation.

To automatically set up the cameras, the video operator depresses the *Auto setup* button on the Remote Control Unit (RCU) for each camera. Because we monitor one at a time, we do them one at a time. To begin the auto setup, a diascope is automatically inserted between the camera and the lens. (Final setup may include operator adjustment to compensate for lens aberration.) Within a minute or so, 90+ camera functions, including full registration and balance, are checked and perfectly set up.

Carl Thompson, a TV engineer in

Davis with the author in one of three production studios using the SK-110 cameras.

Holding room, common to all three studios where camera cables originate.

master control, said that it takes about 10 minutes or less to set up all six cameras. After auto setup, each camera is fine tuned by using a gray-scale box (a brainchild of the author). This box has a regular gray-scale test chart glued on the front with a rectangular hole in the center that creates an absolute black for the camera to reference. Black balance is set using this device, then white balance is set. Next, flesh tone is verified. This is done because color temperature varies between the three studios, and the auto setup must be modified to match cameras.

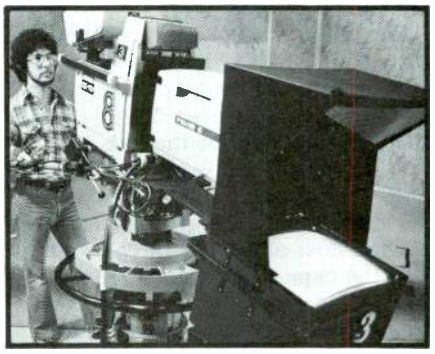
Daily, a quick visual inspection is made of the camera and the racks housing the Setup Control Unit (SCU), the power supplies, etc. The new cameras run cool in the racks, and the lower temperature reduces potential for problems.

Thompson likes having the six cameras' remote controls in the horseshoe at WFAA's master control. There is one complete station with six RCUs—one for each camera. We plan to install two remote stations to control iris and black level so that three operators can work simultaneously, one for each studio. At the RCU the operator can not only perform the auto setup, but also can remotely control all functions needed for painting, exposure, black level, special file recalls, etc.

The computer control is a labor-saving device that eliminates the need to rush through setup. Once the cameras are set up, the information is filed in the computer and the camera will line itself up for normal operation. The SK-110 is the only camera with green reference. You can take one SK-110 that has a picture you like with correct gamma and flare and, using an input mode on the other

The author with gray-scale setup box he devised. (Note hole in middle of box that creates absolute black reference.)

Bob Cardenas, studio supervisor, likes the swivel viewfinder that allows operation of two cameras simultaneously.



Special large reflection glass had to be installed on prompters because of wide-angle lens.

cameras, you can set the other cameras to the one you like. That way everything, in terms of video, is alike. To our knowledge, no other camera does that.

Maintenance and the SCU

Beaven Els, maintenance supervisor, said that the SK-110 makes him feel like the proverbial *Maytag repairman*. He has not gained much experience maintaining the new cameras because there have been virtually no problems. Consequently, he has been able to attend to the installation of other new equipment, such as the sophisticated routing switcher that the station purchased.

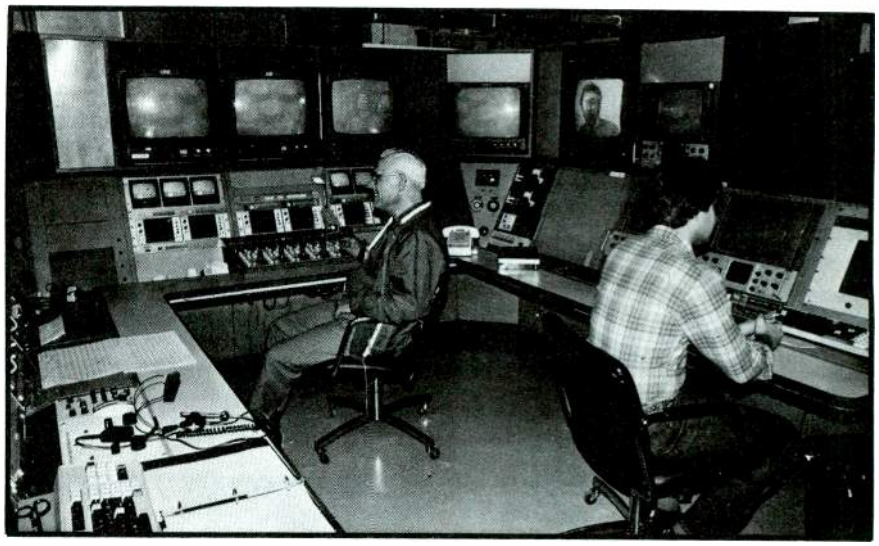
The maintenance routine involves sitting at the SCU and checking the auto setup of the camera. The maintenance engineer might make slight corrections for the lens aberration, adjust the slope of the knee setting, the gamma, the enhancement, the subcarrier phase or the horizontal phase. Most of this would be done to give the cameras the *look* that WFAA likes. Generally, these changes are subjective judgments to override the auto setup.

When Els sees a camera in operation that has *a perfect look*, he will often print out a hard copy of the camera's parameters so that if there ever is a problem he can run another hard copy to compare against the perfect one. It might give him a clue to what the problem might be.

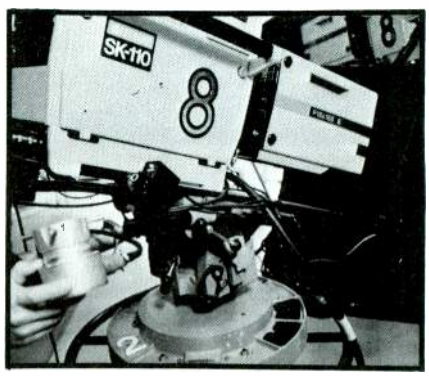
Actually, these cameras are so stable that they require little or no maintenance. We have not even had to run a computer diagnostic check on any of the six. It was the geometry of the camera and the diagnostics that were two of the main reasons I wanted the cameras. The corner geometry from first auto setup is good, and it is adjustable dynamically to tight specs. Concerning the diagnostics, there is no other camera like it on the market. For instance, you can go to the camera and put a problem in the red preamp, then run the computer program and the words *fault in the red preamp* will printout. Other cameras will print out the parameters of the cameras, but they will not diagnose the problem.

The Hitachi camera control units and power supplies are rack-mounted beside the SCUs that have everything the RCUs have, plus file data, complete painting and precise control of many of the system parameters.

Even though we were impressed by the easy access to the pull-out boards in the camera head, we have not had the occasion to touch these boards. Any routine adjustments that need to be made can be done at the SCU.



