

JULY 1985

\$3.00

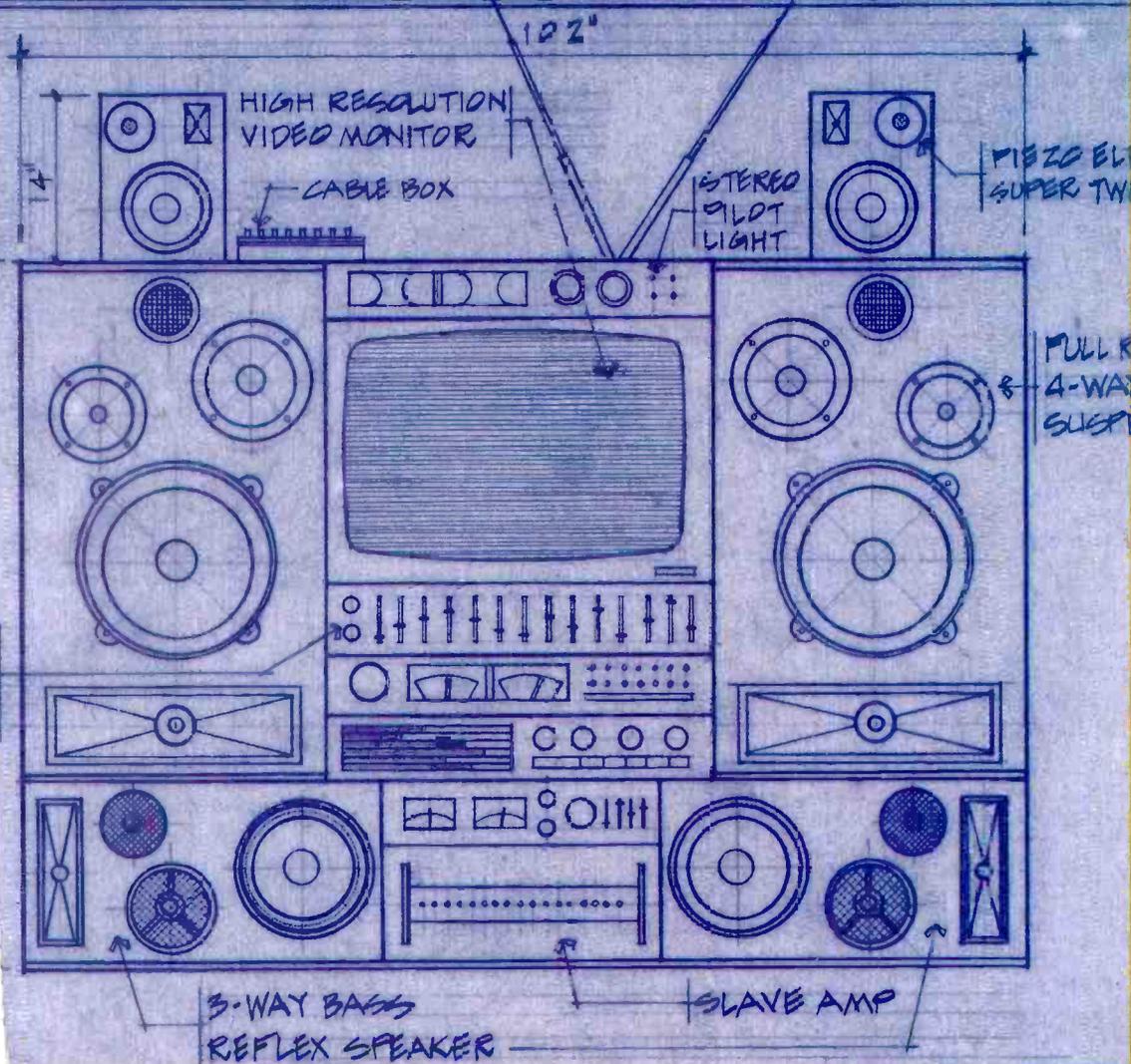
BME

BROADCAST MANAGEMENT/ENGINEERING

PROGRAMMING &
PRODUCTION:
THUNDERSTORM WARNINGS

Multichannel TV Sound

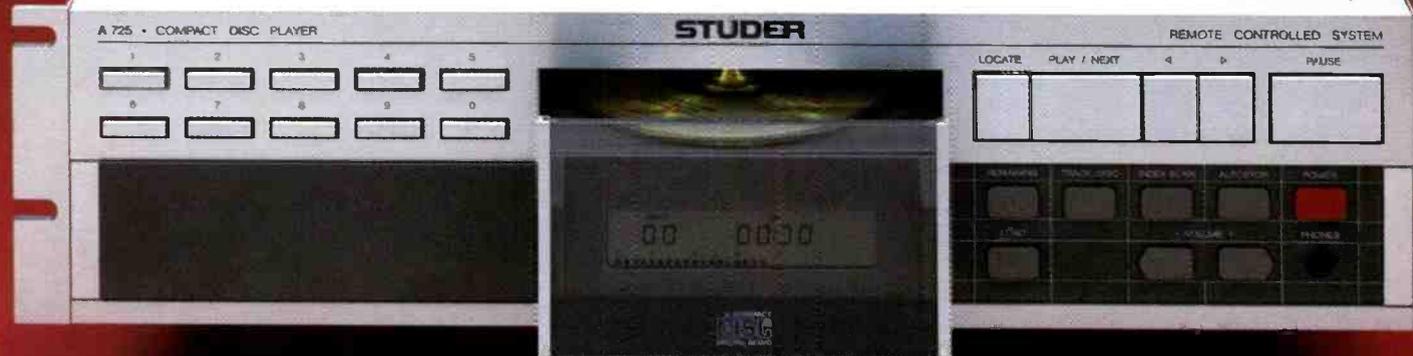
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Also in this issue:

The Technology of Tape ■ Building a Radio Facility ■
Radio Commercial Production ■ Horse Racing on TV

Studer Audio: Digital Playback Systems



A Sensible Solution to Your CD Dilemma.

Should you try getting by with a CD player made for home hi-fi use? Or should you invest heavily in a multi-thousand-dollar pro CD system? Fortunately, there is another alternative.

A Practical Professional. The new A725 CD player from Studer makes sense, for the present as well as the future. It gives you a modestly priced yet fully professional CD player for the present – a time when you'll be using CD's alongside other sources. And it also serves as the first building block in a larger, multi-unit, computer-controlled system for the future.

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remaining time on track, or remaining time on disc. A bar graph gives additional information on tracks remaining or approximate elapsed time, depending on display mode. When indexes are accessed, index numbers are also displayed.

The Programming Department. Programming controls (lower left) may be used to pre-select up to 19 separate steps, including nearly every conceivable combination of repeat, skip, loop, and autostop functions. A protective cover is provided to prevent unauthorized use of these controls. A serial data port allows linkage to external computer control systems.

Critics Choice. The A725 utilizes oversampling (176.4 kHz) and digital filtering as well as proprietary analog filtering circuits. This same combination in our

Revox B225 consumer version has earned unanimous praise from audio critics. Because it simply sounds better.

Price Surprise. The A725's professional features and superior performance come with a price you might not expect: \$1550.* This is the sensible professional CD player broadcasters have been asking for, and it's available now from your Studer dealer. For more information or dealer referral, please contact: Studer Revox America, 1425 Elm Hill Pike, Nashville, TN 37210; (615) 254-5651.

*Manufacturers suggested retail price.

STUDER REVOX



Track Time Remaining



Disc Time Remaining



Track Time Elapsed



Disc Time Elapsed

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PICTUREMAKER[™] 3D VIDEO ANIMATION SYSTEM.



SOLID DEVELOPMENTS WITH PICTUREMAKER[™] — SIGGRAPH UPDATE:

Cubicomp's PictureMaker 3D Video Animation System was a star attraction at the National Association of Broadcasters Conference this year. Since NAB, our sales are positive proof that video producers have found in PictureMaker all the features needed to generate and animate 3D scenes.

PictureMaker is easy to use, with many capabilities:

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- **Sequencing** — Composes and shoots sequences automatically.

- **Titling** — 8 standard fonts included and more available as options, plus the ability to create your own fonts.

- **Paint** — A built-in paint program enables you to create 2D backgrounds and special effects.

If you missed PictureMaker at NAB, or would like a refresher demo of this affordable, practical 3D animation system, come see us in San Francisco at Siggraph, Booth #654, July 23rd to 25th at the Moscone Center.

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**SONY PRESENTS THE MOST ADVANCED
FIELD/STUDIO CAMERA UNAVAILABLE TODAY.**



**INTRODUCING THE
SONY BVP-360. ON MAY 1, 1985,
THE REMARKABLE
BECOMES AVAILABLE.**

When we previewed this camera at NAB, the response was tremendous. Which, considering Sony's considerable reputation for high performance broadcast portables, wouldn't normally seem so surprising. Except for one detail.

The BVP-360 isn't a broadcast portable. (Although at 50 pounds it's certainly the most portable camera in its class.)

What the BVP-360 represents, however, is the culmination of Sony's work in tube technology, in innovative mechanical design and in High Definition Video Systems. A highly sophisticated, automated camera that promises to usher in a new era in price/performance for cameras in the Field/Studio category.



Sony-developed 2/3-inch Mixed Field Saticon.[™]
(Plumbicon[™] tubes also available.)

**THE 2/3-INCH IMAGE
FORMAT COMES OF AGE.**

For those of you unable to get through the crowds for a close look at the BVP-360, there are two explanations for the exceptional image quality you saw on the monitors overhead.

First, the BVP-360 employs the remarkable, Sony-developed 2/3" Mixed Field* tubes. The first real challenge to big tube performance. Because they deliver twice the registration and geometric accuracy of conventional 2/3" tubes. Plus greater depth of modulation. And thanks to the special Sony-developed FET that is built into the tube and yoke, an extraordinary signal-to-noise ratio. (MF Plumbicon[™] or MF Saticon[™] tubes are available.)

Secondly, the Sony BVP-360 is equipped with a breakthrough FL.2 prism design that single-handedly results in sensitivity and depth-of-field comparable with

25mm image formats. And vastly superior to any current 2/3" Field/Studio camera at any price.

And, naturally, when you combine these factors with the extensive signal processing technology Sony has engineered into the BVP-360, you get specs which could only be described as spectacular.

**A SUPERHUMAN FEAT
OF HUMAN ENGINEERING.**

Many of the experts who were able to get their hands on the camera at NAB were even more impressed by how it performs from a human standpoint.

Some were moved to comment by how easy the BVP-360 is to move around. Its smoothly integrated handles. Low weight. The highly maneuverable viewfinder. And the shortest lens-front-to-viewfinder distance in the industry.

Others cited the uniquely pragmatic approach to automation. An approach that concentrates the camera's considerable microprocessor-based intelligence on the most difficult setup operations; functions such as digital registration, B/W balance, flare and gamma.

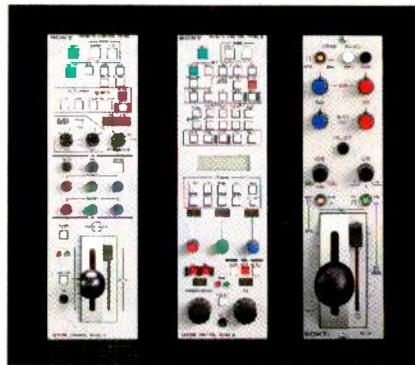
And still others referred to the BVP-360's extensive camera head memory, which can store up to sixty-four scene files, eight setup files, sixteen lens files and three reference files.

Plus the advantages of being able to choose from three remote operational panels.

**NOT JUST A CAMERA.
A CAMERA SYSTEM.**

But perhaps the most striking aspect of the BVP-360 is its "building block" design concept. An arrangement that makes it particularly easy to customize the camera for various production situations.

It starts with a



BVP-360 Remote Control Panels: (left to right) a flexible Field unit, a highly sophisticated Creative Production panel and a simple Studio unit.

camera head able to transmit component signals via Triax or Multicore. Or function as a stand-alone camera.

Then, on the technical front, alignments are handled at the Camera Control Unit. With each camera able to be tweaked individually. Or addressed as part of up to an eight-camera chain linked to one Master Setup Unit.

And finally, on the operational front, all control during production may be directed from one of three types of Remote Control Panels—a simple Studio model, a flexible Field unit, or a highly evolved Creative panel with extensive memory and scene-painting facilities.

**ADOPT A
WAIT-AND-SEE ATTITUDE.**

Of course, as we said at the outset, the BVP-360 isn't ready for delivery tomorrow. But that doesn't mean you have to wait until May to see it. There are units here right now for demonstrations and evaluations.

And of course, by the time you're finished testing it, raving about it and getting a budget for it (although that last part may go faster than you're used to thanks to the BVP-360's incredible price/performance), it won't be tomorrow. It'll be closer to May 1.

SONY
Broadcast



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INTRODUCING

Phase 2

Now with two channel capability



Intercom technology takes a giant step forward as Telex advances to PHASE 2 of its popular Audiocom Intercom System. What's more, two channel capability and a full duplex audio system for both monaural and binaural systems is only a small part of the story! The new master station/power supply shown above features built-in IFB (interrupt feedback) and easy-to-use color coded line/channel buttons that can correspond with the same color of optional extension cables for convenient visual reference. The master station also features a brand new 20 kHz light signaling system, interlocking push-button channel switches, a listen/volume control, a mike on/off/signal control and a power on/off LED indicator.

Belt-pack headset station has special features

The new two-channel belt-pack intercom station allows the operator to selectively monitor one channel or both simultaneously. It has a mike on/off switch and separate listen/volume controls for each channel as well as a special carbon headset input and separate sidetone adjustments. There is also a rack mountable version of this unit available with all the same features. Additionally, Telex has developed an entirely new line of intercom headsets to accompany these exciting Phase 2 changes. And, they are lighter and more comfortable than ever before! The new offering consists of single/dual side units, monaural and binaural units, a super lightweight and a new headset.

ANNOUNCING complete compatibility!

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DON'T GET LOST IN THE FOREST, GET TOUGH . . .

PCL-606 and PCL-606/C

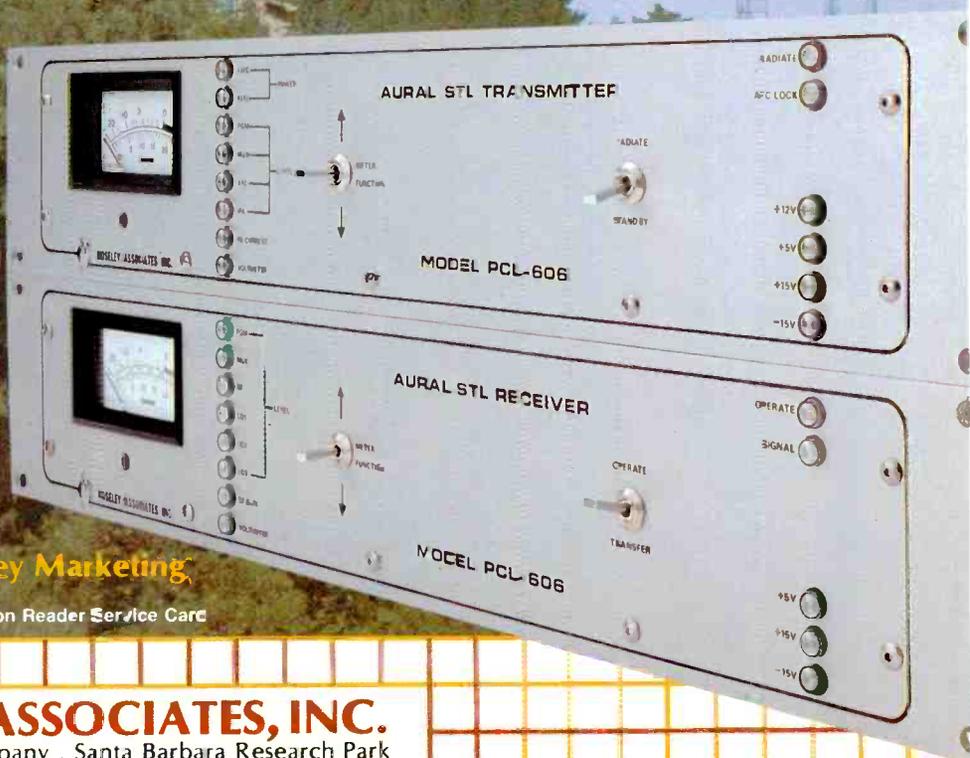
There's a jungle in the Angeles National Forest. Most of the broadcast transmitters for the greater Los Angeles area are at this single site on Mount Wilson. That means intense competition for both bandwidth and audience. The vast majority of Mount Wilson-based broadcasters choose Moseley because the PCL-606 and PCL-606/C Studio-Transmitter Links are tough, proven winners in both respects.

To keep the signal strong and distortion-free, the monaural PCL-606 and composite stereo PCL-606/C use PIN diode attenuators to maintain maximum signal level and dynamic range while preventing overload from out-of-band noise. The receiver is very selective, and the bandwidth is adjustable so that if selectivity is not critical, distortion can be further reduced.

To keep the signal bright and clear, careful IF modulation techniques are employed. Digital demodulation and a series of ultra-phase linear IF filters split the baseband frequency from the two subcarrier frequencies without noticeable noise or distortion. The subcarriers can be used for SCA or remote control data carriage.

The PCL-606 and PCL-606/C are constructed for years of service in rugged environments yet designed for easy maintenance. They feature built-in internal system performance metering for both transmitter and receiver. All service adjustments can be made through the top cover, and modular construction makes repair easy. Continuous broadcast is assured even in case of failure or abnormality shutdown because the receiver automatically switches to a redundant standby unit.