Master control *horseshoe* arrangement presently houses one set of six RCUs. WFAA plans to add two more sets on left and right side.



Long camera support bar with weight attached on end opposite prompter had to be custom-made for cameras using prompters. Note how operator's hand must leave handle to operate motorized zoom.

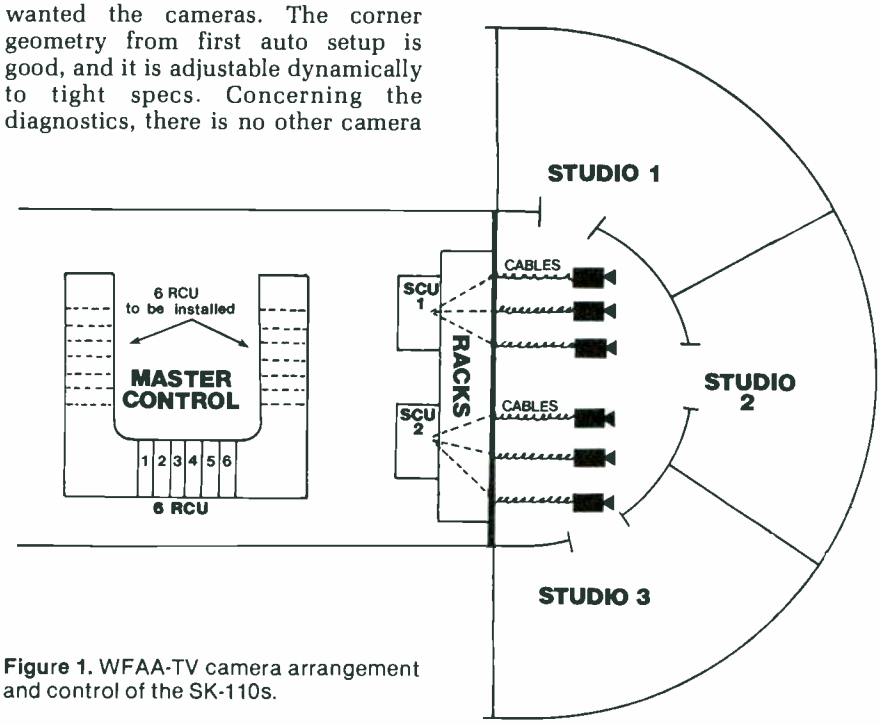


Figure 1. WFAA-TV camera arrangement and control of the SK-110s.

Art Henderson, maintenance technician, shown at the SCU, checks the registration of one SK-110 camera.

CHINA

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Broadcast Engineering invites you to join this high level delegation.

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Contact:

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Modifications

We have special demands placed upon our SK-110s that are unique to WFAA's operation. These demands were not in the minds of the camera designers. To meet our needs, we did the following:

•We defeated the encoding timing switch because we believed it was not a parameter to be adjusted by an operator in WFAA-TV's operation. (This switch was used as the mono-with-burst switch mentioned in the next modification.)

•We had an on/off mono-with-burst switch installed to remove the color when we key.

•We defeated the switch on the camera that allows the cameraperson to insert the diascope. We wanted only the operators at the RCU or SCU to have this control. We realized that if the cameraperson accidentally left it in the wrong position, it could ruin the automatic setup of the camera when performed from the control room.

•We built our own RGB display at the RCU because we wanted this capability, whereas other operations did not. We like to monitor individual color channel levels at the operating position.

•We believed that we did not have sufficient monitoring capability at the SCU, so we had to customize. We in-

Carl Thompson, master control operator, pushes the button at the RCU to begin the auto setup of one SK-110 camera.

stalled video crosspoints to be operated by the SCU picture and WFM switchers.

Problems

As Frank Davis, director of engineering for Belo Broadcasting, said, "We have bought a lot of serial numbers #001, and we know what that means. Some made us pull our hair out. These SK-110s aren't doing that."

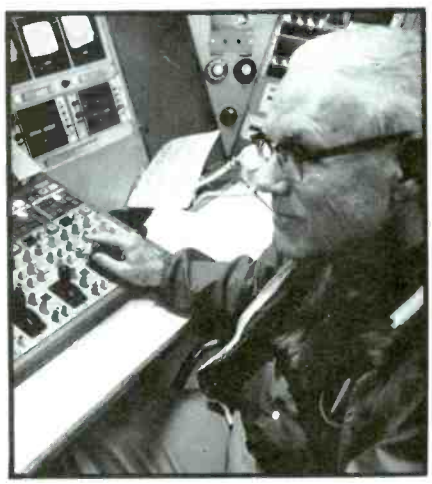
Although we have had no problems with the cameras themselves, except for one viewfinder needing a modification because of overheating, we have encountered a couple of problems putting the cameras into operation.

The balance of the SK-110s was perfect until we tried to attach the prompter. First we found that the camera plates available were not long enough to accommodate the camera and the prompter. Vinten had to make us a special support plate that had a weight attached to the back to balance the weight of the prompter on the front. One reason the prompter was so heavy was that we found we had to special order a larger reflection glass because of the extremely wide angle of the lens.

Another problem, which could be rightly termed an annoyance, is the location of the power zoom for the lens. Because it is more than a few inches away from the handle, operators must let loose of the handle to activate the zoom. Cardenas prefers to hold the handle and maintain complete control of the camera.

Our own luxuries

If I could say we treated ourselves to any luxuries when we purchased these cameras, the main one would be



Thompson remotely controls six SK-110 cameras.

that we bought *two* complete SCUs. The greatest fear I have always had is to not have cameras for the news show. And when I thought about having computer-controlled cameras that we, in essence, cannot get *into*, I thought we should have full redundancy. It turns out my fears have been unfounded. We have not had trouble, but by having two SCUs we can control three cameras on one and three on the other, knowing that if anything were to happen to one SCU, we could quickly switch the camera cables so that all six cameras were on the other SCU.

Another luxury might be the lenses. We chose the Canon 18:1 zoom lens (P18X16BIE) with 1X and 1.5X extenders. Although we could have gotten by using a 10:1 lens like we had on our old cameras, our news lenses allow us to do virtually anything we desire, including macro shooting.

To do close-up shooting on our old cameras, we had to use a diopter, which meant removing the lens. It took a lot of time and trouble. We are pleased with the performance of the lenses and all of our options.

Boards are easy to access, but service has not been needed thus far.

Overall reaction

As Frank Davis told me, it's one thing when the management personnel, production and technical staff comment on how much better we look on the air now that we have the SK-110s, but it's quite another thing when someone in accounting tells you your picture looks better. And, it's something again when your competition takes you out to lunch and tells you that you look "damn good" on the air. It's almost too much when the camera venders who lost out call you up and say, "Those cameras look like dynamite."

Our original mandate, when we purchased the six Hitachi SK-110 cameras, was to buy the best studio camera that we could find on the market—a high spec camera. We believe we did that, and we hope that WFAA can use them for 5-10 years. They will probably last a lot longer, but technology will change. For now we have a *generation-newer* camera than any of the competition. As far as 30mm cameras are concerned, I think that the Hitachi SK-110 is the best in the field. |:(-))))|

Editor's note:

The field report is an exclusive **BE** feature for broadcasters. Each will be prepared by the staff of a broadcast station, production facility or consulting firm. The intent is to have the equipment tested on-site. The author is at liberty to discuss his research with industry leaders and to visit other broadcasters and/or the manufacturer to track down pertinent facts.

In each field report, the author will discuss the full applicability of the equipment to broadcasting, including personal opinions on good features and serious limitations—if any.

In essence, these field reports are prepared *by* the industry and *for* the industry. Manufacturer's support will be limited to providing loan equipment and to aiding the author if support is requested in some area.

It is the responsibility of **Broadcast Engineering** to publish the results of any piece tested, whether positive or negative. No report should be considered an endorsement by **Broadcast Engineering** for or against a product.

The **BE** staff met with the author during the SMPTE-'82 convention in New York and worked out the details for this article. The author had already accepted the delivery of the SK-110 cameras and reported on how he and his staff found their performance. Literature on the SK-110 may be obtained from Hitachi Denshi America Ltd., 175 Crossways Park West, Woodbury, NY 11797.

associations

AFBA Armed Forces Broadcasters Association
P.O. Box 12013
Arlington, VA 22209
1-202-696-5268

Broadcasters form AFBA

Broadcasters and others who have previously served or are now serving in military radio and television as civilians or as service members have formed the Armed Forces Broadcasters Association (AFBA). Supporters of military broadcasting and individuals now in the media are also eligible to participate and corporate and associate memberships are available.

The AFBA plans to support the professional growth of present and former military broadcasters, as well as provide an opportunity for social and professional contacts for all members. A newsletter, job information center, seminars and other programs are being planned.

NRBA
National Radio Broadcasters' Association
1705 De Sales Street, NW
Washington, DC 20036
1-202-466-2030

SCA paging regulations supported

In reply comments filed with the FCC in Docket #82-536 last week, NRBA reiterated its position in support of the FCC proposal that would authorize the use of FM subcarriers for paging. Replying to many negative comments that have been submitted by opponents of the FCC proposal, NRBA said that nearly all of the opposition to allowing FM broadcasters to operate paging systems without common carrier regulations were motivated by fear of competition among presently entrenched radio common carriers. NRBA also said that "if broadcasters are permitted to enter the paging field, they will be able to provide paging services to millions of people, such as those who live in rural areas and in small communities, who presently don't have access to such services. In addition, because the cost of providing the paging service will be shared with the cost of providing the broadcast signal, the FM licensee will be able to provide this service on a more economical basis than is presently offered."

NRBA urged the FCC to permit the SCA use proposed in its Notice of Rulemaking and not to apply common carrier regulations as some interests have suggested.

9871 radio stations authorized

As of Jan. 31, 1983, the FCC had authorized 4848 AM radio stations, 3779 FM stations and 1244 FM educational stations (including 279 affiliated with National Public Radio). The grand total is 9871, an increase of 709 stations since July 31 of last year.

Industry employment figures released

The 1982 employment profiles for broadcast stations having five or more full-time employees, and a state-by-state trend report for the past five years in each class of service, have been released by the commission.

Total broadcast employment for stations with five or more employees rose 3.2% over 1981 figures. Employment in the top four job categories (officials and managers, professionals, technicians and sales workers) rose 3.46% since 1981. However, female and minority employment in those jobs was largely unchanged. In 1982, women made up 25.9% of top-four employees, while minorities comprised 12.7%. The comparable figures for 1981 were 24.9% and 12.7%, respectively.

nab National Association of Broadcasters
1771 N Street, NW
Washington, DC 20036
1-202-293-3570

FCC spectrum scheme needs more evaluation

William L. Stakelin, NAB board chairman, said recently he was shocked by the FCC's staff refusal to grant an extension of time for filing comments on its new microwave spectrum allocation plan, which Stakelin said would have a "devastating impact" on TV broadcasters' ability to serve the public. His remarks followed a discussion during an NAB executive committee meeting of FCC Docket #82-334, which would require TV broadcasters to share their auxiliary broadcast service spectrum with displaced occupants of the 12GHz band, which has been allocated for DBS service. Numerous parties, including the NAB, had requested an extension of time to file comments on the proposal, but the FCC rejected their requests.

Why ABC Sports selected Panasonic

ABC Sports demands uncompromising picture quality. Mt. Everest demands absolute portability. Panasonic Recam delivers both.

That's why Recam was the natural choice for ABC's "American Sportsman" to capture all the beauty and danger of the U.S. expedition scaling Mt. Everest this Spring. John Wilcox, executive producer of "American Sportsman", said it best: "Recam's picture quality is as good as one inch...the 3-tube Plumbicon® camera and M-Format recorder give us the opportunity to shoot broadcast quality pictures in any location."

And perhaps no location is as demanding as Mt. Everest. As the expedition ascends the mountain, ABC will capture it all on Panasonic half-inch video equipment. Recam

Recam to climb Mt. Everest.

recorder/cameras will transmit pictures via microwave to a base station specially outfitted with two Panasonic AU-300 source decks, an AU-A70 editing controller, an AS-6100 switcher and another AU-300 for mastering. These high-quality Recam pictures will then be beamed via satellite to the U.S.

But this is just the beginning. Recam's picture quality and portability will be used by ABC Sports for future remote locations whenever the going gets rough.

Look into Recam for yourself and see why it's becoming the choice of demanding professionals whatever their EFP needs.

Panasonic.
AUDIO-VIDEO SYSTEMS DIVISION

Circle (124) on Reply Card

FCC update

Continued from page 6

long-awaited lottery rules on March 31. Also on the agenda for that day was a reconsideration order refining the basic LPTV rules adopted in March 1982.

Under the lottery system, applicants will be given preference points depending on their minority status and extent of other media interests. After the commission has identified a group of mutually exclusive applications and has completed the process of assigning lottery preference points, a computer will decide the winner of the construction permit. The first such lotteries are expected to take place late this year.