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- ULTRA LOW NOISE AND DISTORTION
- SELECTABLE IF BANDWIDTH
- EXCELLENT SELECTIVITY
- BUILT-IN DIAGNOSTIC METERING



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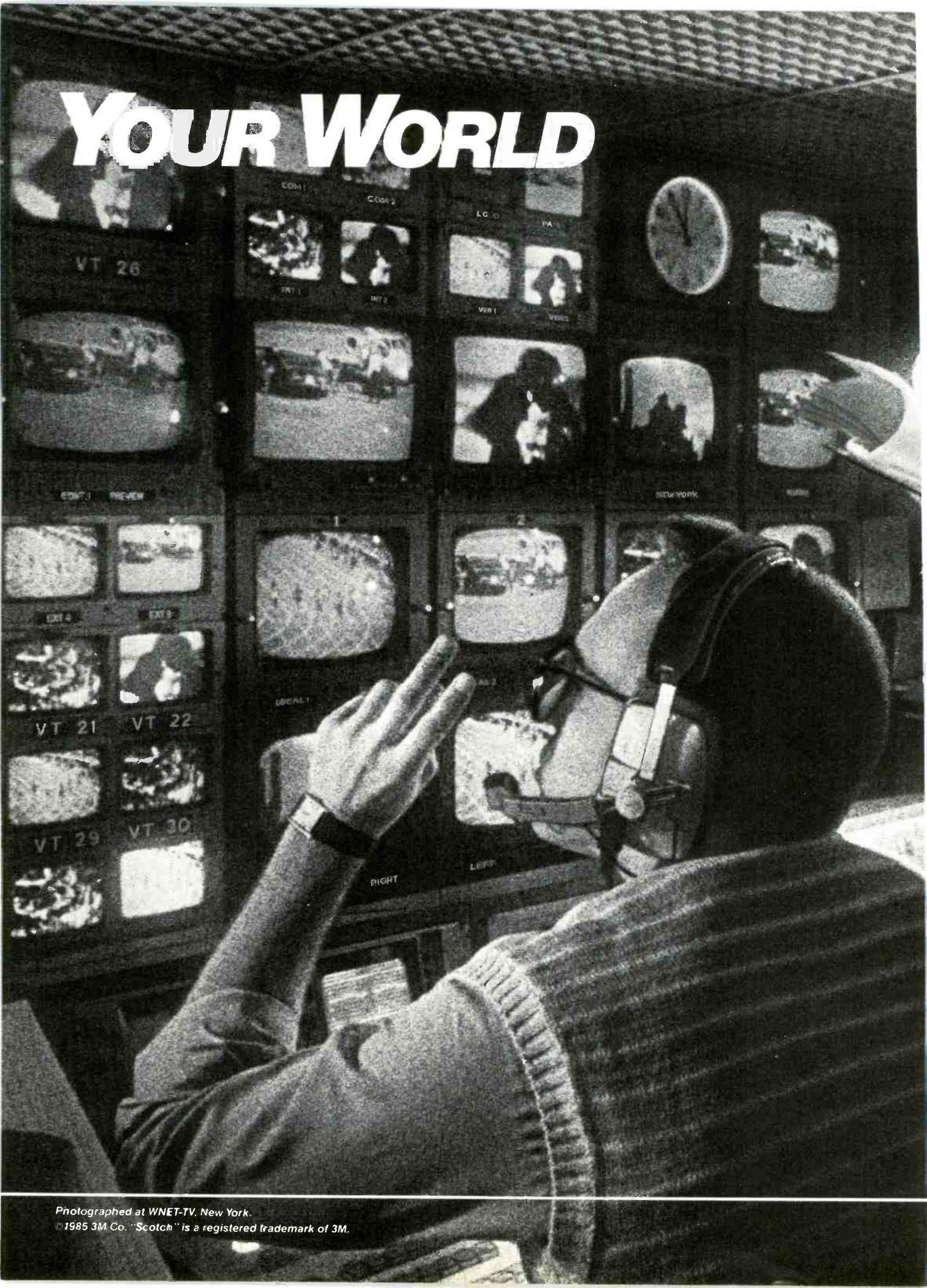


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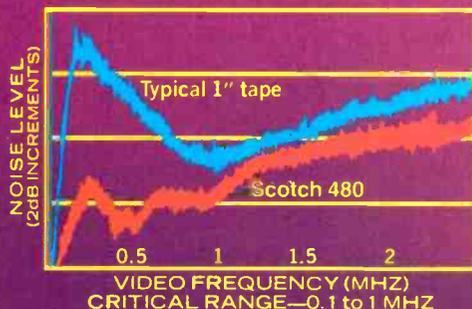
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BROADCAST MANAGEMENT/ENGINEERING

JULY 1985

VOLUME 21/NUMBER 7

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Fidelipac: Designing a Broadcast Tape Plant

Sony: The Increasing Density of Magnetic Recording Tape

Ampex: Incoming Raw Material Control for Magnetic Tape Manufacturing

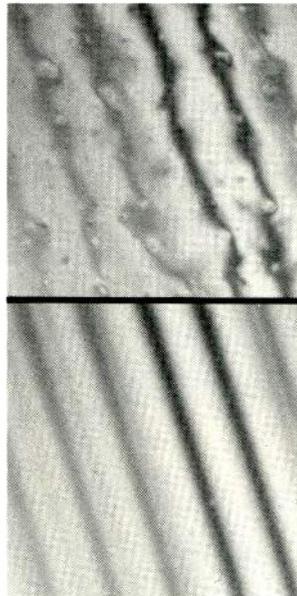
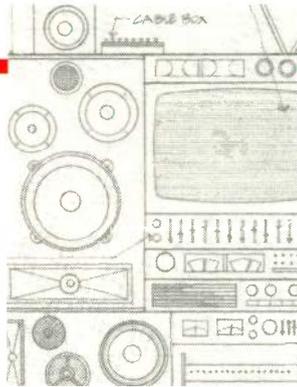
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NEXT MONTH

■ THE SOURCE:
1985 BUYER'S GUIDE

It takes a unique graphics look to stand out from today's look-alike news productions. So we've built some unique graphics tools into our new ESS-3 Still Store that you won't find anywhere else.

The ESS-3 lets you compose an unlimited number of elements, all with the fidelity of first generation video. You can cut and paste, key and drop shadow irregular shapes, and program your own dissolves, cuts and wipes. And with its var-

iable compression you can insert over-the-shoulder stills—without a digital video effects unit.

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And, to make your news preparation fast and effortless, the ESS-3 displays 12 stills at one time for you to browse through and edit. Compare *that* to any description-only

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Our new
Still Store helps
take the snooze
out of your news.



AM Appeasement Committee

When the NAB's Engineering Advisory Committee decided, in the fall of 1983, to examine the technical plight of AM radio, it was a cause for radio broadcasters, specifically those in the AM band, to at last feel optimistic. No one knew better than they how the decline of AM listening had reached alarming proportions. For once, AM station owners and engineers could rest assured that the NAB had their best interests at heart and would come up with some practical approaches for warding off the oft-uttered predictions of disaster about the future of AM radio.

But now, more than a year later, the AM Technical Improvement Committee has made its report, and AM broadcasters cannot be faulted for feeling once again that they have been dismissed with a mere token appeasement.

The committee's stated purpose was to analyze current problems and reach a "consensus" on ways to improve AM. But that consensus is not evident in the committee's report. Nor is there any indication that the report gives more than a perfunctory glance toward any of AM's real and pressing problems.

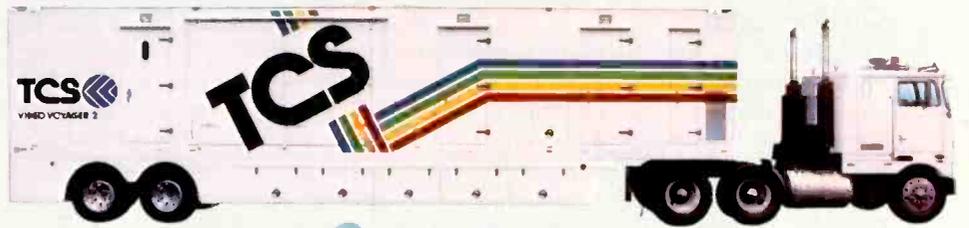
The most glaring example of the committee's failure to respond to the industry's needs is on the question of AM stereo. Stereo transmission remains AM's most heated controversy—but also its greatest hope for the future. With the excuse that its controversial nature precluded a consensus, the committee wrote off the AM stereo question entirely, saying it was not in the scope of the committee's work.

The committee's work on other crucial issues was hardly more encouraging. It recommended that AM listening be promoted, but admitted that it didn't know how such a suggestion could be implemented. It put off any substantive discussion of alternate antenna designs, pending further research. It failed to reach a consensus establishing a standard preemphasis curve, throwing a suggested ceiling of 12 kHz back onto individual stations on a "voluntary" basis. The question of TTD (transmitter transient distortion) was barely addressed. And at the same time that it urged the development of a high-quality IC for AM receivers, the report admitted that the premise on which the suggestion was based was "arguable."

Very few radio broadcasters operate under the illusion that the NAB is a technically oriented group. Still, it is becoming increasingly difficult to believe the sincerity of the NAB when its technical committee pays only lip service to the critical issues facing the industry today.

Despite the NAB's recently expressed concern for its radio members, and despite such gestures as recommending that radio be separated out in its own exhibit hall at NAB '86, radio broadcasters in general, and specifically AM broadcasters, must be asking themselves just whose best interests the NAB has at heart. Unfortunately, such a feeble effort as the report of the AM Technical Committee gives them even more reason to suspect that the NAB may be in danger of becoming instead the NA(TV)B.

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Changes Proposed in AM Technical Rules

The FCC is seeking comments on the proposed revision or deletion of certain AM transmission technical rules that "may no longer serve their original regulatory purposes," according to the Commission. Actions under consideration include:

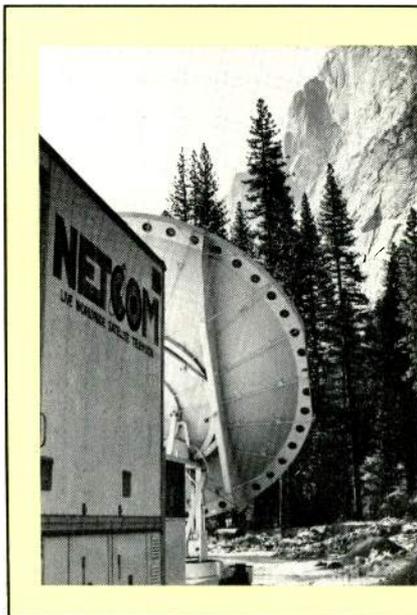
- Deletion of program signal quality requirements for AM stereo transmission systems.
- Deletion of requirements for comprehensive reports on measurements of antenna resistances.
- Deletion of transmission system safety requirements that may duplicate regulations of other government agencies.
- Revision of the requirements for indicating instruments.
- Deletion of rules which provide engineering advice.

NARTE Expands Certification

Though the FCC has dropped its own engineering certification program, interest has remained strong within the engineering community for finding some way to determine the level of an engineer's training and knowledge. Like the Society of Broadcast Engineers, NARTE (National Association of Radio and Telecommunications Engineers), based in Salem, OR, is making a push to establish its certificate as an industry standard.

To do this, NARTE is expanding its certification and endorsement program for radio and telecommunications technicians and engineers. NARTE says it expects its certification tests to set a new standard for thoroughness and range. Endorsement for technical areas which the association says have not been covered previously in FCC or industry tests will be available.

Engineers already holding an FCC license can have their license grandfathered through the end of this year. Those who did not have a license but can prove enough experience, such as persons who have worked for the government, are also covered by the grandfather period, as are those who want to upgrade due to experience gained on the job. A first-class engineer requires



When There's Only One Direction to Go

Yosemite National Park may be a rock climber's and photographer's dream, but live coverage from one of its valley floors does pose a transmission problem. Thus, when ABC Sports wanted to give its viewers the hair-raising thrill of watching, live, a 3000-foot free-climb up Lost Arrow Spire, one of the park's vertical rock faces, it had Netcom bring in a portable C-band uplink to get the story to New York. Netcom, a production facility/equipment rental/satellite broker based in San Francisco, says it is providing 10 or more such links for ABC this year.

one of the following: a minimum of 15 years experience in engineering; a BS (or BA in a technical program) plus 11 years experience; a professional engineering registration certificate plus 11 years experience; or an engineering registration from a country other than the U.S. plus 11 years experience.

Criteria are similar for a first-class technician, and second- and third-class engineering and technician certifications are also available.

Additionally, NARTE is arranging for its tests to be administered both at institutions across the country and for graduates of certain technical schools to be certified.

Complete details are available from NARTE, Box 15029, Salem, OR 97309. (503) 581-3336.

Radio Survey Shows AM Stereo to Grow

The NRBA has released the results of its 1984 National Radio Programming Survey, which indicates that a substantial increase can be expected in the number of AM stations broadcasting in stereo. The results of the NRBA's third annual survey are based on a reported response rate of 46 percent of all commercial radio stations, the highest number of returns the survey has ever achieved.

Among the AM stations responding, 13 percent say they are currently broad-

casting in stereo, compared with four percent in 1983. An additional 11 percent plan to go stereo this year. Of those, the formats most interested in stereo are easy listening, soft rock, and adult contemporary; besides news/talk, the least interested were CHR, religious, and big band. Among AM/FM simulcasters, AOR and adult contemporary have the biggest plans for stereo.

Many of the remaining stations that have not yet gone to satellite plan to do so this year. With the 14 percent of AMers that plan on either satellite service or a dish, virtually all AM stations will be tied to satellite. The nine percent of FMers intending to start satellite use will join the 72 percent that already do so.

Newscasts did not decline in average length, despite FCC deregulation, the NRBA notes. The AM average for last year went from 5:15 for the previous year to 5:48; FM increased from 4:00 to 4:05.

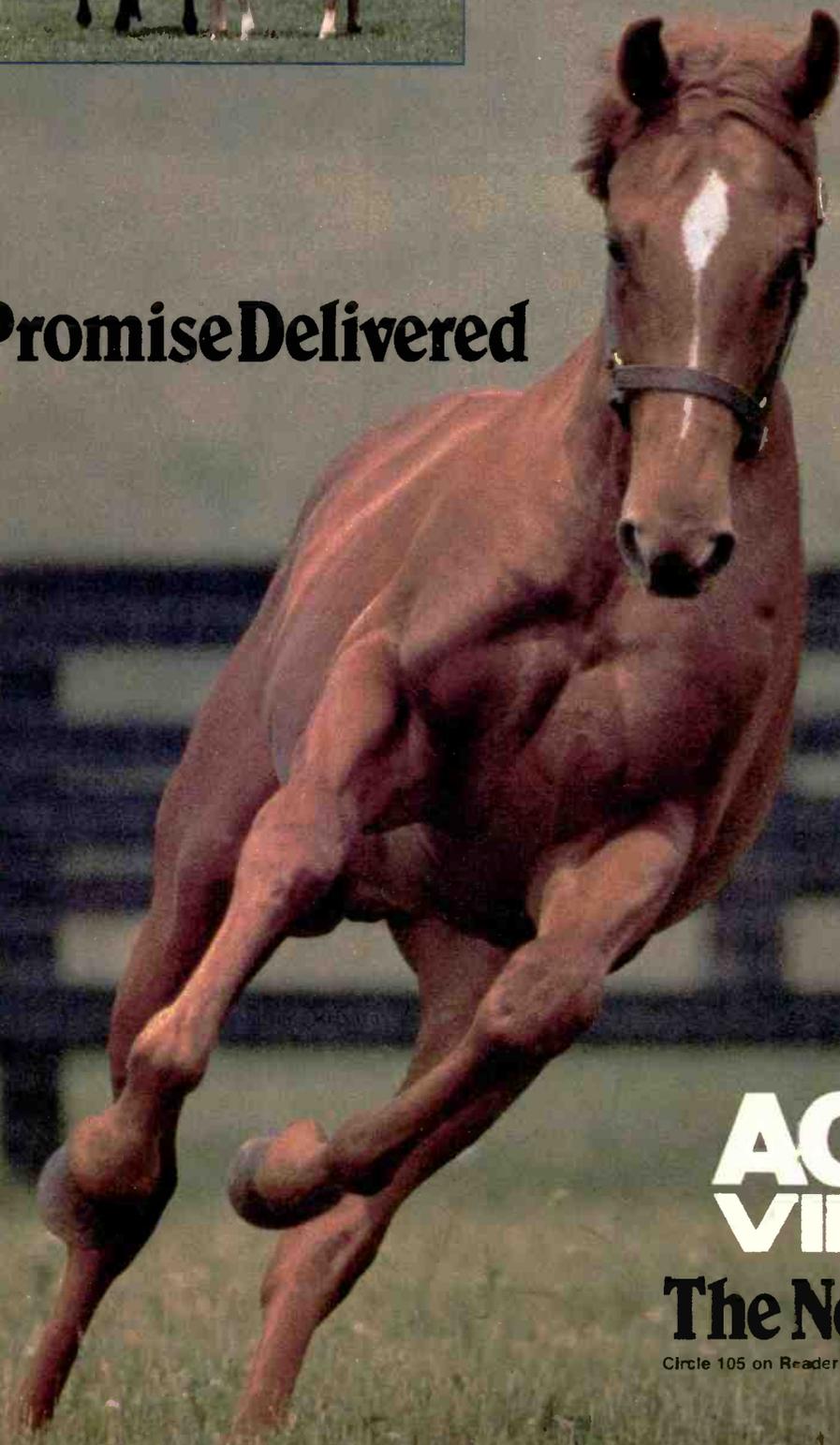
Average commercials per hour on FM increased from 9:25 to 9:54 and average spots per hour from 11.9 to 12.4. AMers reported 10:52 of commercials per hour on average, down from 11:35, and 14.2 spots per hour, down from 15.5 in the previous year.

As for the programming itself, adult contemporary still leads for FM and full-time AM, and country for AM daytimers.