Major issues scheduled to be decided in the LPTV reconsideration order were as follows: reservation of frequencies for LPTV applicants proposing non-commercial, educational service; revision of operator requirements; and a redefinition of "major" change to permit the filing of amendments and modification applications that do not propose coverage of new territory.

Once the new rules are in place, the commission will be in a position to begin processing its 8000 LPTV applications. The computer that the commission needed for this purpose has been delivered and the programs to be used in processing are nearly completed. If the entire computer system tests out, the commission will begin issuing "B" cut-off lists next fall. These lists will identify groups of mutually exclusive applications and, if current plans are implemented, will report the assignment of lottery preference points. Applicants whose proposals are placed on the lists will be given an opportunity to alter their proposals.

In identifying groups of mutually exclusive applications, the commission's system will compute HAAT through the use of a terrain database obtained from the US Geological Survey. Coupled with the technical information included in FCC Form 346, this will permit interference studies to be made entirely by computer. For this reason, it is essential for applicants to provide the FCC with accurate and complete data on their antenna systems, including polar diagrams for directional proposals. Existing stations have been urged to file such information to ensure that they will receive the interference protection afforded by the rules.

If the computer system works well, and the Court of Appeals denies expected requests for stays of the lottery rules, meaningful progress in reducing the LPTV application backlog should be made by this time in 1984.

Satellite update

Continued from page 14

Network radio

The first major satellite radio network, National Public Radio, has been broadcasting via satellite to hundreds of affiliates for the past five years in conjunction with the Public Broadcasting System's TV network. Now ABC, CBS, NBC and RKO are committing their national radio networks to satellite distribution via dedicated transponders, using a digital time division multiplex (TDM) technique. This technique provides 19 radio channels (15kHz each) in a transponder and gives the networks what they believe is the best combination of channel quality, flexibility, network control features and cost per channel for the type of distribution systems involved.

These major networks distribute programming from New York to their affiliate broadcasters all over the country. The affiliates will have the ability to select any number of channels simultaneously, with a single digital decoder. Because a total of approximately 3000 local broadcasters will have receiving earth terminals before the end of 1984, it is obvious why the TDM multiplexing technique was used for this type of distribution network.

Other types of broadcasting networks have different requirements. For example, regional or state networks generally require program feeds from participating affiliates, making necessary a network design with low cost earth terminals for transmitting as well as receiving. For this type of network, a satellite transponder is best used in a frequency division multiplex (FDM) mode, with a single channel per carrier (SCPC) technique. SCPC has been used since the mid-1970s for satellite telephony networks in remote regions or underdeveloped countries. The economics required for radio networks, however, did not make the technique attractive until recently when lower cost hardware has become available. The development of receivers that can work at much lower signal levels has made it possible to reduce the transmit levels required by the same amount, allowing the use of solid-state transmitting hardware and reducing the cost of a transmit station from $500,000 to $80,000. This dramatic cost reduction makes it possible for many more regional (and national) networks to be realized, opening up a whole new era in radio broadcasting.

Feedback

Continued from page 16

manufacturers? Conversely most medium and small market stations are forced to purchase equipment just to make tests!

What about the interfacing of audio processing equipment with the various AM stereo exciters? Are there unique problems indigenous to each system? I have heard that the use of pre-emphasis with AM stereo can be a problem.

As a consulting engineer, I am quite concerned about the effects of directional antenna systems on the stereo signal when transmitted. Little, if any, meaningful data has been published on this topic.

If the marketplace is to make a prudent decision as to which AM stereo system to adopt as a standard, should not the relative merits of each system be dealt with extensively?

I believe that it is time for the trade publications of this industry to make an effort to publish articles by reliable, competent sources regarding AM stereo test data during actual operation in the field.

James S. Stanley
Hesperia, CA

SMPTE-'82 update

Our coverage of the fall SMPTE-'82 convention held in New York last November is contained in our January 1983 issue, pages 92-110. A couple of exhibitors who shared booths with main exhibitors were inadvertently missed in this coverage. The following notes are an update to correct these omissions:

- *Film/Video Equipment Service Company of Denver, CO, shared a booth with Cinema Products. The company exhibited the Wide Eye I and II wide-angle lens attachments for ENG/EFP video zoom lenses; sealed lead-acid battery packs and chargers for camera power sources that they market for Portable Energy Products; and their capabilities to provide service on lenses for TV and film cameras/-equipment.*

Product literature from Film/Video may be obtained by circling (481) on our Reader Service Card.

- *Artel Communicaitons was missed in the fiber-optics story on pp. 126-127. They were at the show in a corner of the Camera Mart booth. Details of the Artel fiber-optics line may be obtained by circling (482) on our Reader Service Card.*

BE staff

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BROADCAST engineering

new products

TEC feature added

Since Jan. 1, 1983, all *Fortel Y-688*[32] total error correctors have included DYNA-TRAC. The new feature allows the equipment to operate with Sony BVU-820 slow-motion U-Matic systems for full reverse play speed to 3X forward capabilities. A field modification for previous production models of the Y-688[32] is available.

Circle (530) on Reply Card

Greater delay times

The *Eventide Clockworks* 1745M digital delay line is now available with delay lengths eight times longer than original models. Delays of 2.5s (or 5s in the *double* mode) are possible. Retrofits for previous 1745M models are available.

Circle (531) on Reply Card

Phono preamp

A 3-year warranty backs the *Ramko Research* PRIMUS series laboratory-standard turntable preamplifiers. THD at 0.0018% maximum, unmeasurable IM distortion and a −93dB A weighted hum and noise rating are claimed. Maximum output is +26dBm.

Circle (532) on Reply Card

Tension gauge

The *CB* series of tape tension gauges from *Tentel* are designed for use with 1-inch C Format machines, such as the Sony BVH 2000 and Ampex VPR 2. The product uses miniaturized ball-bearing rollers on the three measuring probes.

Circle (533) on Reply Card

Video projector

AQUARAY color video projectors include microprocessor circuitry to maintain monitor alignment and analyze circuit operations. Produced by *Electronic Systems Products*, the projectors produce 400lm peak white output on curved or flat screens, 4-20 feet wide. The AQUARAY is portable.

Circle (534) on Reply Card

Shipping cases

From three to 10 ¾-inch or ½-inch videocassettes, with or without storage boxes, may be contained in *Plastic Reel Corporation of America's* new shipping containers. Plio-Magic positive locking of the polyethylene polymer case ensures safe shipping. Carrying handle and address card holder are featured.

Circle (535) on Reply Card

CRT cleaner

Complementing its line of recording heads and recorder maintenance products, *Nortronics* offers the CMP-160 antistatic CRT screen cleaner. The non-corrosive spray is usable on metals, plastics, painted surfaces and elastomers.

Circle (536) on Reply Card

Tape evaluator

The Elcon 254, marketed by *Television Equipment Associates*, accommodates 1-inch tape exclusively. An improved display of tape conditions includes three linear LED units representing "top edge," "video" and "bottom edge." A printout of the evaluation is produced. Tape is cleaned during evaluation.

Circle (537) on Reply Card

Cable bundling device

New from *Dennison Mfg. Company* is the Flip-Clip fastener. Molded from type 6/6 nylon, the devices are available in various colors. No tools are required for installation. Reuse and removal are possible. Bundle diameters to ½-inch are fastened with a simple twist.

Circle (538) on Reply Card

Digitizing camera

Direct camera to disc storage of high resolution digital images is possible with the *Datacopy* 322D solid-state camera. A selectable data rate is possible. A motor-driven CCD array captures images to a resolution of 1720x2592.

Circle (539) on Reply Card

Improved software

CMX/Orrox has announced improved software for THE EDGE editing controller system. Faster match framing, simpler list manipulation and easier A/B roll editing are the result.

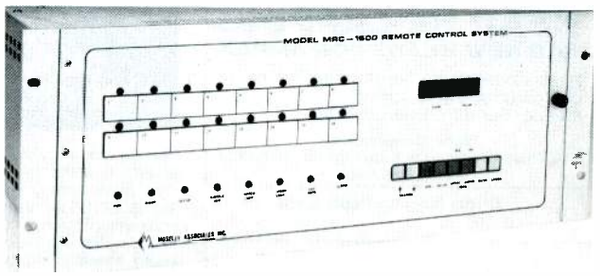
Circle (540) on Reply Card

ENG cabling

Custom-built cable assemblies for any combination of ENG camera and VTR have been termed "gorilla-proof." The *Connector Systems (BIW)* cables include a highly flexible stainless steel armor covered by a rubber jacket. Connectors are molded directly to the armor.

Circle (417) on Reply Card

Remote control



Raise and lower commands with LED status indicators and analog telemetry return for 16 channels are available in the *Moseley Associates* MRC-1600. This microprocessor-designed remote control system includes digitally displayed data for increased accuracy of meter readings.

Circle (418) on Reply Card

Uplink terminal

A 90% efficient switching cathode power supply is included in the MCL model 10717 3kW C-Band TWTA uplink terminal. The single cabinet system provides 2.8kW of flat usable power in the 5.925-6.425GHz spectrum. A Thomson-CSF 3640 TWT tube is used.

Circle (541) on Reply Card

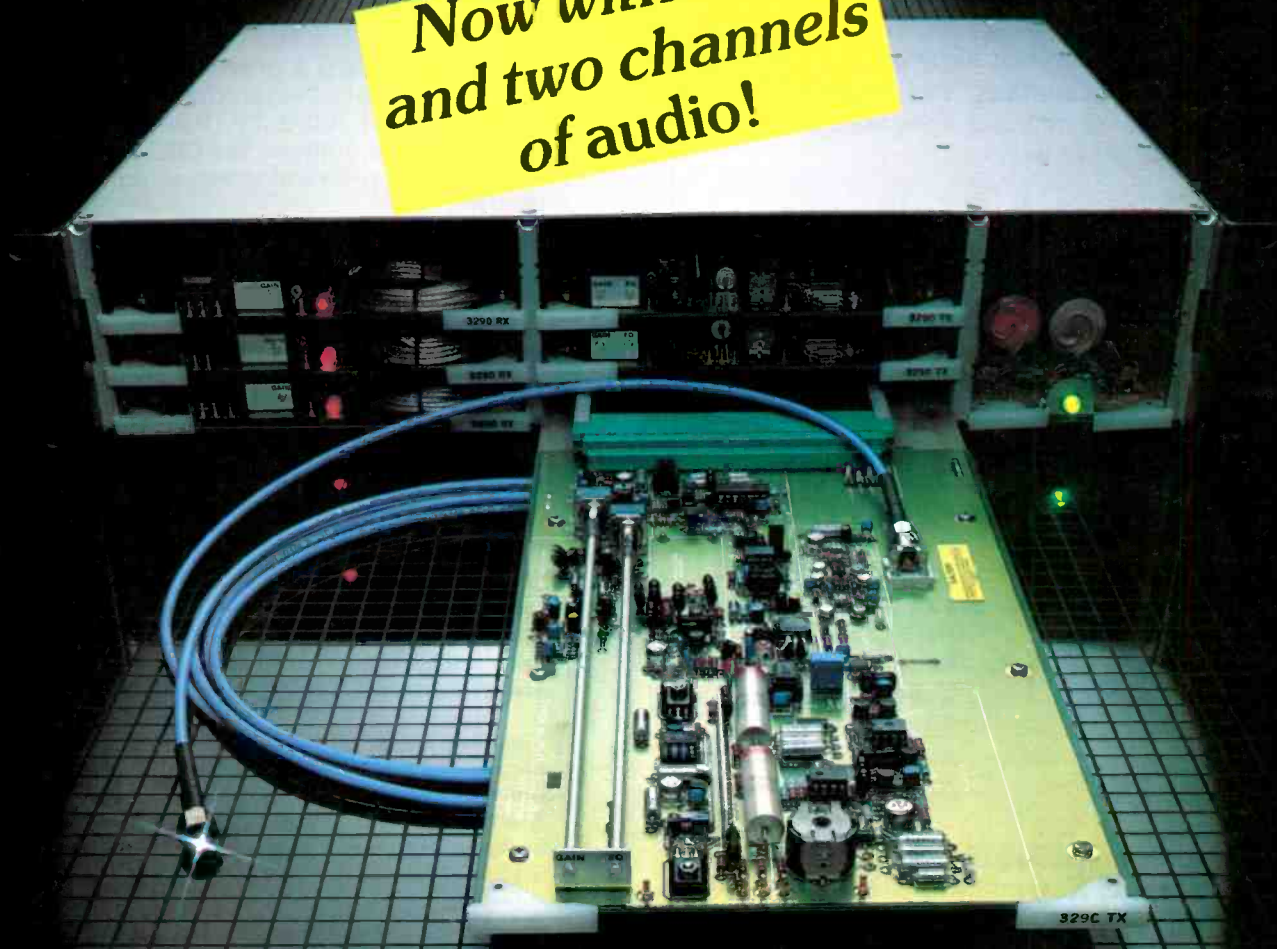
Turntable system

Gotham Audio Corporation, which represents the *EMT-Franz* organization in the United States, has introduced the EMT938 turntable system. Including the turntable, tonearm and built-in equalizer amplifiers, the system provides a nominal +4dB into 200Ω. Direct drive and three speeds (33⅓ rpm, 45 rpm and 78 rpm) accompany a 0.5s start time.