Promise Born

Promise Delivered



**AGFA
VIDEO**

The New Breed

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NEWS

Eight Local Stations Win ACT Awards

Eight local stations, including two radio broadcasters, have picked up Achievement in Children's Television Awards, presented each year by advocacy group Action for Children's Television (ACT). Two stations were recognized for their PSAs.

Local commercial broadcast television winners were WCCO-TV, Minneapolis, for "High School Year-

book Special" and WNEV-TV, Boston, for "The Story Lady."

Public broadcast winners included KTCA-TV, Minneapolis, for "Newton's Apple," and "Wonderworks" by WQED, Pittsburgh.

Radio stations that received an ACT Award were WNYC-AM, New York City, for *Small Things Considered* as well as WUNC-FM, Chapel Hill, and the Southern Educational Communications Association for "East of the

Sun—West of the Moon."

PSAs were also recognized, and KTVU, San Francisco, won for its "Child Safety Spots." WBZ-TV, Boston, got an award for "It's Okay to Tell Secrets" and WNEV-TV picked up another award for "Build Happiness at Home."

Television Stereo: The Beat Goes On

The movement to stereo among television stations is picking up speed as broadcasters across the country race to be the first in their area to convert. Here are some stations that have recently made the change:

• WYES-TV, the public television station in New Orleans, has finished its gradual conversion over the past three years and is now on-air in stereo—the first in that market, it says. Last fall the station installed two new Harris TV 35 H transmitters and now has installed a stereo generator.

• WCLQ-TV, Cleveland, is broadcasting synthesized stereo full-time, making it the first commercial station to do so in the state, it believes. It modified an FM generator with processor cards purchased directly from dbx.

• WAPB in Annapolis, another public broadcasting station, reports that its DATE presentation of *West Side Story* inaugurated stereo broadcasting in Maryland. All Maryland public stations are scheduled to go stereo within two years, and Maryland public television programming is now being synthesized for stereo.

• WTBS, Ted Turner's superstation out of Atlanta, has gone stereo and is being distributed that way to cable operators by Satellite Syndicated Systems using Wegener's 1600 Series Transmission gear.

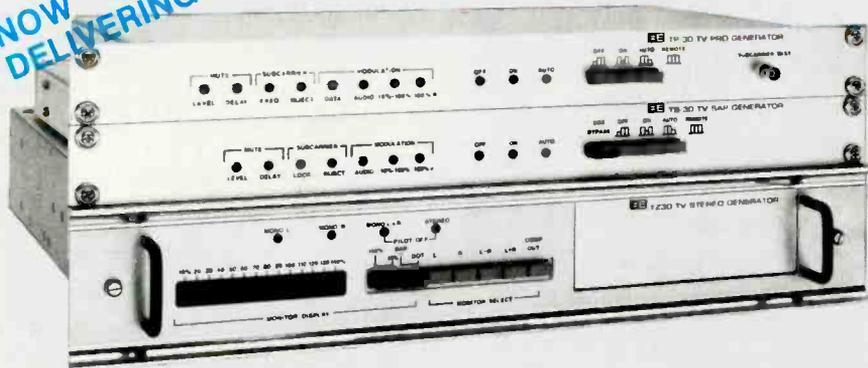
1001 EBS Alerts, Or, "This Is Not A Test"

Broadcast stations activated the Emergency Broadcast System at least 995 times in 1984, according to an FCC tally of reports it received last year. The most common causes were tornadoes and severe thunderstorms.

Since 1976, when the state and local sections of the EBS program were started, many broadcasters have kept in close touch with designated local offi-

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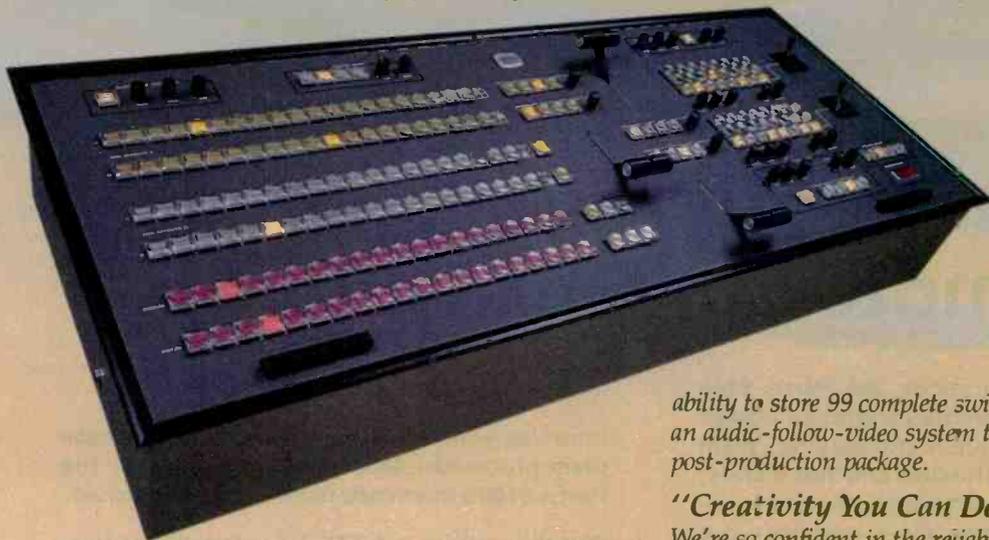
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mote control system on the market.

Improve your manpower allocation. Increase plant protection. Maximize equipment life. The Harris 9100's automatic features are unmatched.

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HARRIS

NEWS

cials, who keep watch over storms along with local citizens. In the mid-west, where most of the activations occur, those peculiar green and yellow skies preceding a bad thunderstorm can, without warning, sprout a funnel cloud lasting for seconds or minutes and travelling at will across the countryside or through towns.

Man-made disasters, including a toxic spill, also account for some of the 1000 EBS alerts last year.

The National Weather Service itself accounts for about 90 percent of the alerts, according to Ray Seddon, chief of the FCC's Emergency Communications Division. Seddon reports that the service attaches requests for an alert to its weather reports for any of the 585 EBS operational areas that will be subjected to dangerous weather. Stations choose whether they want to notify their listeners with the EBS alert tone or just by an announcement.

In Carbondale, IL, WCIL-AM/FM used the EBS 40 times in the second half of last year. News director Joey Helleny says the station's alerts have received a good response from listeners, who depend on the EBS tone to signal them when the radio is playing in the background. Several other stations in the area also monitor WCIL, he reports, because they can be sure to find out if severe conditions exist that their listeners should know about.

WCIL, in fact, distinguishes different levels of an EBS alert. For a storm or tornado watch, the weatherman or DJ repeats a message between each program element. When tracking a tornado during a tornado warning, however, they stay on the air continuously. Also, WCIL has rigged itself to start simulcasting on both AM and FM just before announcing a warning. Helleny says this is not done for watches, which merely cite the possibility of a tornado. When a tornado has been sighted and is being tracked, however, a few minutes can make a crucial difference. In 1982, a tornado killed 11 people in the nearby town of Marion.

For that reason, WCIL and its neighboring stations cooperate closely, calling each other if it seems likely a tornado is headed at one of them. This neighborliness extends across state lines to nearby Missouri since storms tend to come from the southwest.

About 200 miles west and a little south of WCIL is KTTS-AM/FM of Springfield, MO, which sounded 80

EBS alerts from September to December of last year, almost all for thunderstorms and tornadoes. News director Dan Shelley says the alerts are always based on National Weather Service advisories for the 35 counties in the listening area, and that the stations have built up a reputation as the source for weather information.

Audience reaction, Shelley finds, is "extremely good," and in fact some listeners buy special receivers that automatically turn on the amplifier when

activated by the EBS tone, KTTS, which has donated some of these receivers to local hospitals, shopping and civil defense centers, has won at least one regional news award based on its severe weather coverage, Shelley adds proudly.

As for any adverse reactions to the frequency of stations' EBS use, Seddon of the FCC says the only letters of complaint he has received concern stations that precede ads with the emergency tone.

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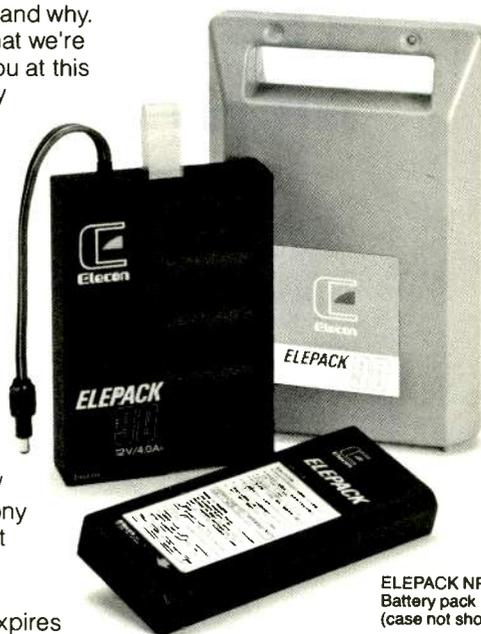
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NEWS

New Push Behind WST Teletext

A new agricultural information teletext service, using the World System standard (WST), has been launched on Wisconsin public television stations. Zenith, which manufactures WST decoders, is helping to promote the service, called Infotext, by demonstrating it on Zenith sets at 90 retail outlets throughout Wisconsin.

Infotext provides up-to-date market

reports, commodity prices, weather data, agricultural bulletins and other information of interest to farmers and agribusinesses on the VBI of eight public stations.

Zenith estimates that some 85,000 Zenith color TVs in homes throughout Wisconsin are adaptable to WST decoders by installing the Zenith Redi-Plug.

Another push for WST teletext has been launched by Taft Broadcasting, which has been offering its Electra

Teletext service for several years. Currently, Electra can be picked up from the VBI of superstation WTBS.

Now Taft news director Terry Connelly says Electra has become a national service, to be offered free to any station that wants it. Connelly said the national Electra service has 50 pages of world and national news, plus business, weather and sports information. To take advantage of the free service, which is being offered by Taft along with Syndicated Satellite Systems of Tulsa, OK, a broadcaster has only to sign a one-year affiliation agreement, downlink the WTBS signal, and install a data bridge to strip the teletext information from the WTBS VBI and insert it into their own.

With the controversy over teletext standards fizzling out, now that NBC has abandoned its competing NABTS teletext service and CBS is not as eager to push their NABTS service, the only stumbling block remaining to widespread acceptance of WST teletext is the lack of decoders or receivers finding their way into consumers homes. That problem may be lessened later this year, however, with the first showing of digital TVs on the market. According to the WST people, the ITT digital chip in the sets allows for built-in reception of WST teletext without a separate decoder.

Radio Station Takes Nets Via Satellite

KHVV-AM, an all-news station in Honolulu, has begun receiving its five news and information networks by satellite, using three earth stations on Oahu. Of the five news nets, three will be converted to digital for transmission, and two will be fed by standard analog systems.

Prior to its satellite conversion, all KHVV's network programming was accessed by way of a truly long line, full-time, from Hawaii to California. Some sports programming will still be received this way until capability is available.

"We are very excited about the latest technological improvements," said KHVV president Lawrence S. Berger when the change was made, "not only because Newsradio 99 will sound better, but also because satellite communications will give us greater and more complete access to our mainland networks."

"FOR THE GENERAL BROADCASTER THERE'S NO CHOICE. THE AN-2 STEREO SIMULATOR IS COMPLETELY MONO COMPATIBLE, SOUNDS GREAT AND IS PRICED RIGHT"

*Jim Swick
Assistant Chief Engineer
Maintenance and Design
WTTW Chicago*

"We were the very first TV station to broadcast full-time in stereo and Studio Technologies' Stereo Simulator was with us from the start. As we began experimenting with on-air stereo I was told about the unit. Being an old radio type I was skeptical... make stereo out of a mono signal? Sure. But when I plugged it in I was surprised. It gives you really nice room ambience and sounds great. We've been using it ever since. What's terrific about the AN-2 is that it is fully mono compatible—absolutely

no artifact left when you mix the two channels back together.

We use another AN-2 in our audio studio for 'stereoizing' movie clips for our Sneak Previews series... it's excellent for that.

We get a lot of feedback from our 'golden ears' listeners and all comments have been positive about our stereo sound... they really like it!"

For more information on the AN-2 call Studio Technologies, Inc. at 312/676-9177.



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NEWS BRIEFS

The European Broadcasting Union has chucked the 80 Hz HDTV standard it had suggested, but officially stated its reluctance for 60 Hz, favored by the U.S. and Japan, despite NHK's conversion studies. However, the EBU says it will continue to work towards a worldwide 60 Hz standard.

Those interested in specifics on the ANSI safety guidelines for **exposure to RF radiation**, which the FCC has adopted, can obtain a copy by asking for Standard C95.1-1982 from the American National Standards Institute, Fifteenth Floor—Sales Dept., 1430 Broadway, New York, NY 10018. Cost is \$7 The NAB has asked the FCC to set up a "government-industry" advisory committee to study **land mobile interference with UHF signals** The FCC has proposed amending its **remote pickup and low-power auxiliary service** regulations. "Short-term operation" would allow full-time local operation of broadcast remote pickup stations with the basic broadcast license. The 950 MHz broadcast wireless band would include 944 to 952 MHz.

According to a World Communica-

tions survey, over 700 commercial television stations, 88 percent of the U.S. total, can receive **C-band** satellite transmission Hubbard Broadcasting's **Conus Communications** says it has added seven new member stations to its satellite news-gathering group.

NPR members adopted a new funding plan which distributes federal money directly to the stations instead of through NPR.

As expected (see last month's *BM/E* News section), the All-Industry Radio Music License Committee has asked a U.S. District Court to set **ASCAP's fees for radio** stations The NAB has filed with the **Copyright Royalty Tribunal** for more money for television stations and a first-time share for radio stations.

The annual Roper poll conducted for the NAB shows **television news** ranks tops again in believability and as a primary source of news. Local stations lead over other media for "good performance in their communities" A Television Bureau of Advertising-sponsored study shows increased **television reach** into almost all age,

income, education, and occupation brackets.

The NRBA and NAB have told the FCC that they oppose its proposal to eliminate regulations concerning **combination advertising rates** and joint sales practices. The NRBA supports, and the NAB takes no position on, the elimination of fraudulent billing and clipping regulations.

The **National Computer Graphics Association** is holding a regional conference in Atlanta on October 21 to 24. Ted Turner will be the featured speaker, and hardware and software exhibits will be present Forox Corp. is taking entries for its sixth annual **Creative Slide-Making Contest**. Entry deadline is July 31; call (203) 324-7400.

The Libel Defense Resource Center has published an updated edition of its *50-State Survey*, which includes 1984 developments in **libel** and invasion of privacy law. Cost is \$75; call (212) 687-4745.

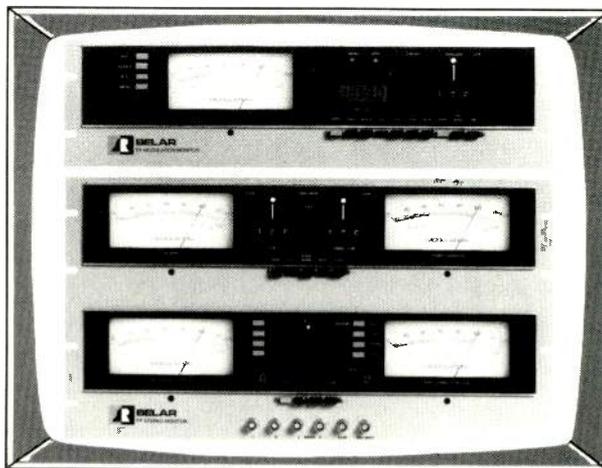
The Association of Independent Television Stations (INTV) has elected a new president, **Preston R. Padden**, formerly associate general counsel for Metromedia Broadcasting.

TV STEREO

BTSC SYSTEM AURAL MODULATION MONITORS

MODEL TVM-100 Wide Band Aural Baseband Demodulator/Monitor

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Compare pictures. You'll notice the AK-30 produces a superrefined video image. The kind of image broadcasters love to see. But that's not surprising with these kinds of specifications: Horizontal resolution is 650 lines center. S/N is a very quiet 62dB (-6dB gain), the highest ratio in the industry. Digital registration is 0.05%, 0.1% and 0.25%. And illumination is a mere 24 lux at f1.4 (+18dB gain).

This high level of performance is achieved with a unique combination of image-enhancing circuitry and high-focus-field Plumbicon* tubes.

You'll also appreciate the AK-30's automatic circuits. Like auto-white balance with memory for setting 2 color temperatures. Presettable black stretch. Auto-black balance, and a knee circuit for variable dynamic range.

Together, they let you customize the image you're shooting for.

Still, the AK-30 has plenty more going for it. Consider its dual outputs. One works with standard NTSC. The other lets you set new standards because it's compatible with component recording. That means you can use it as part of our famous M-format Recam system.

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ANOTHER BROADCAST INNOVATION FROM MATSUSHITA ELECTRIC

LETTERS

AM STEREO

To the Editor:

When I read your April story "AM Stereo Battle Continues Unabated" (p. 26), I was shocked by Motorola's latest statement concerning "The Secret." And at this point, it takes quite a bit for Motorola to shock me!

The Secret, as those involved in the AM stereo competition know, is a *trade secret* designed to allow Motorola-only radios to provide stereo reception for the large-audience Kahn/Hazeltine stations. It does this without in any way degrading the receiver's normal stereo performance for Motorola stations.

Thus, Motorola's statement that The Secret "to a degree degrades the performance of the Motorola system" is false, and denigrates this device. To say it more emphatically, The Secret is transparent as far as Motorola's stereo performance is concerned. Of course, the receiver will, when tuned to

Motorola stations, still jump in and out of stereo under heavy noise and/or "platform motion." But this is a flaw in Motorola's system and is not attributable to The Secret. Platform motion is a matter of physics and a basic problem with quadrature modulation.

A Delco representative was also quoted in this story, claiming that the Sony chips, even if they "cost under \$5 would probably double the cost of the finished radio receiver."

There are two disturbing points in this statement. (1) Delco well knows that the Sony devices are well under \$5—more like \$2 in the quantities Delco would normally purchase. And (2), we have a question of mark-ups. Why would something that sells for approximately \$2 double the price of a radio that retails for approximately \$350? It is most noteworthy that the new Sony car radio (XR-A33) that offers four-system, fully automatic switching AM stereo, is priced at approximately \$25

more than its AM *mono* counterpart. Delco is only considering converting an AM stereo single-mode stereo to multimode, and yet this would require a difference of \$350! I must assume that the person quoted misunderstood the normal pricing policy of Delco and General Motors.

Leonard Kahn
President
Kahn Communications
Westbury, NY

IMPOSSIBLE FILTER

To the Editor:

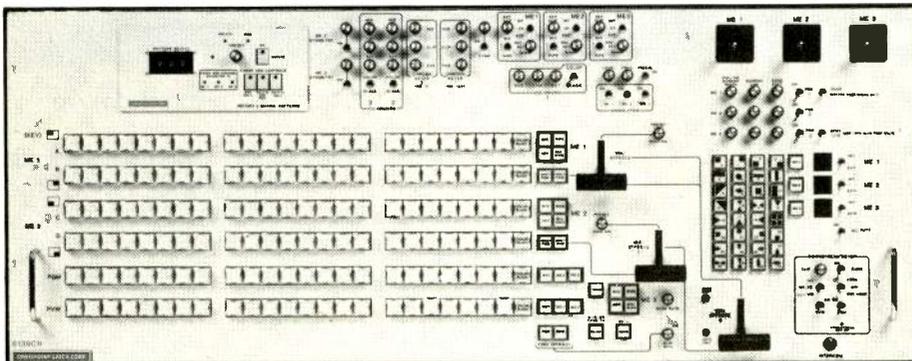
I would like to comment on the article "The Design of the Almost Impossible Filter." This article contains several inaccuracies and misleading statements.

First, the schematic shown as a "seventh-order active elliptical filter used in the Modulation Sciences MTS filter" is, in fact, a *sixth-order* filter which, further, is not elliptical because

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Consider the facts: The Panasonic AU-220 records, utilizing the M-Format, on standard 1/2" VHS cassettes. Yet it delivers the kind of picture quality that's long been the broadcast standard. Luminance is 4.0MHz (typical). Chrominance is 1.0MHz. While the video SIN is every bit as good as 1" with chrominance better than 50dB.

For total flexibility, the AU-220 includes a built-in

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Circle 114 on Reader Service Card

ANOTHER BROADCAST INNOVATION FROM MATSUSHITA ELECTRIC

LETTERS

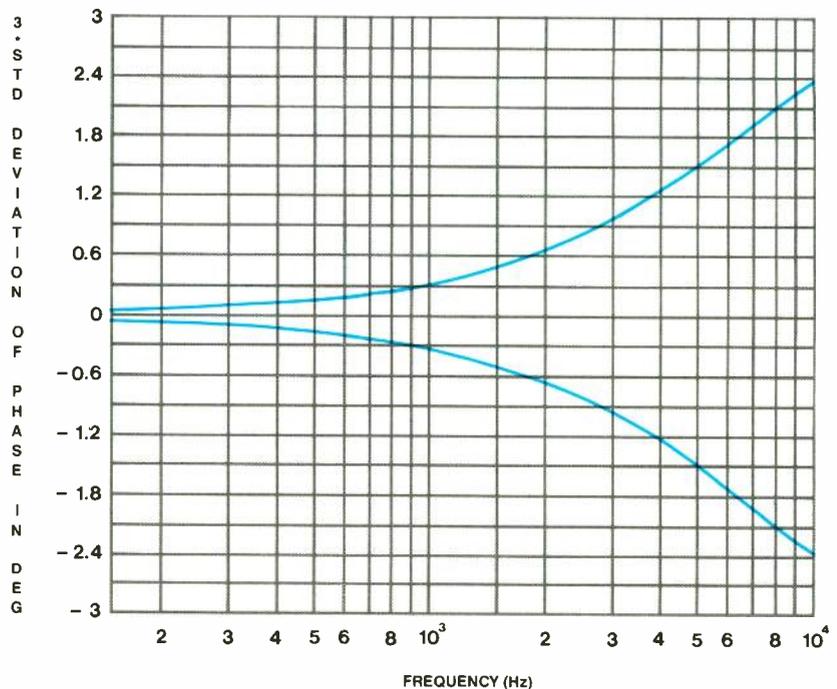
the circuit shown cannot produce notches in the stopband. I have enclosed a computer simulation of this filter using custom software running on a Tektronix 4052A desktop computer. (The passband gain is shown as +26.65 dB because I omitted the last amplifier in the schematic, whose sole purpose is to restore unity gain.)

The SPICE program is *not* required for such an analysis; there are many programs available for eight- or 16-bit machines which are perfectly adequate for the task. In addition, contrary to the article, SPICE is available for the IBM PC.

The results show a filter with an extremely gentle rolloff. While such a filter would be expected to have a good transient response with low ringing, there is a price to be paid. The frequency response is already down -1 dB at approximately 8 kHz. Such a gentle filter is not even appropriate for FM stereo, let alone TV, if flat response to 15 kHz is desired.

While the article claims that "flat response is maintained up to 15 kHz,"

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As your needs grow, so will your system — because it's designed,

built and backed by Grass Valley Group.

Check out the 160C-4S/M200. In 2003, you'll still be glad you did.

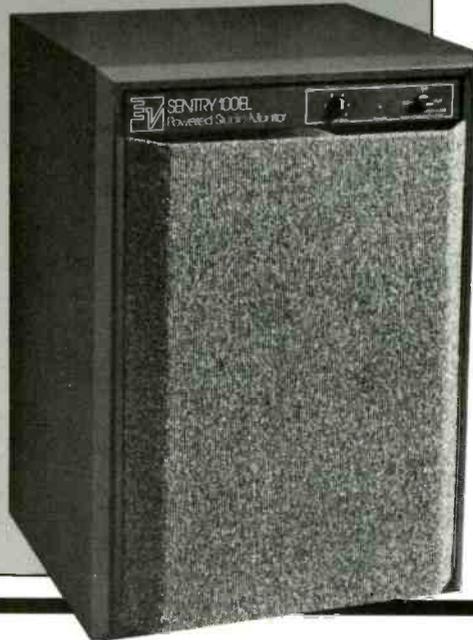
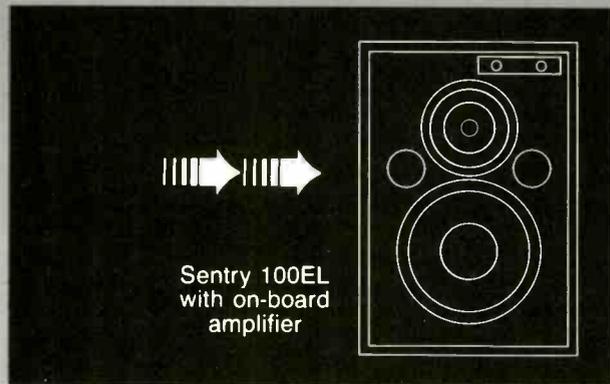
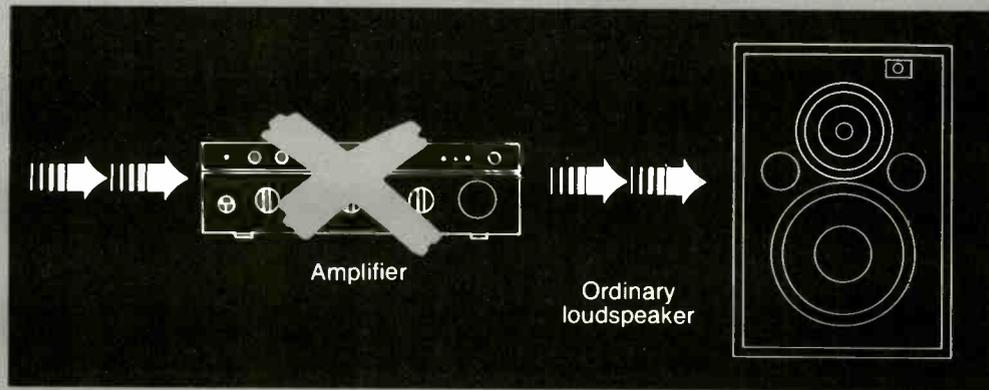
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LETTERS

the published specifications for the Modulation Sciences generator state that 15 kHz can be as far down as -4 dB. Which is correct?

A given filter response can almost always be realized by many different circuits. The realization shown in the schematic is commonly known as "cascade-form" with "Sallen and Key" sections (named after the original inventors of this topology). Each of the three sections shown realizes two poles of the filter. The computer printout in the article (which shows the frequency response of each of four sections of a seventh-order elliptical filter) suggests that the *actual* seventh-order elliptical filter (not shown in schematic form) was also realized in cascade-form.

This type of filter realization is commonly found in cookbook-type filter handbooks because it is easy to design without sophisticated mathematics. However, it is well-known that this realization, while simple, does not produce filters with low sensitivity to component variations induced by temperature changes, time, or tolerance.

Because Modulation Sciences uses this naive realization, and because certain other realizations can achieve equivalent accuracy with substantially less accurate components, the article's emphasis on a "filter that can be built with available commercial components and practical production methods" is difficult to justify.

Professional filter designers almost always use so-called "coupled" topologies when designing high-performance filters because, in the filter's passband, such topologies have much lower sensitivity to component variations than do cascade-form realizations. "Coupled" topologies are generally based on mathematical transformations of passive LC ladder filters, which have the lowest sensitivities of all known filters. Some of the common transformations are known as "leap-frog," "gyrator," and "frequency-dependent negative resistor (FDNR)." (The filters in the Orban stereo generator are built with FDNRs because such filters have a relatively low component count and favorable sensitivity

performance.)

To verify manufacturability, we have written several computer programs which analyze the effect of component variations upon the frequency and phase response of circuits. As an example of the output of these programs, I have enclosed a plot of the deviation from ideal phase response into which 99.74 percent of the filters shown in the article's schematic would fall in production, assuming use of ± 1 percent tolerance resistors and capacitors.

Robert Orban
Chief Engineer
Orban Associates
San Francisco, CA

ENGINEERING TO *BM/E*

To the Editor:

In regard to your April issue Editorial "News to Engineering," your comments seem to be a perfect example of what we in the broadcasting business are often (and sometimes justly) accused of: not having all the facts before

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LETTERS

air time. It may be possible that the seeming lack of interest in newsroom automation by engineering managers is in fact a statement that indicates a truly flexible system for this purpose is not as near as we would like. Perhaps they realize that computers are nothing more than tools, just like cameras, recorders, and transmitters.

News people, along with the rest of us, want to think they are the most important, and want their needs tended to first. But without the rest of the operation, the game is lost without even going to bat. Any good GM will tell you that, and will have the interdepartment relationships to bear him out. When I hear news directors or chief engineers or, for that matter, promotion managers bad-mouthing one of their station's departments with statements like those you quoted, I tend to think that maybe the department is bigger than the station—and then I wonder who is really running what.

I'm sorry the people discussing what is obviously an irritating subject, news computers, decided to spout off about

engineers. Perhaps they wish they had listened when that seeming lack of interest was, in fact, a lack of excitement about a tool that just isn't ready. It has been my experience that most engineers do, in fact, keep track of the future, and in quite a few cases use what they know to decide just what to get excited about and what to wait for.

John Demshock
Assistant CE
KHOU-TV
Houston, TX

900 FEEDBACK

To the Editor:

In reference to AT&T's 900 service described in your April issue's "Radio Programming and Production" story, last year we dialed one of the early feeds off the Indianapolis 500 net on the 900 network. What we heard so appalled us that we ferried a Comrex down to Indianapolis and made arrangements with a contact at one station to use his listen line to send the local network feed (off a hard line from

the track) back to our station. This gave us the low-end response equivalent to a nonequalized loop lacking on the 900 lines, as well as considerably less distortion.

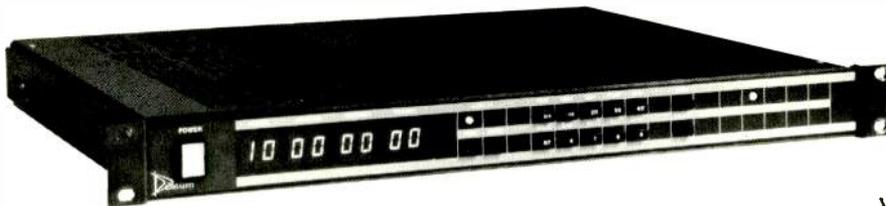
This year our network insists we use its 900 feeds, having found out about the "bypass" by our station and several others. Its hard-line equivalent is a 5 kHz loop out of WIBC, paid for by the station. If Mr. Arnold and Mr. Savatiel think quality oriented stations will tolerate trashy-sounding 900 feeds for very long, they may find themselves with a much smaller network in future years.

As older generations of TV engineers will learn with TV stereo, the public will not tolerate poor quality audio for long. Any engineer who thinks "the voice quality over 900 phones is the same for dedicated lines" might want to reexamine his or her career choice.

Tom Taggart
Attorney at Law
WIBC-AM/FM
Toledo, OH

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*As required by BTSC Standards, EIA Systems Bulletin No. 5, Section 3.2, Monitoring and Measuring.

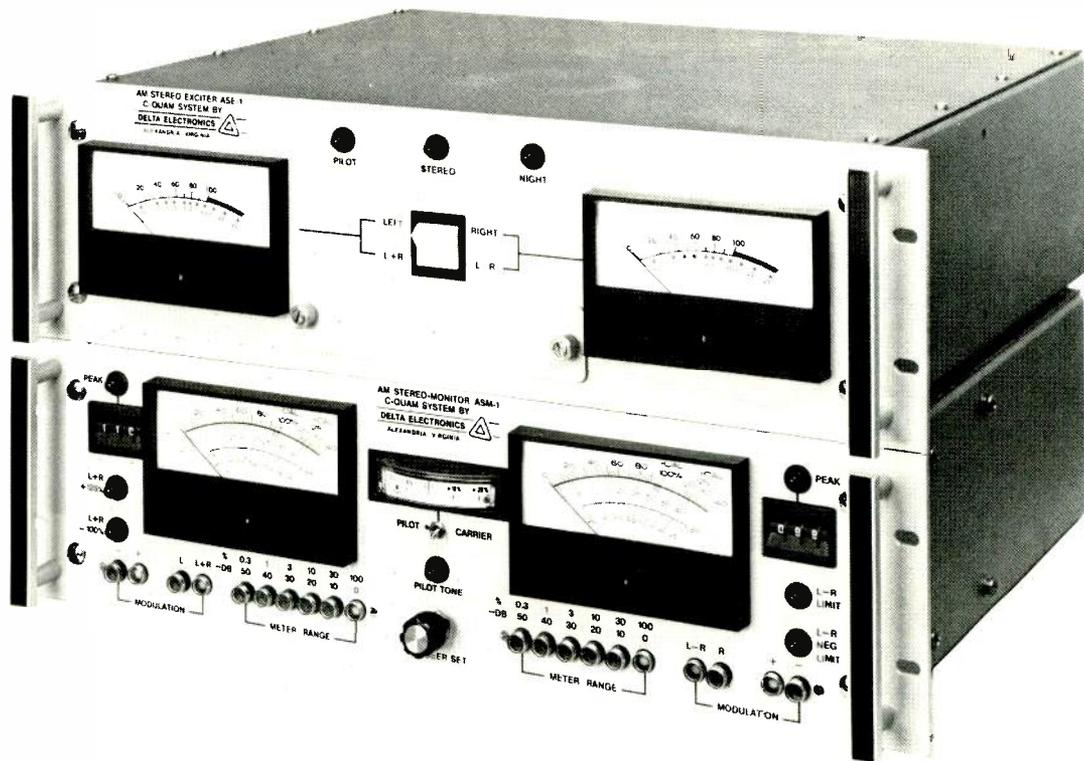


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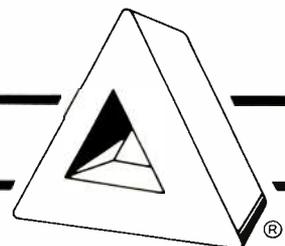
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RADIO

programming & production

There's No Place Like Home for Thunderstorm Forecasts

By Mary Schneider

If Dorothy had heard the weather forecast over KJLS-FM radio in Hays, KS, she may have decided to postpone her runaway trip with Toto until the storm had passed. And she may never have met the Wizard of Oz.

Like wizards themselves, KJLS disc jockeys are telling their listeners there's no place like KJLS for receiving current bad weather information. On-air announcers now monitor bad weather with the aid of a thunderstorm-tracking instrument originally used in aircraft. That's good news for Kansas residents who, like Dorothy, are all too used to getting caught up in a storm.

Upgrading the quality of weather forecasting is the latest in a series of steps to improve the overall quality of the station.

"We've done a few things differently than most stations," says Mike Rogers, manager of the 100,000 W adult contemporary station. KJLS recently installed an eight-track recording studio with a TASCAM ATR and 10-channel Ramsa console for production purposes and a 24-track Ramsa mixing board in the on-air control room. Commercials—90 percent of which are produced in-house—are now broadcast in stereo.

"We've entered quality into broadcasting in this area," Rogers says. "But we had a problem," he adds. "No news and no weather."

KJLS airs broadcasts from the ABC entertainment network on the hour and RKO news during the night. However, Rogers does not have a local news staff. "After all, what is news in western Kansas?" he asks. "It's the weather."

"As for our weathercasts, they used to be a joke. Our announcers run live shows and don't have time to analyze the forecast coming off the weather wire. The wire doesn't tell them where



The thunderstorm-tracking instrument superimposes a weather mapping grid, which corresponds to a grid on the Stormscope CRT, over a local highway map.

the weather is happening unless they have a map in front of them."