Circle (542) on Reply Card

AN EVOLUTIONARY MILESTONE IN TV SIGNAL DISTRIBUTION.

Now with data and two channels of audio!



Broadband analog signals can now be reliably and cost-effectively transmitted over fiber optic cables, opening the door to levels of system performance and capability simply not possible with conventional metallic cable systems.

Developed by Grass Valley Group—the undisputed world leader in video switching and distribution equipment for television broadcasting and production—WAVELINK equipment is already in use internationally.

Present applications in the TV broadcast and production industry include interconnection between studios, transmitters, satellite earth stations, buildings, remote facilities and microwave stations.

Our extensive experience will assure you a WAVELINK system designed to fit your exact needs. Call on our worldwide sales and service network to help you discover the fiber optic advantage.

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THE GRASS VALLEY GROUP, INC.®

P.O. Box 1114 • Grass Valley, California 95945 USA • Tel. (916) 273-8421 • TWX 910-530-8280

A Tektronix Company

Circle (128) on Reply Card

business

Sony Betacam flys high

A recent episode of NBC' *Fantasy* series used taped segments produced by two Sony Betacam units, which were suspended from a hang glider used in the dreams-to-reality program.

Harris Digifont adds capability to Iris II

Harris Video Systems has announced that the Digifont character generator is now available for the Harris Digigraphix graphics equipment for use with its IRIS II digital still-store units. Chyron Corporation engineered the font generator.

Dubner CBG 2 provides animation

A Dubner Computer Systems CBG 2 graphics generator is in operation at WRAL-TV, Raleigh, NC, providing animated weather displays. The CBG 2 system has also been used for graphics and screen animation in the NBC *Knightrider* series.

WCIU broadcasts Italian programs

Station WCIU-TV 26, Chicago, and its affiliate in

CORPORATE DATA

Telex Communications has announced the acquisition of the **Singer Audio Visual Division** of **Singer Company of Canada Ltd.** in Scarborough, Ontario. The company name was changed to Telex Communications Ltd.

Orrox Corporation has announced that its **Satcom** subsidiary has suspended manufacturing of DBS systems following a reduction of perceived opportunities in the DBS industry brought about by intense price competition from Japan and the lack of available external funding for Satcom's operations.

The West Coast sales office of **Gotham Audio Corporation** and its subsidiary **Gotham Export Corporation** has been relocated on the premises of **Quantum Audio Labs,** a company recently acquired by Gotham. The new address is 1909 Riverside Drive, Glendale, CA 91201; 1-213-841-1111.

Quad/Eight Electronics has announced that Kenneth C. Davis, Jr. has acquired the company. Bud Bennett, who founded Quad/Eight in 1962, will remain with the company as chairman of the board and Davis will assume the duties of president.

EQUIPMENT SALES

AF Associates has delivered a 45' x 8' mobile unit to the NBC-TV Network for its major sporting events.

Crawford Communications has purchased **Ampex** audio and video equipment valued at $1.2 million for installation in its new post-production facility in Atlanta.

Satellite Television Corporation (STC) has signed a time and materials contract, estimated at $250,000, with the Communications Systems Division of **RCA Corporation** to provide design work for the integration of equipment for STC's Broadcast Center to be built near Las Vegas, NV.

Milwaukee, W55AS, have begun improved operation with a new antenna from Alan Dick (Canada); a transmitter from Townsend Associates; and a waveguide from MCI. Program fare includes a weekly 2-hour feed, via satellite, from Radiotelevisione Italiana (RAI), an Italian TV network.

Mycro-Tek improves 7000 character generator

Mycro-Tek, a division of Mergenthaler Linotype, Wichita, KS, has announced the interface capability of the Mycro-Vision 7000 character generator to the upgraded National Weather Service forecast wire service. In another announcement, the company said that a 7000 titling system has recently been donated to the Wichita State University TV production department.

Davis buys Quad/Eight

Quad/Eight Electronics has been acquired by Kenneth C. Davis, Jr. Bud Bennett, who founded Quad/Eight in 1962, will remain with the company as chairman of the board, and Davis will assume the duties of president.

WOR Radio, New York, has agreed to purchase the News Fury system from **BASYS,** Mountain View, CA.

M/A-COM has announced the sale of satellite receiving systems to **National Cable Television Institute,** Denver, CO, and Jones Intercable, Englewood, CO; and sales of terrestrial microwave equipment to Pye TVT Ltd., Cambridge, England, for use in the Korean Broadcast System.

NEW ADDRESSES, DIVISIONS

Dielectric Communications has appointed **Lenbrook Industries Ltd.** as representative for all of Canada, with offices in Calgary, Montreal, Toronto and Vancouver.

Compucon has opened an East Coast office, located at 1200 New Hampshire Ave. NW, Suite 320, Washington, DC 20036; 1-202-293-5731.

BASYS has relocated to 2685 Marine Way, Mountain View, CA 94043; 1-415-969-9810.

TTC (formerly Television Technology Corporation) has announced the establishment of a new division to serve the international market for LPTV and commercial program satellite systems. The address is 5970 W. 60th Ave., Arvada, CO 80003; 1-303-423-1652.

EECO's Electronic Products Division has formed a customer service department. To contact the new department, call 1-714-835-6000, ext. 419.

Sony's corporate communications department is now located at the following address: Sony Corporation of America, One Sony Drive, Park Ridge, NJ 07656; 1-201-930-6432.

Hitachi Denshi America Ltd. has introduced the Everex name for the equipment in its new Visual Products Division.

news

First US multi-track digital recorder sale

Anyone who has heard digital audio compared to even present analog audio technologies is impressed. For those who are not able to hear the difference, perhaps some numbers would be equally impressive.

Dynamic range: >90dB
Frequency response—flat: 20Hz-20kHz
Harmonic distortion: <0.05%
Wow/Flutter: inmeasurable

These specification values did impress John Moran of Digital Services, a Houston equipment rental firm. However, several other characteristics of the Sony PCM-3324 professional multi-track digital audio recorder also played a part in culminating the first sale of the Sony system outside Japan to the Texas organization. Moran said that he is convinced that the PCM-3324 represents the first standardized digital machine, and that other manufacturers will follow the Sony lead with the format to maintain compatibility.