Rather than spend a fortune maintaining a news staff, Rogers decided to invest in equipment to improve his local weather forecasts. However, he didn't want to buy something so complicated that he would need to hire a meteorologist to interpret it.

Accurate and informative

Rogers found what he wanted by looking through aviation magazines. The disc jockeys now combine information from the thunderstorm instrument (3M's Stormscope Model WX-120 Weather Mapping System), the National Weather Service weather wire, and radar summaries to put together a weather forecast that is accurate and informative.

The new instrument locates thunderstorms by detecting electrical discharge activity, not precipitation. Each time an electrical discharge occurs within a thunderstorm, it sends out electromagnetic frequency energy in all directions. The Stormscope system receives these

signals through an antenna. A computer processor organizes and maps their location. The information is then plotted on a CRT in the form of bright green dots to show distance and direction.

Even though the electrical discharges are transitory, the computer memory stores information so each dot can be shown continuously on the screen. Clusters of dots are plotted in the position that most accurately maps the location of thunderstorms for a full 360 degrees within a preselected range of 25, 50, 100, or 200 nautical miles. Size and density of the cluster, and the rapidity of appearance, indicate thunderstorm severity.

In spite of the high technology, Rogers' on-air staff has adapted to the Stormscope system easily and uses it enthusiastically.

"Before we had the Stormscope unit the disc jockeys relied on the weather wire for their forecasts. They would read forecasts like 'under partly cloudy skies' when it would be raining. Now they look at the WX-120 and say, 'We

RADIO PROGRAMMING

see severe activity 35 miles wide approaching from the west at 25 mph. We are waiting for information from the National Weather Service and will keep you informed.' ”

Quick weather summary

“The Stormscope system draws a picture for us,” says Rogers. “We don’t rely on it solely. By reading the weather wire, keeping in touch with the National Weather Service, using a map and watching the MX-120, the announcers can put together a simple, quick and intelligent weather summary.”

The system was installed in time for the 1983 thunderstorm season. “In several cases, we were one step ahead of the National Weather Service,” Rogers boasts. “Often our announcers were aware of severe weather in the area half an hour before it came over the weather wire.”

Advertising bonus

Not only has the new system boosted the station’s weather forecasting credibility, it has given a boon to advertising dollars.



KJLS manager Mike Rogers (left) and program director Dr. Ken Charles.

“We used to have three or four weather sponsors during the entire day,” says Rogers. “After we bought the Stormscope system we opened up 36 weather sponsorships. Today every one of those slots is sold.”

KJLS competes for advertisers with three other FM stations, four AM stations, two TV stations, a newspaper, and a shopper. It offers its clients half-price sponsorship of weather spots if they agree to sign up for a full year. The \$1200 annual rate from each of the 36 sponsors enabled Rogers to pay for the \$11,000 system in three months.

“And it was all new money,” he explains, “either from new sponsors or from existing clients who agreed to pay \$100 more a month to advertise during the weather forecast. I wish I could make an investment like that every day!”

Like Dorothy, the staff at KJLS has discovered that there’s no place like home—for gaining credibility and advertising dollars. **BM/E**

Mary Schneider is an independent writer based near St. Paul, MN.

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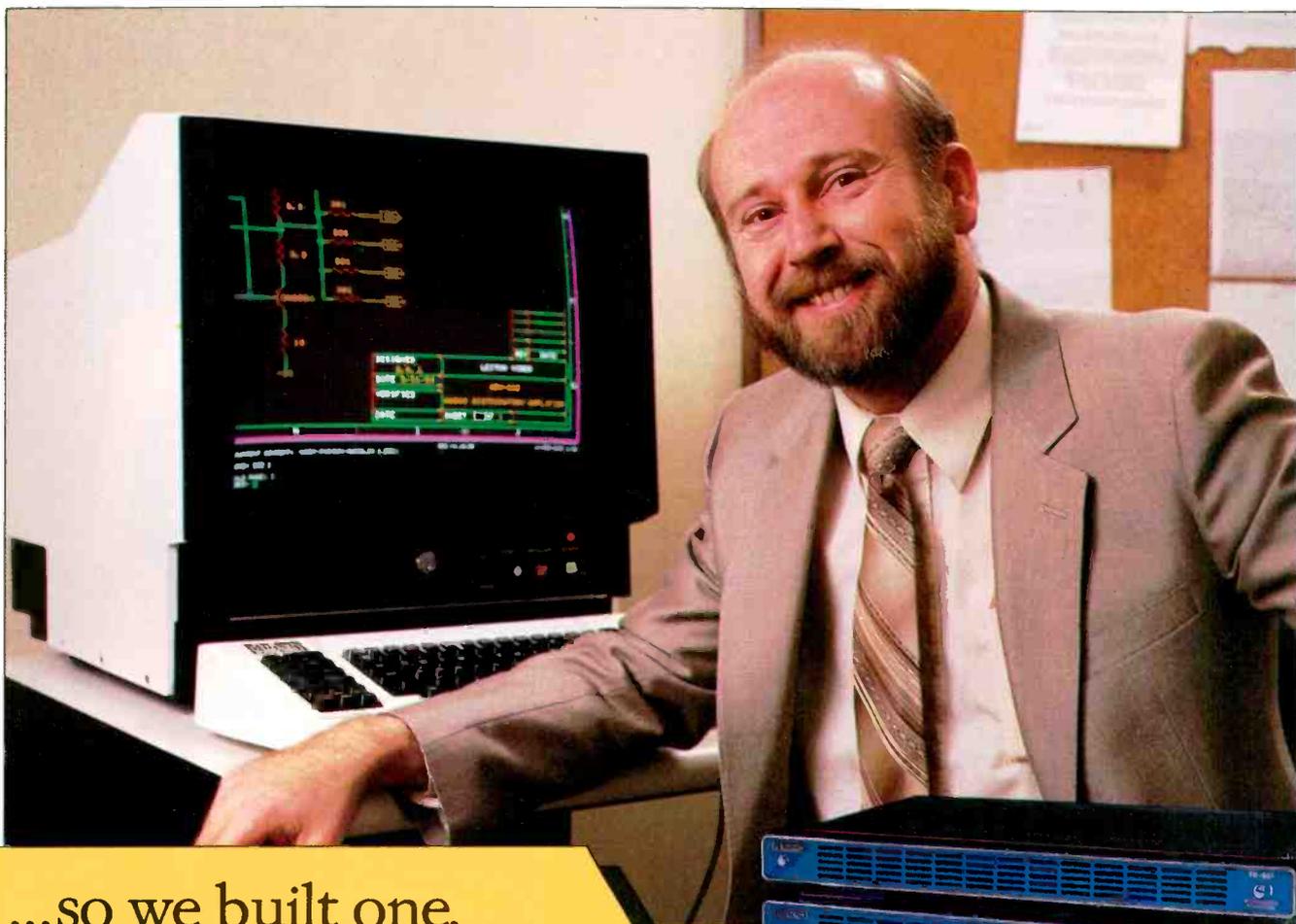


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TELEVISION

programming & production

A Day at the Races: Broadcasters "Can Do"

By Douglas Damoth
Assistant Editor

When the FCC ruled last year that broadcasters could cover a complete day's schedule of thoroughbred or harness horse racing, it opened the way to a new kind of programming which had been outlawed since the early 1960s. Most stations, of course, cannot hope to pump up their ratings by regularly airing hour after hour of racing. But as a special during an otherwise boring summer, a day at the races built around a special stakes race with a substantial purse can provide an excellent local programming option.

One successful formula for producing this kind of coverage comes from TCS, a Pittsburgh-based company which puts together a complete 4.5-hour racing package that airs three nights a week on cable from the Meadows racetrack in Meadow Lands, MD. Viewers are able to phone in bets from home, something that is prohibited in most states. Far more than just the races themselves, the programs are full of feature material—odds, background stories, and educational features for the uninitiated—that keeps viewers' attention during breaks between races.

Viewer involvement

Onnolee Blinkiewicz, TCS's producer/director and feature producer, says that to do these features, a crew of three goes to the track in the days preceding a race, gathers material for four or five hours, and then edits it down to a series of three-minute stories. The topics are chosen to "get people closer to the driver," as the show's former producer Tami Rippi says; they include driver profiles, what the equipment is and how it's used, track activity, and the breaking of a yearling. For the holidays of the racing calendar, the stakes races, the special horses and drivers get individual attention, including footage



WLKY-TV news anchors Ken Rowland and Liz Everman talk among the evergreens on top of Churchill Downs while two of VTA's Ikegami HK-357 cameras cover the racetrack using Canon 40:1 lenses with 2x extenders.

from other tracks. A flashback segment of classic races will be added to the prerace show.

For the live event itself, the TCS 1 truck is wheeled-in about six hours before the races start. One Hitachi SK-96 camera goes up on the roof in the announcer's booth, where it provides the main coverage of the race itself and of Roger Huston, who is the official track announcer, and his guests. Another SK-96 is perched about 10-feet-high at the first turn, providing tighter shots of that half of the course. Both use Fujinon 30:1 lenses. In the winner's circle, too low to cover the race, is camera three, an Hitachi SK-91 with a Fujinon 17:1 lens. Usually these cameras handle everything, but for the stakes races a second SK-91 serves double duty covering the paddock and the far left turn. All cameras are linked with the truck via triax and an RTS intercom system.

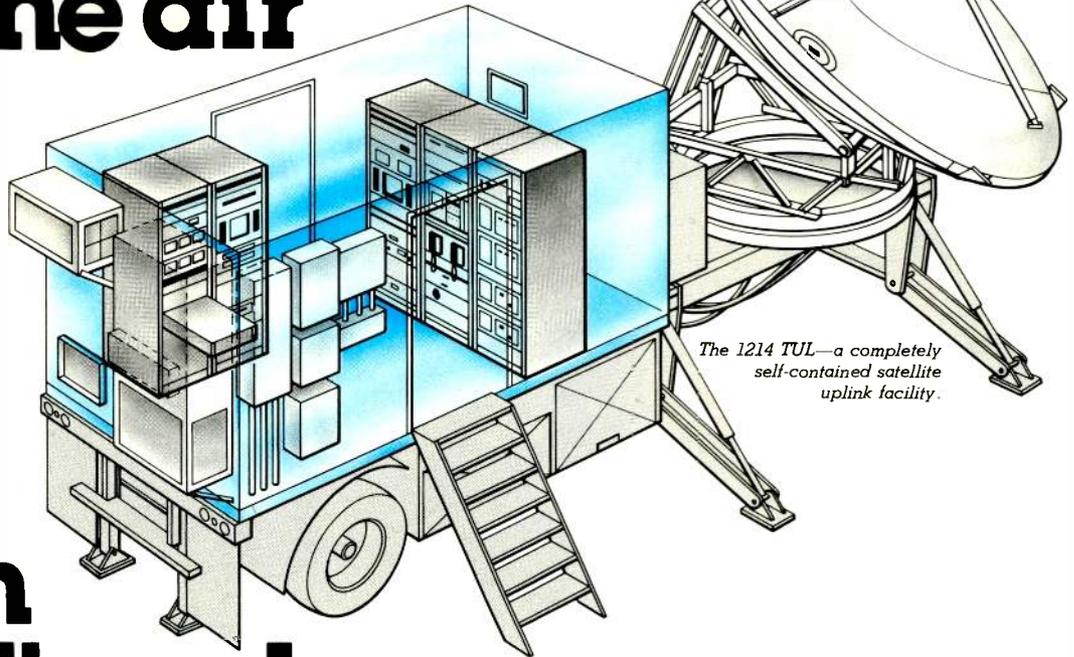
Races are never called off because of weather, Blinkiewicz notes, so camera two has its own waterproof covers.

The fourth camera is practically mandatory for a bigger race. With it, talent gets interviews from the paddock, and Blinkiewicz can spice up the race itself with shots of the horses walking out onto the track and going to the gate, besides giving viewers close shots of that last turn before the stretch. Blinkiewicz says she uses this camera quite a bit when it's available.

Back at TCS 1, which was built by A.F. Associates, three Hitachi HR-100 one-inch machines are in use, one for the race, one for commercials, and another for isolated angles. A Sony 5600 VCR handles the features, which are shot on 3/4-inch. Standard coverage of a race consists of the live action, a commercial break, then a replay from the half unless there is an inquiry. Switching is done on a Grass Valley Group Model 1600, graphics on a Chyron IV.

Crowd noises are taken from the announcer's booth with an Sennheiser shotgun mic, and there's a Yamaha PM-2000 audio board in the truck.

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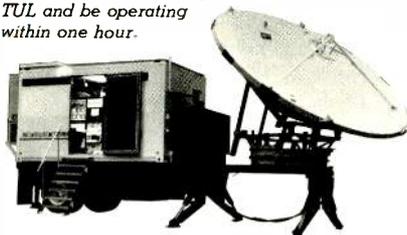
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When it comes to high stakes races, of course, the Kentucky Derby is the one to watch. The Derby receives international attention and full network coverage. For the last two years, however, it has also received the undivided devotion of two stations in Louisville: WHAS-TV, the long-time favorite, and challenger WLKY-TV, a UHF ABC affiliate, which made a serious bid to dent its rival's ratings this past Derby by airing 10 days of racing and



Sports director Mike Hartnett looks sharp for cameraman Jay Sheldon and his HL-95 at the shute entrance to the Derby track.

festival specials, including eight and a half hours of live programming on the race day.

Thoroughbred horses are important

in Kentucky, both as an industry measured by miles of board fence and as a popular sport, and Lexington residents hold at least their fair share of Derby

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TELEVISION PROGRAMMING

Day parties, for which the television, of course, is brought out into the yard on an extension cord.

The Derby is actually a series of races and ceremonies which culminate with the main running, and like most mature sporting events, the social angle nearly overshadows the races. To provide truly complete coverage, therefore, WLKY had to deliver not only the Derby Trial and the Kentucky Oaks, a race for fillies, but also the steamboat race, the post parade, awards presentations on the infield, the garden, the celebrities, and the general effect on local citizenry. This year, as a bonus, the Derby Museum marked its grand opening with a charity gala. The only relief was that ESPN and ABC Sports supplied feeds for the preliminary races, while ABC had exclusive coverage of the main race.

To deal with all this, Don Helms, WLKY's producer in charge of the Derby, spent several months preparing a 400-page script, coordinating with Video Tape Associates the use of their

new 34-foot truck and enlisting every person and piece of equipment at the station. One thing the Derby does well, he observes, is build station morale.

Considering the situation they had to work in, one can see why. First, the race grounds are wall to wall people. The air, too, was so thick—with RF from the networks, Secret Service (for former presidents), three police forces, internal security, and the caterer—that Gil Lochner, the assistant chief engineer, didn't even try to establish two-way communications with the three ENG cameras. Instead, runners were assigned to them, and they worked on tape-due-at-the-truck schedules. Live coverage of the infield is not advised anyway, because the cameras have been known to cause mooning, although elsewhere soap opera stars were the catch of the day. Even the weatherman turned anchor and filed reports from the track's garden, a famous showcase for the rich and famous. And it was all live for over eight hours.

As for technical logistics, VTA

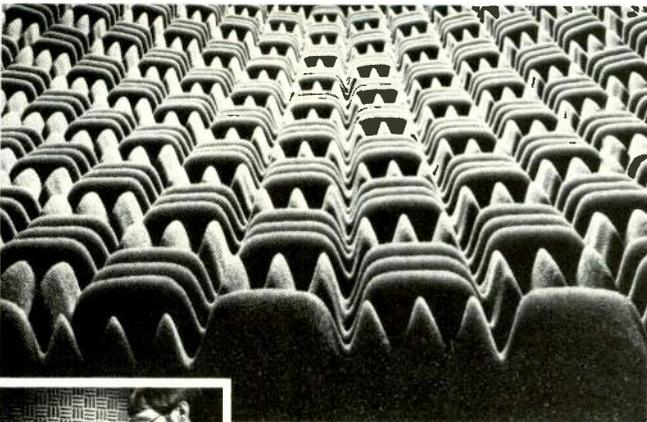
supplied most of the equipment. Three Ikegami HK-357 studio cameras were installed on the roof, one with a Canon 18:1 lens for WLKY's news anchors, who functioned as primary anchors, with the infield as a background. Two were equipped with Canon 40:1 lenses with 2x extenders for the races and the post parade, to follow the horses as they walked to the starting gate.

An HL-95 waited trackside, where the sportscaster gave viewers the odds and interviewed the winning jockeys of preliminary races after their post-race weigh-in. Another HK-357 covered the infield's presentation stand along with the morning news anchor from a safe elevation.

Of the station's own four RCA TK-76s, one handled the celebrities on the Star Terrace, one showed the well-watered spectators in the infield, a third ranged through the grandstand, and the last was a roving camera which followed a novice reporter who had never been to the Derby.

Except for the roving camera, all po-

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TELEVISION PROGRAMMING

sitions were determined before the race on a walking tour with Derby officials, something which producer Helms advises anyone interested in shooting horse races to do.

The VTA truck was equipped with three one-inch Ampex VPR 2B VTRs for opening and closing bumpers, replays including slow motion, and reproduced features. As 3/4-inch tapes came in by runners, a Sony BVU-800 with rapid search capability provided live-on-tape playback of material which was run through a frame synchronizer, reviewed, and timed. Two directors worked in two-hour shifts, with the person off-duty acting as assistant. "We stayed with the script as much as possible," Helms comments.

To get the signal back to the station, a M/A-Com MVS 2CP microwave transmitter was set up on top of the truck, where there was line of sight to WLKY's regular ENG relay station. The station also fed WTVQ, the ABC affiliate in Lexington, KY, which simulcast the big day's events from 10:30

to 6:30, and ESPN, which had arranged to pick up any material it liked.