The 24-channel audio recorder includes separate time code and internal control tracks. Using ½-inch tape materials, the system also records two analog tracks, designed as part of a system that adds a provision for razor blade editing capabilities to the sound technicians.

Digital TV signals transmitted between BBC studio centers on optical fiber

Digital TV signals of the recently approved CCIR standard were successfully transmitted by optical fiber link between two TV studio centers in December 1982. The experimental transmission used equipment developed and built by the BBC Research Department at Kingswood Warren.

The optical fiber cable, containing eight graded-index multimode fibers, was installed by British Telecom in the existing ducts between the BBC studios at Lime Grove and Television Centre, a path length of about 800 meters. The signals were carried on a single fiber, the basic bit rate of 216Mbit/s being increased to 270Mbit/s by channel coding. A direct modulated 820nm laser transmitter was used, the power launched into the fiber being 600μW.

As the TV signal was in separate component form, original RGB quality was obtained at the receiving terminal. Avoiding intermediate PAL coding will allow remote downstream processing (for example, color separation overlay and special effects), to be done with a precision that has up to now been achieved only at the source itself.

Editor's note:
For more information, see "Optical Fibers For Digital Studio Interconnections," **BE** March 1983, page 300.

Alexanderson inducted into Inventors Hall of Fame

Dr. Ernst F. W. Alexanderson, the late General Electric Company engineer whose high frequency alternator gave the United States its start in the field of radio communication, was inducted recently into the National Inventors Hall of Fame in Arlington, VA.

A native of Sweden, Alexanderson worked at GE's engineering laboratories in Schenectady, NY, from 1901-1948. His inventive genius made it possible to transmit the human voice for many thousands of miles, linking country to country and continent to continent. He died in 1975.

calendar

May 21

"Production Lighting Techniques" is the subject of an all-day seminar organized by the Hollywood Section of the SMPTE. It will be held at Universal Studios, Stages 43 and 44.

Some of Hollywood's directors of photography will demonstrate and discuss typical, full-scale lighting situations for film and television, as well as possible solutions to some of the problems inherent in lighting certain interior and exterior sequences. Ample time has been set aside for questions and discussion. For further details and seminar registration forms, contact: Jack Spring, Eastman Kodak Company, 6706 Santa Monica Blvd., Hollywood, CA 90038; 1-213-464-6131. You may also contact Howard La Zare, Consolidated Film Industries, 959 N. Seward St., Hollywood, CA 90038; 1-213-462-3161.

May 25-26, July 19-20

Two-day workshops for those involved with video-teleconferencing will be held in May in Washington, DC, and in July in San Francisco. The workshops feature an overview of the video-teleconferencing field, from basic definitions to the latest technological developments. For registration information, contact: PSSC, 1660 L Street, NW, #907, Washington, DC 20036.

May 28-June 2

The 13th International TV Symposium will be held in Montreux, Switzerland. A technical exhibition is planned. Keynote addresses will focus on HDTV. Wireless TV broadcasting, cable TV broadcasting, digitization of video signals and home terminals will be included as session topics. A roundtable discussion among invited speakers, other experts and symposium participants will also be featured. For more information, contact the International TV Symposium and Exhibition, P.O. Box 122, CH-1820, Montreux, Switzerland.

June 1-3

The *1983 IEEE MIT-S International Microwave Symposium* will be held at the Sheraton Boston Hotel. Paper topics include the following: solid-state devices and circuits, filters and multiplexers, passive components, microwave systems and high power techniques. For registration information, contact Frank Leith, Alpha Industries, 20 Sylvan Road, Woburn, MA 01801.

June 19-22

The *19th Annual International Conference on Communications* will be held at the Sheraton-Boston Hotel, Boston. Approximately 2000 scientists, engineers and electronic industry leaders are expected to attend. For more information, contact Dr. Leon J. Ricardi, MIT Lincoln Laboratory, P.O. Box 73, Room D-422, Lexington, MA 02173.

June 27-29

Videotex '83 will be held at the New York Hilton. Sessions include the following: "Videotex and the Media: Contending with Dollar Decisions"; "Advertising on Videotex: Can You Count on It?"; "Content and Design: Getting it Right"; and "Focus on Teletext: Setting a Fast Pace." For more information, contact: Pam Fendel. London Online, 1133 Avenue of the Americas, 33rd Floor, New York, NY 10036; 1-212-692-9003.

people

Stainless has appointed **Robert A. Farrington** as president and chief operating officer, succeeding **Henry J. Guzewicz,** who will continue as chairman of the board of directors and chief executive officer. **Richard J. Eberle** will assume the office of vice chairman of the board of directors, relinquishing his present position as executive vice president to **Jess C. Rodriguez,** who until now has served as vice president and director of sales. **John L. Windle** will become vice president, engineering, moving up from his current position as chief engineer of design and fabrication.

John D. Rittenhouse has been elected group vice president of RCA Corporation. He had served since 1981 as division vice president and general manager of the RCA Picture Tube Division in Lancaster, PA. In other announcements, the company elected **James Vollmer** senior vice president, technical evaluation and planning; and RCA Americom presented its first Technical Excellence Award to **Irving W. Harrison,** for work that resulted in a redesign of the tracking, telemetry and control computer software systems that maintain the company's communications satellites in their orbits.

Richard R. Green has become PBS' director of engineering development. Green was formerly director of the Advanced Engineering Technology Laboratory for CBS, where he was responsible for research and development activities in advanced video systems, satellite communications, fiber-optics and laser technologies, and computer generation and processing of imagery.

BGW Systems has announced the promotion of **Irwin Laskey** to director of sales and marketing. Laskey joined BGW Systems in 1978 as a sales representative and was later appointed sales manager.

Tom Long, previously associated with Tektronix, has assumed the position of executive vice president for Analogic Corporation.

John Camarda has been named sales representative, broadcast products, for Elector USA. Camarda was formerly director of marketing for RF Technology.

Frank G. Shufelt has been named New England regional sales manager for ADDA Corporation. He was formerly New England and Metropolitan sales manager for Ampex Corporation.

The appointment of **Jim Lucy** as vice president of marketing was announced recently by Elcom-Bauer.

Appointment of **Richard J. Quinlan** as Eastern regional sales manager has been announced by Shintron. Responsible for all company sales activities in New England, New York, the Middle Atlantic States and the Southeast, Quinlan comes to Shintron from his previous position as national sales manager at US JVC Corporation.