The programming was designed to appeal to all parts of the audience—those watching just for fun as well as the racing set. A four-part series on betting basics introduced people to tote boards, racing forms, odds, and how to properly place bets. The roving novice reporter started with the parking situation (\$25 for a spot in someone's driveway) and then worked her way in, talking with a vendor about why she should buy a tote board, and eventually getting a scoop on the official preparation of mint juleps.

A jump on the competition

Interlaced with the live Derby programming, which totalled about 10 hours, was special programming designed to help win the ratings race. For bumpers, the station used two versions of a custom-produced animation on the theme of "Countdown to Derby," as well as a 13-part series on the history of the Derby that included film showing a

hockey-like fight among the jockeys. WLKY designed the animation itself using its ADO, then handed it to Griffilm of Lexington, which produced the spot on 35 mm film. The station had decided to get the best possible look, Helms says, and the graphics house was able to generate effects that were just not possible in-house either technically or due to time limitations.

Putting on this kind of operation obviously cost a lot, and Helms readily states that the station did not break even that week, but management had committed itself to the Derby as a useful programming and promotion event. Thus, the station splurged on high-quality graphics, which can be used again next year, and rented a top-flight truck when Helms was able to find an attractive price. WLKY hopes to see substantial gains when the ratings come out, plus a long-term gain in its competition with WHAS. As to who Helms thinks won the race between stations, don't bother to ask; he's already working on next year's Derby. **BM/E**

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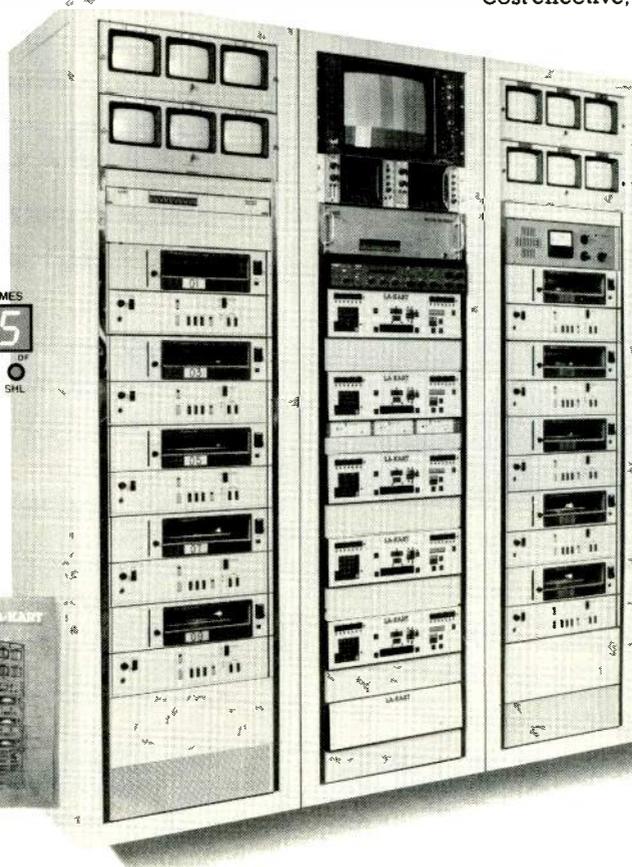
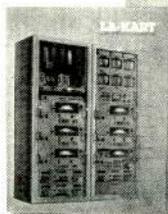
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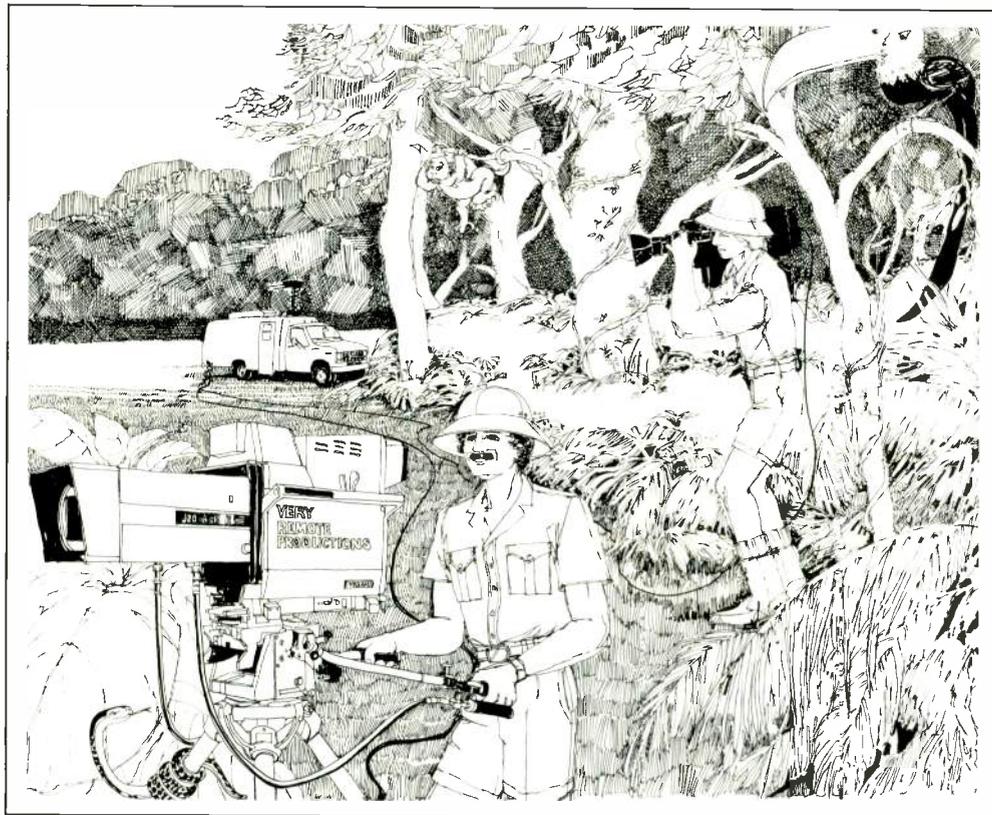
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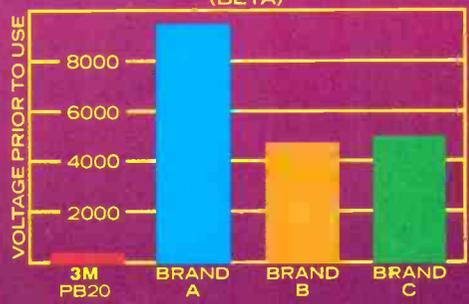
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Processing for

Multichannel TV Sound

How Much Do You Need?

By William A. Resch
and Gary A. Breed

Engineers whose stations have gone stereo must now address the issue of audio processing for multichannel sound.

Now that the initial stage of how to get started in multichannel television sound has been around for a while, stage two is about to begin. Engineers whose stations are now on-line with MTS are wondering just what form and how much processing they should be adding. Part of this concern comes from the new expectations of audio fidelity that MTS creates. In part, it also comes from advertisers who view the improved audio as an enhanced selling opportunity.

There are currently two schools of thought on audio processing for MTS.

Proponents point to the need to automatically adjust levels and prevent excessive modulation. Newer high-tech processors control loudness, mask noise, reduce mechanical wow and flutter, reduce lip sync errors, and can synthesize stereo sound.

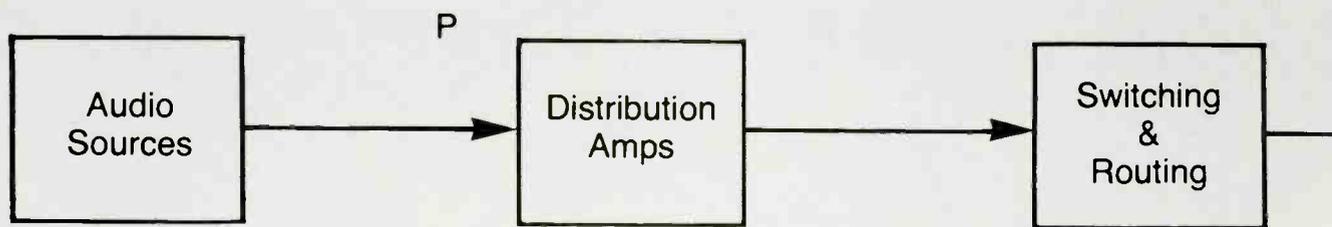
Opponents argue that too much processing can detract from the producer's artistic intent.

Most stations have learned to control the "irritant" factor in their audio fairly well. If the commercials are too loud, voices too low, or sound too distorted, the phone will ring with irritated listener complaints.

Problems arise with the aim towards higher fidelity, especially with

achieving and maintaining uniform quality. There are many limitations throughout the broadcast system that make it difficult to deliver quality audio. The problems begin at the audio source—these can include wide dynamic range magnetic stripped film, level-changing live mics, low dynamic range VCRs, and uneven quality satellite feeds. Some material is so poor to begin with that airing it can only detract from the station's image as a high-fidelity audio leader.

In addition, distribution problems can occur from video, power line and RF interference. The FCC-mandated preemphasis of the L+R channel requires special attention to prevent high



P location of processing amplifiers

Audio broadcast system block diagram.

frequency audio spectral content from exceeding modulation limits or overloading amplifiers. The BTSC L-R channel is companded with a similar type of high frequency preemphasis, and this spectral companding, along with the sharp cutoff filters, make the L-R channel sensitive to high frequency transients. Processing both music and voice programs must be done carefully so as not to introduce distracting artifacts. In some cases, music video for example, the material is already so highly processed it need only be set up to air properly.

In TV, processing does not mean plugging up a finite hole or creating a new sound as it does in competitive FM music stations. One measure of a good TV processor is its ability to maintain intelligible voice in average to a good listening environment, accompanied by long pauses and over various background noises.

Types of processors

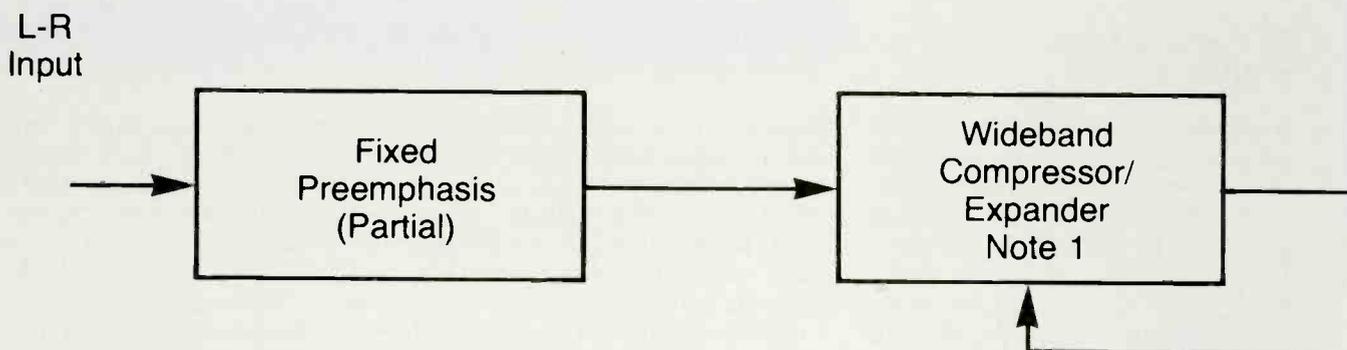
Processors can be grouped into three basic types: limiters, automatic gain control (AGC), and compressors. Their goal is to control some aspect of modulation. The limiter prevents short duration transients from exceeding a predetermined level, usually corresponding to 100 percent modulation. The AGC rides gain, and AGC amps are often very high-tech, employing the latest log-linear feedback control circuits for uniform transient response independent of gain control level. Some even split the band up and integrate spectral sound duration to analyze program loudness. Compressors alter the average dynamic range by changing the input/output gain slope above a certain threshold. For stereo, processors must also preserve a relative amplitude and phase between L and R channels. Some

processors measure L+R or L-R before operating.

The more specialized types of processors include noise reduction, digital delay, digital audio time base correction and stereo synthesizers.

Noise reduction in the BTSC system is accomplished with compression in the transmission of the audio signal, and expansion in the reception. Digital delay is useful for establishing lip-sync caused by repeated video passes through time base correctors. Digital audio TBCs encode recorded audio in order to synchronously eliminate wow and flutter. Stereo synthesizers either simulate stereo sound or mono recordings, or help enhance existing stereo sound.

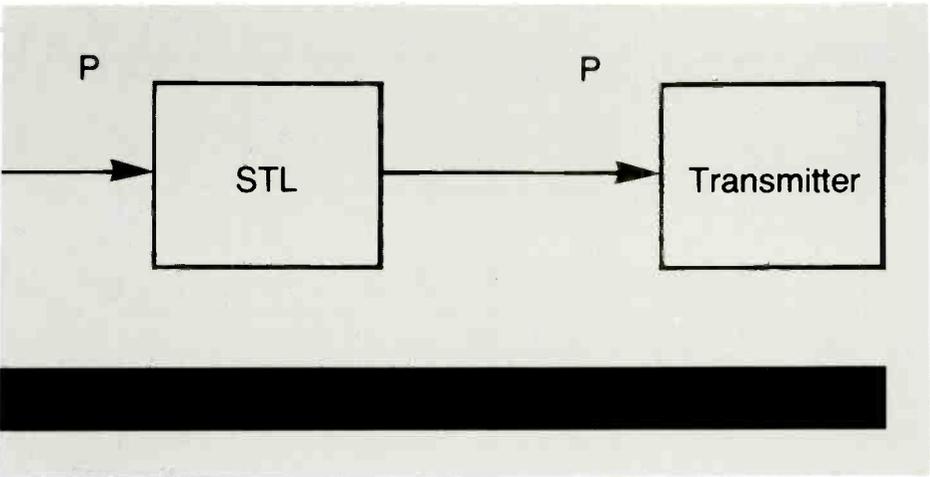
There are currently two types of processing for MTS sound. One has the processing built into stereo generating equipment, and the other adds processing at other points in the audio



Note 1. Gain dependent on signal amplitude.

Note 2. Gain dependent on signal amplitude and special content.

BTSC L-R encoder block diagram.



chain.

How much processing, what kinds, and where to add it must all be determined by careful evaluation of the broadcast system, a specific idea of audio fidelity goals, station teamwork, and some creativity.

Measuring the system

It is impossible to separate the implementation of an audio processing scheme from the analysis of the audio quality of the entire audio chain. The performance of the most advanced audio processing equipment and techniques will be limited by the basic, unprocessed performance of each component of the system, and the total performance of the system as a whole. In order to have an effective means of accomplishing the goals of audio processing, two prerequisites are in order.

First, the entire audio chain must be

evaluated for proper audio quality standards, correcting any deficiencies that are uncovered. This should be done one step at a time, working from the transmitter backwards through the individual components of the system.

Secondly, the locations within the audio system where audio processing can be used to its greatest advantage need to be identified. In order to do this, the goals of the station, with regard to the audio quality of the transmitted signal, must be clearly established. Also, the specific conditions and equipment configuration at the station must be well understood.

The audio chain

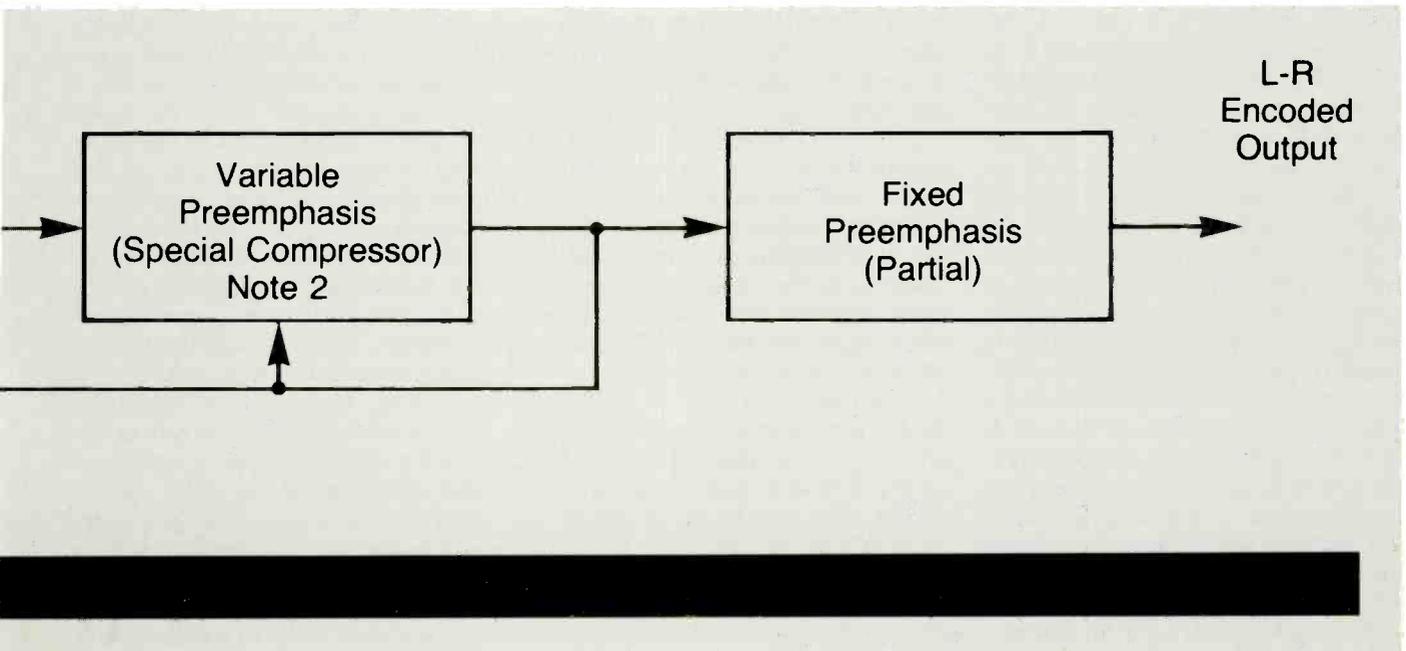
As the performance of the audio chain is evaluated, several parameters need to be measured, and acceptable performance obtained.

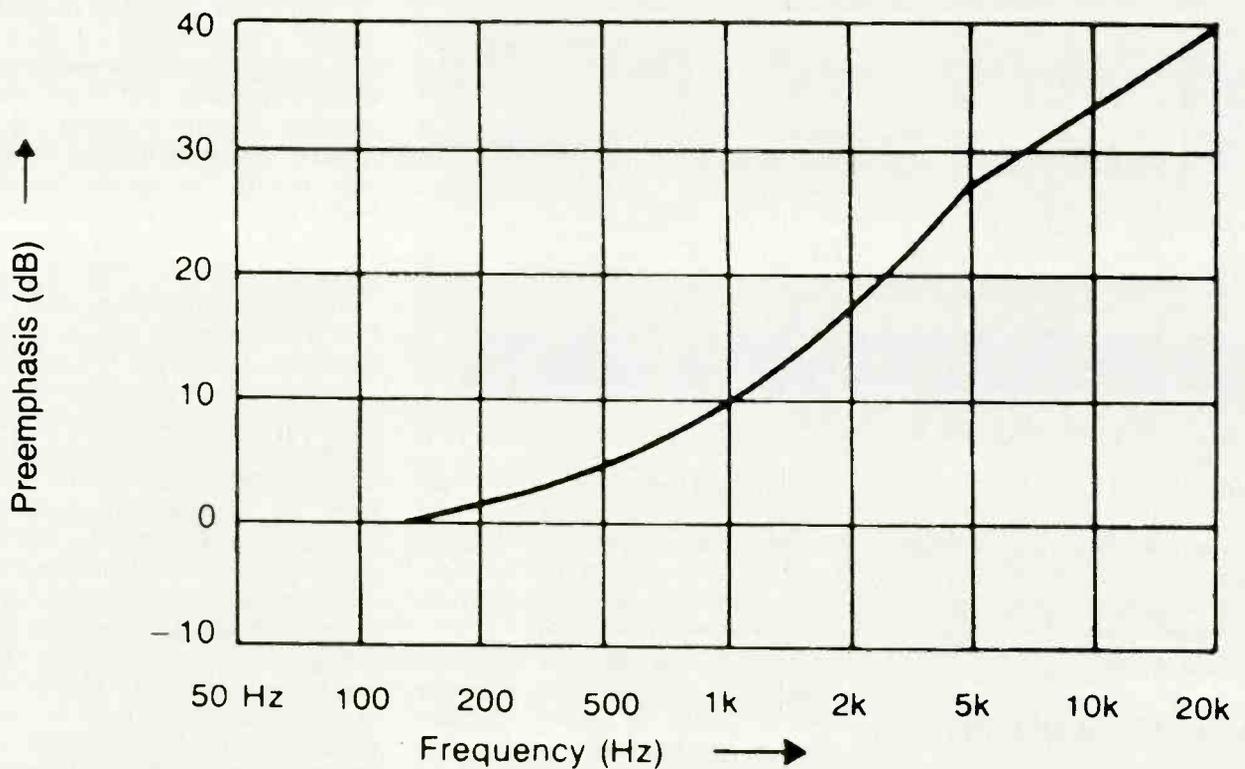
First, the frequency response of any

one item in the audio chain should be flat within 1 dB, from 50 to 15,000 Hz. The entire system should not vary more than 2 dB over the same range. With modern equipment, and proper wiring techniques, there is no reason why this standard cannot be met. In addition, any "bumps" in response should be looked into, as such a variation from a smooth response characteristic could indicate trouble.

Secondly, harmonic distortion (THD) should be less than one percent over 50 to 15,000 Hz. It may not be possible to meet this standard with some older equipment, or with everything connected as a system, but one should not be satisfied until the system meets this standard. Intermodulation Distortion (IMD) should be less than one percent over the entire frequency range. Again, some difficulty may be experienced in achieving this figure. On the whole, very low levels of distortion are good indicators of other areas of performance, since noise and hum, rectification at connection points, and the state of repair of the equipment will all limit distortion performance, when measured with standard test equipment.

Noise, hum, and crosstalk all represent the intrusion of outside interference into the audio system. All of these should total no more than 65 dB below the standard audio signal level. However, sometimes a discrete frequency can be objectionably audible at this low level, such as crosstalk from an in-house setup tone into the program line, so close attention must be paid to the





Curve showing the L-R preemphasis.

nature of the noise which underlies audio signals. Audio processing tends to decrease signal-to-noise ratios, and can behave erroneously in the presence of excessive noise.

Headroom is also an important consideration. Every piece of equipment should not exhibit a significant increase in distortion when a signal 15 dB above normal is presented to it. Since VU meters are still the most predominant form of level indicators, this kind of performance is needed to allow for program peaks, which may be more than 15 dB above the indicated VU level.

Another factor is phasing. There are two parts to phasing. The first is the obvious need to keep left and right channels in phase. This isn't always as simple as it seems, with some of the very densely-packed wiring that is needed to connect to a routing switcher. It needs to be checked every step of the way, so double reversals are avoided. It is extremely frustrating to have everything working fine in normal operating configuration, then suddenly finding left and right out of phase when things are routed or patched differently. When monaural was the only audio, phasing meant nothing at all, but with stereo audio, an out-of-phase condition will

make monaural virtually disappear.

The second part of phasing is the input-to-output phase shift of each piece of equipment. Any gross variation in phase shift from high to low frequency, or from low to high levels, probably indicates a problem within that unit.

Even more important than the individual channel frequency response or phase shift, however, is the difference in tracking response between the left and right channels. Variations in the way the two channels pass through the system will result in errors in both the stereo and monaural performance. With the channels balanced at 1 kHz, the L-R component is measured by summing the two channels in an out-of-phase condition, or by reversing phase of one input, and summing the outputs in-phase. Good balance will have an L-R component at least 45 dB below the L + R component. Good equipment will not have less than about 38 dB L-R at the low and high frequency extremes. One area to watch closely is Distribution Amplifiers. Different models or different brands may have somewhat different amplitude and phase response characteristics, so the left and right channels should be certain

to utilize the same type DAs at the same point in the audio chain.

Poor left to right tracking will result in such errors as off-center stereo, phasing errors that reduce stereo separation at different frequencies, and monaural summing errors that can be very obvious and disconcerting to the viewer or listener.

Each facility needs to establish a standard level of distribution of audio throughout the entire station to assure consistency of levels. Using the results of headroom checks, and the specifications of the equipment, a level that gives good performance can be selected. It may be 0, +4, +8 dBm, or some other level, but it must be consistent. Routing and patching will continually change the configuration of equipment, and it is essential that no change occur in the overall response of the system. In the days of monaural, this was less important, as a turn on the level pot kept things approximately the same. However, stereo audio is a lot more than two monaural channels; there is also the relationships between them, and it takes extra effort to assure that performance is maintained, whatever routing or patching arrangement is in use.

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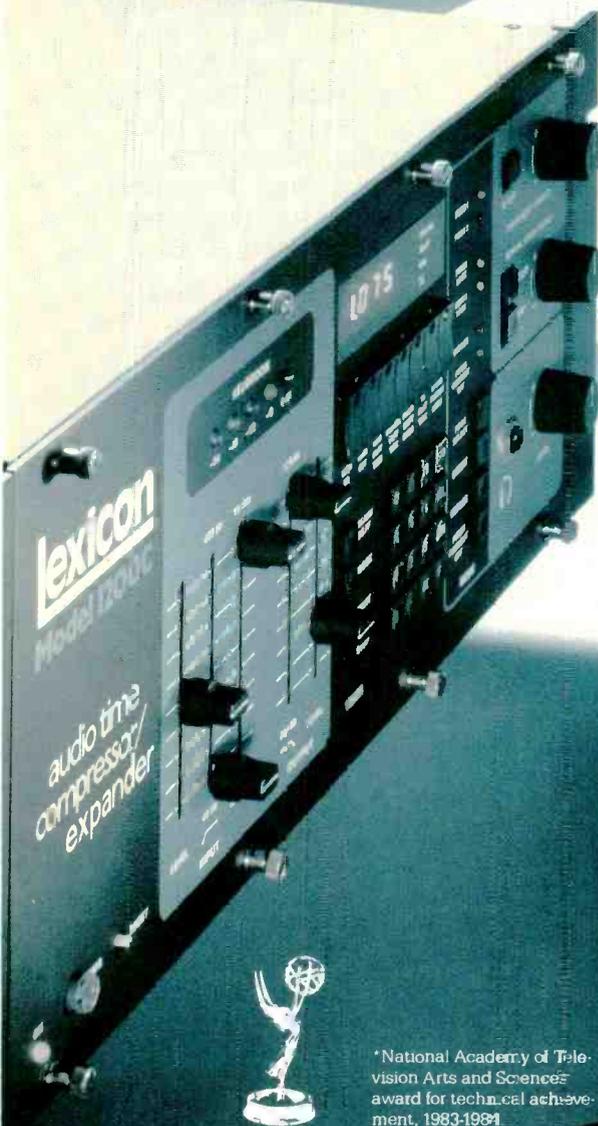
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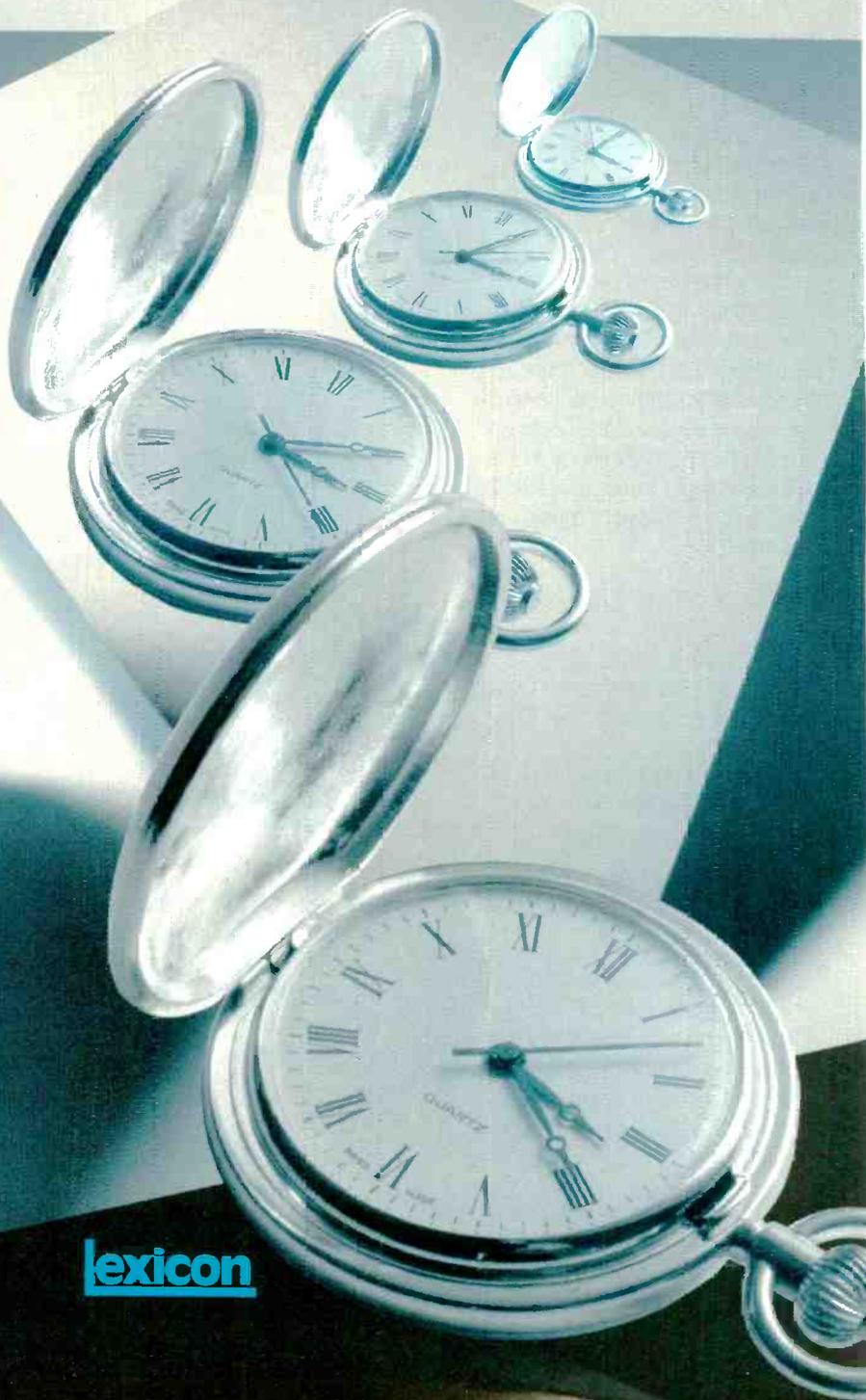
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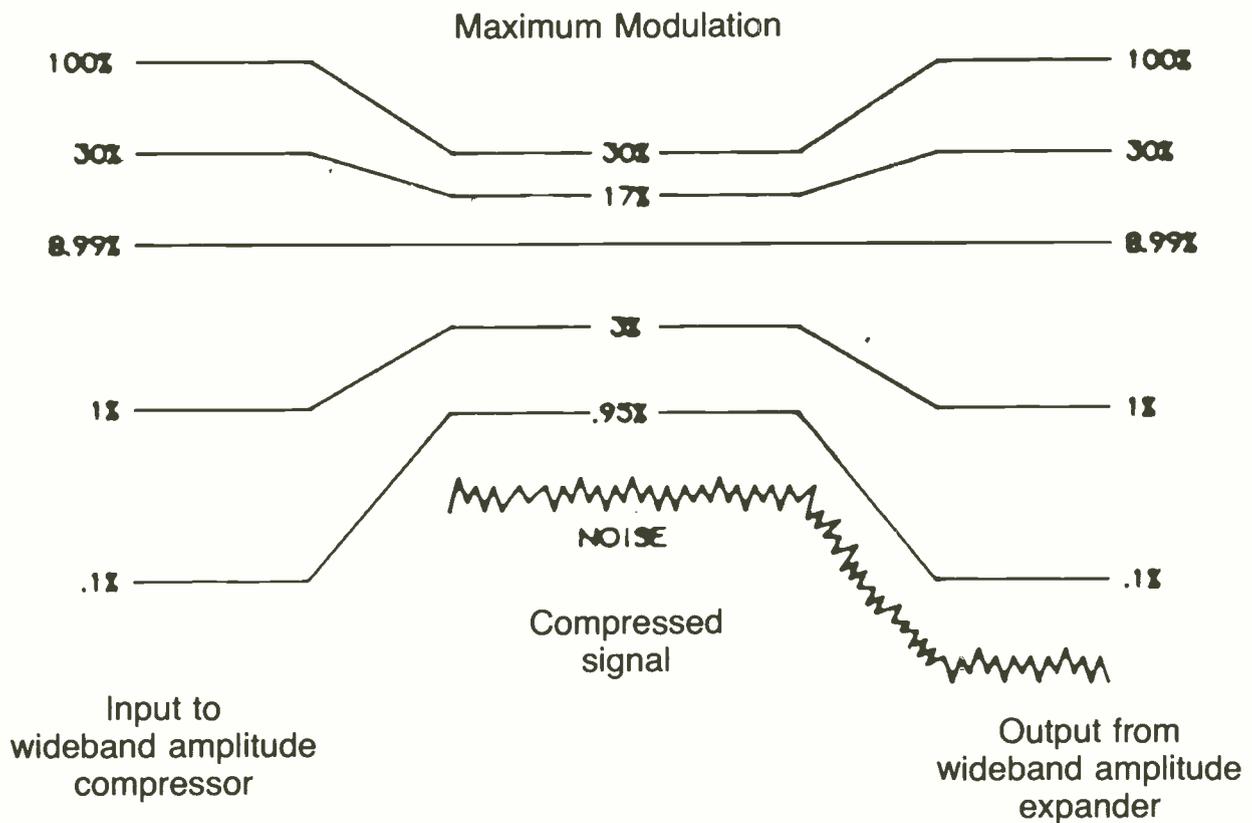
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* National Academy of Television Arts and Sciences award for technical achievement, 1983-1984

lexicon





The wideband compressor curve.

Links in the audio chain

Having examined some audio performance basics, a look at the individual components of the audio chain is in order.

The entire transmission system should have been thoroughly evaluated for proper stereo performance at the time of installation of the stereo generator. No station should even consider the installation of stereo capability without complete evaluation and, if necessary, modification of the transmitter and its aural modulator, plus the diplexer and other combining equipment. ICPM correction, aural bandwidth determination, and modulator performance checks all need to be completed at the time of installation of the stereo generator. If the transmitter requires FCC notification of its modification, complete data on performance *must* be obtained.

The main problem with the STL link will very likely be stereo tracking of frequency and phase response, particularly if the units are dissimilar for each of the channels. As was noted earlier regarding DAs, the type of STL modulators and demodulators should be the same, and the potential for trouble will

be minimized.

Audio processing for STLs may be of two types. The more common arrangement is placing the AGC or both AGC and limiter prior to the STL. The advantage of placing the AGC at the STL is that the STL has a controlled average audio level for optimizing the S/N ratio. For the sake of convenience, many stations place both AGC and limiter before the STL in order to have access to all modulation processing accessible to the master control location.

A second type of STL audio processing is noise reduction. This processing can be used to improve signal-to-noise performance.

In switching and routing, the equipment is very complex in the audio signal path, and will have a densely-wired interconnection and arrangement. The opportunity for phase reversals arises, and also the potential for crosstalk. The equipment has to be set up properly for minimum crosstalk among the crosspoints, and minimum distortion and tracking errors between the two channels.