Datatron has announced that **S. Douglas Sorensen** has been appointed Northeast regional sales manager for the Video Systems Division. Sorensen will be based in the Boston area and will be responsible for the territory including Illinois, Indiana, Ohio, West Virginia, Maryland, Delaware, the District of Columbia, as well as the Northeastern states.

ad index

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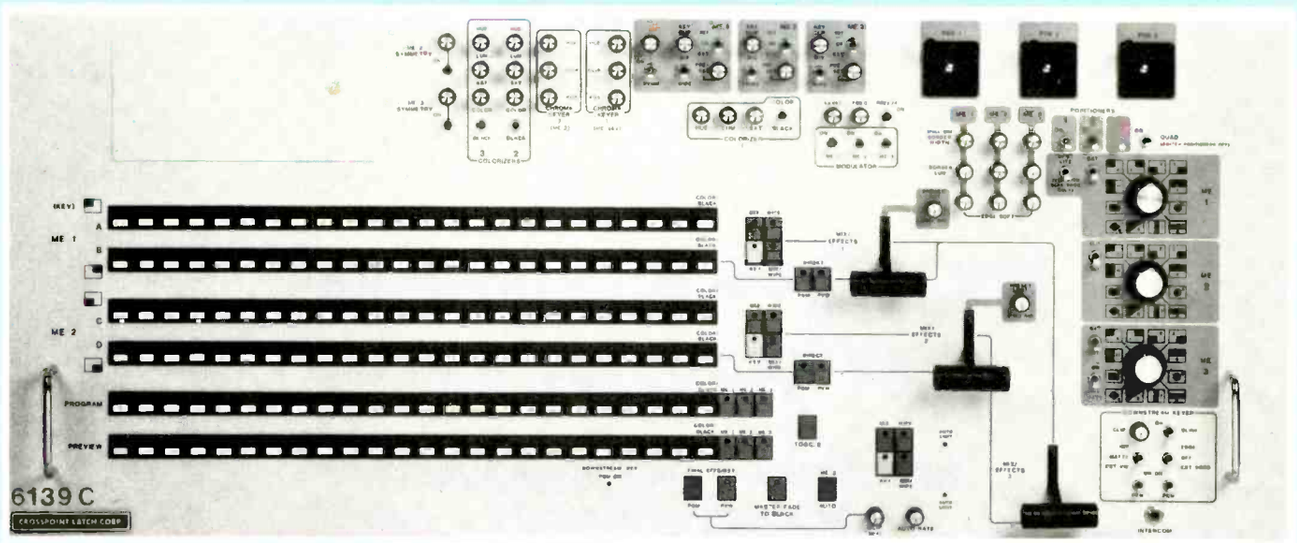

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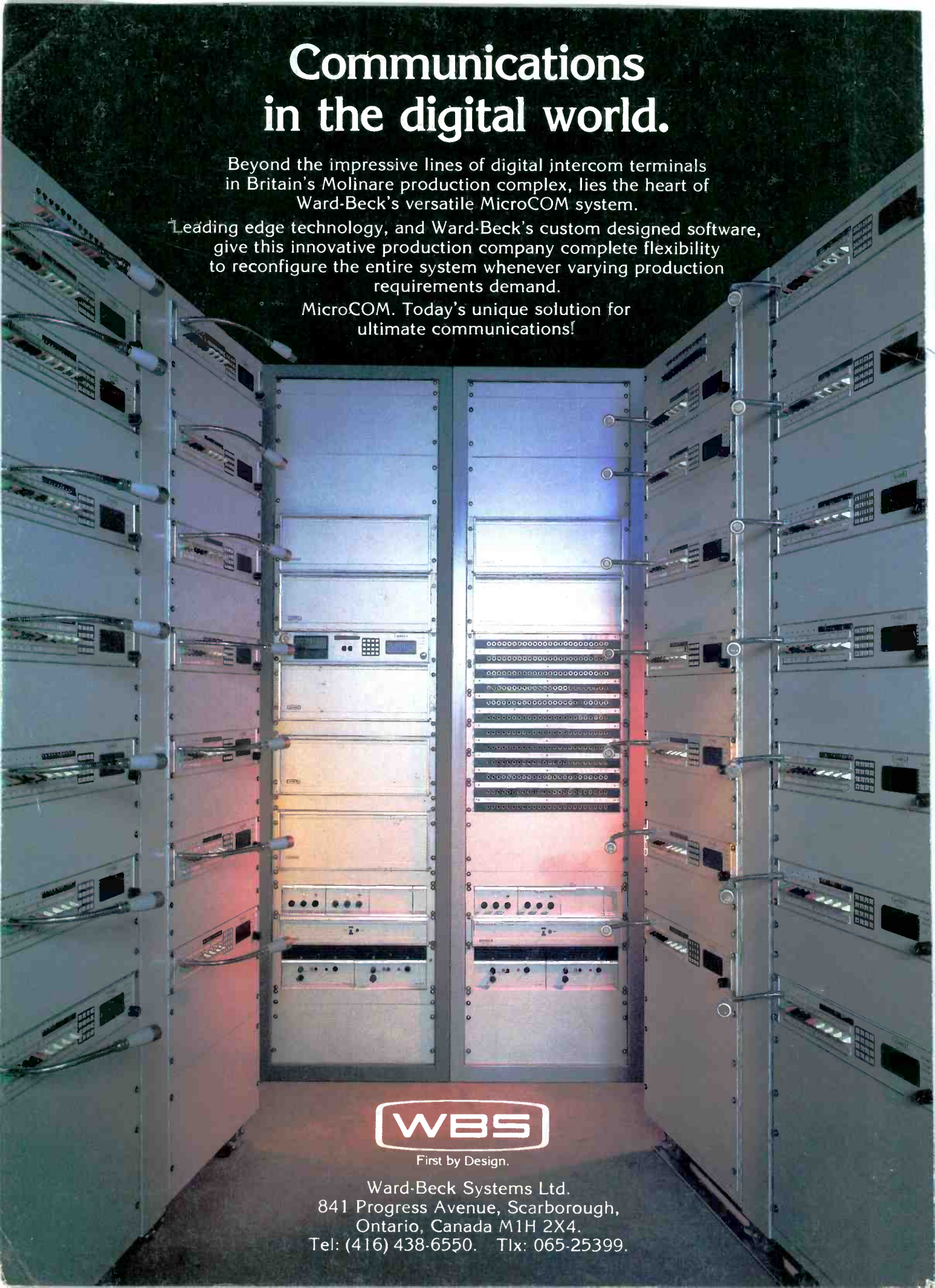
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