Patch panels or other passive

switching systems should also be considered. Good, solid connections and clean contacts are needed to avoid level drops or rectification across slightly corroded contacts. Grounding is often disrupted at patch panels, so attention is necessary to maintain wiring standards.

At this point in the audio chain, audio processing is probably not appropriate, since there is such a diversity of audio sources passing through.

Distribution Amplifiers and in-house wiring is an extremely important part of the audio chain. Performance of the DAs, particularly headroom and stereo tracking, should be given close attention. The cautions noted earlier need to be adhered to. Because of the large number of DAs and the long runs of cable connecting the various sources to them, more errors and performance difficulties occur here than anywhere else. Unless a station has the unusual situation of sources directly wired to the switching equipment, the closest attention must be paid to this area of the plant.

This is also not the right place for audio processing, as the same diversity of sources exists as with the switching

equipment.

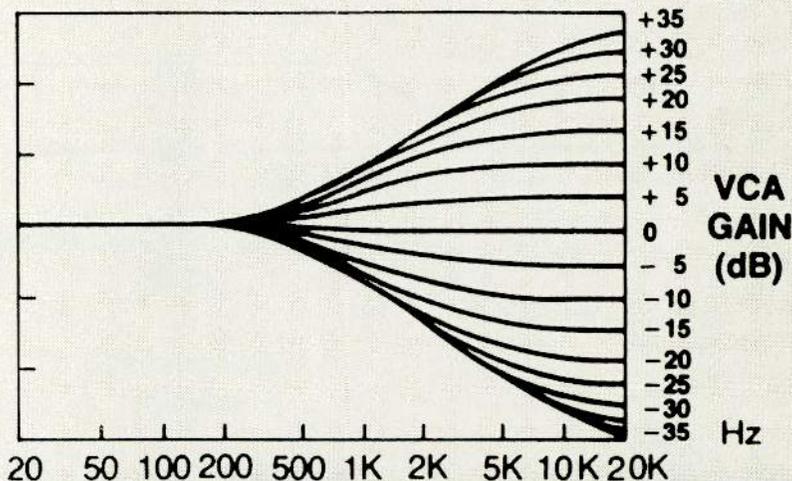
As far as performance of individual sources, all that can be said is that maintenance and alignment is required to keep all tape, film, remote, and studio equipment up to the manufacturer's specifications.

There are a wide variety of audio processing devices that can be very helpful in maintaining a consistent and high quality air sound which can be used at the source of programming. First on the list would be noise reduction for the tape equipment. Major brands of noise reduction systems have replacement audio cards available for most models of VTRs, and can be added externally to any audio equipment. Much of the tape equipment on the market cannot give the best signal-to-noise performance, simply because of the mechanical complexity of video recording systems. Performance is certainly adequate, with 60 dB or better S/N performance, but there is significant improvement with noise reduction systems applied to the audio channels.

One of the most controversial topics in television audio today is the loudness of the commercials. With in-house production, there is control over audio

quality, but agency-produced, or customer-supplied spots may vary quite a lot from in-house standards. There are ways to "unprocess" over-produced spots when they are dubbed for use on the air. Several things are necessary if a station wishes to make this commitment to consistent quality. First, peak

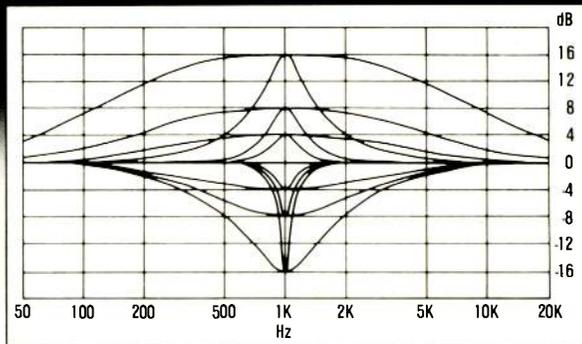
reading meters will be needed to correlate with VU meter indications, and a spectrum display of the audio frequencies should be at hand. With this test equipment, and with an experienced engineer, the approximate amount of compression (peak-to-average ratio of the material) and the extent of equaliza-



The variable preemphasis curve.



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tion (principally midrange to high frequency boost) can be determined. Corrective measures can then be applied using an AGC unit with expansion capability, and a 1/3-octave equalizer. With experience, a good engineer should be able to restore the material to the approximate unprocessed status, or the standards used at that station.

Each individual station will have to determine the need for processing of other sources, such as film, network feeds, or purchased programming. With the variety of possible situations, no blanket recommendation can really be made.

It cannot be emphasized enough that it takes a real commitment for a station to implement more than a very basic audio processing strategy. Personnel and equipment have to be assigned to the task, and a station must decide how important audio quality is in their own

situation.

Audio processing in news & production

Although the programming and commercial material that is produced at a station provides an almost infinite variety of audio objectives, some general rules emerge. First, with stereo, the overall quality of a station's audio has probably improved, and the audience learns to expect that. Greater attention to microphone techniques, equalization of microphones for the various placements and voices, and tighter control over the audio portion of production will be essential. Perhaps the biggest decision will be whether to attempt stereo production at all for a given commercial, or for each aspect of program production. The result of an overall improvement in a station's audio quality will be the requirement that all pro-

A Solution for Overmodulation

The issue of overshoot is addressed in another way by Orban, whose Optimod stereo exciter solves many processing problems with built-in solutions.

Chief engineer Robert Orban says the problem can be solved by adding control before the filters, thereby limiting overshoot energy which can then be clipped.

The EIA Multichannel Sound Committee, in a report on MTS practices, states specifications on filters, and concludes that filters conforming to specifications can overshoot without problems, providing that stereo monitors are designed so their peak flashers ignore short-duration overshoots, Orban points out. He explains that this calls for eleventh-order elliptical filters, which Orban uses.

But the Orban position, although similar to the committee's, actually goes further with some additions of its own. Orban explains that overshoot is minimized by feeding the filters with a "well-band-limited and overshoot-controlled signal from the audio processor which precedes the stereo generator," and goes on to say that any overshoots introduced by the filters will then be caused by nonconstant time delay in their passband. While he says that it would be impractical to delay-

equalize the filters at a reasonable cost, he also notes that the resulting overshoots have low energy because of the preceding processing, and can be clipped at perhaps 150 percent modulation using a baseband clipper. This should affect only the stereo component of the baseband, but not the pilot tone, SAP, or PRO sub-carrier, according to Orban. In addition, he says such clipping protects exciters from possible overload, yet causes no audible crosstalk at other audio subcarriers or visible crosstalk to the video—another important consideration.

To further emphasize the need for such protection processing, Orban adds the caveat that inadequate protection of the stereo pilot tone and/or filtering which is not adequate enough to prevent main-channel to sub-channel or sub-channel to main-channel crosstalk can produce audible distortion. According to Orban, these distortion-producing parameters are solely determined by the frequency response of the filters, and, he says, "their overshoot performance has no audible effect upon the system distortion provided that band-limiting and overshoot control are included prior to the filters (to limit overshoot energy), and the exciter is not driven into its non-linear region."

gramming, including news and commercial production, meet the higher standards established for audio quality. It would take an entire book to begin to describe all of the possible ways that production techniques, including the proper use of audio processing equipment, can be used for news, commercials, talk programs, and any other programs. The education of production personnel in the area of audio is essential, especially in the area of the newest equipment on the market.

Adjustments and evaluation

It takes knowledge of the principles, patience, and an impartial "ear" to choose which audio processing adjustments to try, and to evaluate the benefit of each adjustment. The main thing is not to try to do everything immediately. The evaluation of audio quality cannot be done instantaneously—it takes time to listen to different types of programming, to sort out what characteristics are present in the audio, and to try adjustments to the processing parameters that will achieve the goals of the station.

A thorough understanding of the audio processing and audio quality principles must be mastered before attempting to "tweak" the equipment into the right set of adjustments. A good monitoring system has to be established, to indicate what the viewer/listener is receiving in his home. Judgment as to what really does sound good to the average listener has to be developed. It is very easy to listen with a biased ear, rather than try to place oneself in the position of the average listener.

Most important, it takes the cooperation and commitment of every department to establish the desired overall audio quality of a station. This is no less true in audio than it is in video, and since the subject of top quality audio is new to television, established relationships between engineering, production, programming, and news may have to change, as management presses each of them to make the proper contribution to the audio effort. **BM/E**

William Resch is the principal author of the seventh edition of the *NAB Engineering Handbook's* chapter on TV transmitters.

Gary Breed has extensive experience as a chief engineer, and has spent six years as a consultant.

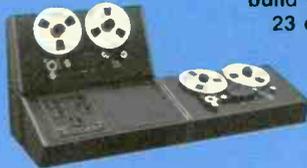
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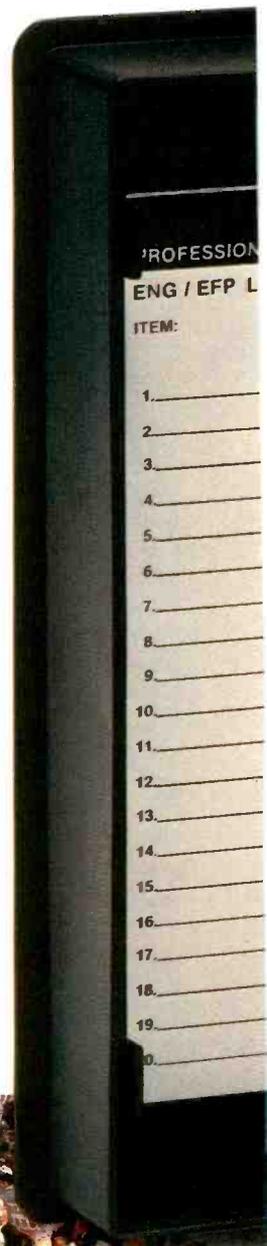
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**SPECIAL
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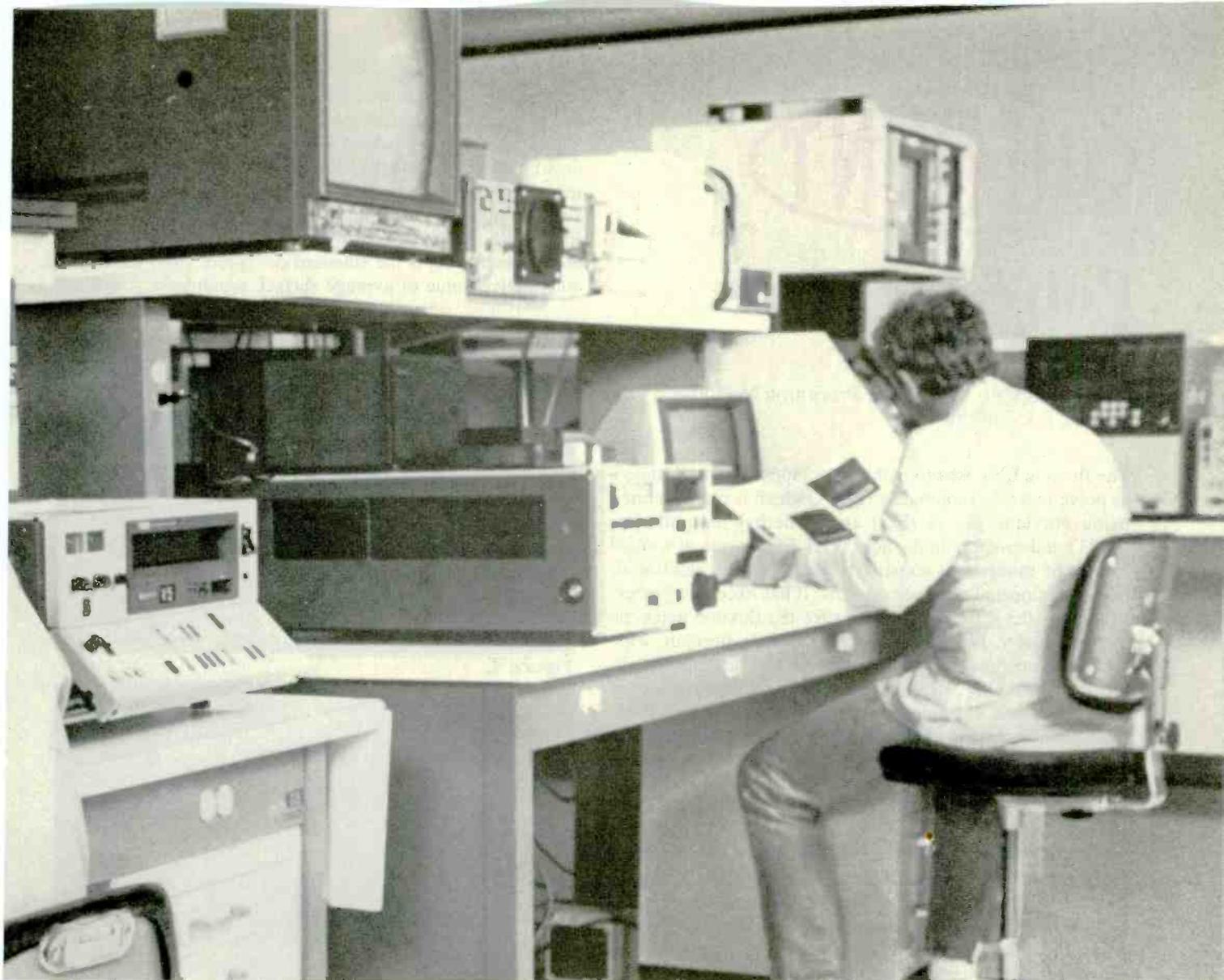
THE FUTURE OF TAPE TECHNOLOGY

There are still some in the industry who think video and audio tape is simply the passive medium used to record program signals. But as tape manufacturers are so fond of reminding us, without tape (or at least some form of magnetic recording medium), TV would be back in the days of live and filmed programming, and radio would have to be all-live. Even as "recording formats of the future" continue to evolve into solid-state memories and the like, it appears that tape's future, in one form or another, is secured.

Indeed, far from being a passive medium, tape is actually

driving recording technology on several fronts. Those committed to establishing a standard for 1/4-inch video recording, for example, are said to be ready to sit down in committee once again now that metal-particle tape, with its higher recording density, has become more of a commonplace reality. Could a 1/4-inch machine using metal tape succeed in passing user requirement tests where standard tape failed?

Another example is the M-II format recently introduced by Panasonic, equaling the signal-handling capability of one-inch Type-C but using metal-particle VHS cassettes. We are



in the midst of an evolutionary stage that has seen “broadcast quality” tape drop from two-inch quad to one-inch Type-C and now to half-inch.

Development of a digital VTR would have been impossible without attendant improvements in the 19 mm tape it uses, now perfect enough so it can record the highly dense digital bit stream virtually error-free.

And what of 8 mm metal tape and the 8 mm recording format, which may one day supersede not only the Beta and VHS home formats, but, in an as-yet-unreleased professional version, become the ENG standard of the future as well?

It is with developments such as these in mind that *BM/E* has invited some of the leading tape manufacturers to describe their latest developments in tape technology. In some cases, the developments described reflect the company’s very latest R&D efforts—the new base material described by DuPont, for example, and the new binding process described in the story from Maxell. In other cases, the manufacturer details the latest news in manufacturing processes—Kodak’s failure mode analysis, for example, and 3M’s laser interferometry.

The common theme among all these developments, however, is that tape is the often-overlooked but vital component in any new recording development. And as the industry looks toward the future of recording technology, tape is anything but a passive medium.

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Polyester Films for Video

By R.A. Repetto, Marketing Programs Manager (Mylar), E.I. DuPont

The flexible film used to make videotape is a plastic known as polyethylene terephthalate (PET), which is manufactured using ethylene glycol (EG) and dimethyl terephthalate (DMT) and/or terephthalic acid. PET film is one of a small family of moderately expensive and broadly functional, highly engineered polymer systems. It has excellent properties and is the substrate of choice for the flexible magnetic media industry. Desirable properties include strength, wide service temperature range (-70 to $+150$ degrees C), dimensional stability, chemical resistance, moderate moisture absorption, and excellent dielectric strength. Unmodified, PET film has excellent optical clarity and an ultra-smooth surface. To aid handling properties and processing, and to meet specific market needs, surface additives and treatments, color modifiers, and different stretching techniques are employed.

After the polymerization of EG and DMT, molten polymer is extruded through a die equipped with adjustable lips to produce a controlled thickness molten web. This web is quenched to form an amorphous film. To achieve final properties, the films are biaxially oriented during manufacture to capitalize on the strengths of the highly ordered molecular chains. Simultaneous with this structural organization process is the development of "strain induced" crystallization which locks in the required high physical properties. The final structure is then dimensionally stabilized by thermally crystallizing the well-organized molecules.

Both film topography and proper selection and processing of magnetic particles are key to the proper functioning of videotapes. Today, PET film is coated with magnetic oxides such as iron oxide or chromium dioxide dispersed in crosslinkable binders. The next generation of videotapes, however, will require significantly smoother surfaces, substrates up to 50 percent thinner, and use of pure metallic particles or thin metal films in order to achieve the desired compactness, signal-to-noise ratios, and longer recording times. These magnetic surfaces, which will have recording densities of eight to 10 times that of those used today, will be applied to the film surface by electron beam curing, plasma sputtering, metal evaporation, or by techniques still being developed.

To meet these demands, considerable advances are being made in film surface technology. Using interference contrast photomicroscopy (100X) we can compare, on a qualitative basis, the differences in the surface topography of the polyester film typically used today by both the professional and consumer video media manufacturers, and advanced substrates that are nearing full commercialization.

But although these pictures give us a feel for the ultra-

smooth films of the future, they do not tell us much in a quantitative sense. Quantitative determinations are best made by surface profilometry, which gives a better insight into the up-down (smooth vs. rough) characteristics of surfaces. Instruments typically used are contact profilometers such as the Talysurf profilometer which measures amplitude parameters R_a and R_q . R_a is the root mean square deviation from the centerline and R_q is the standard deviation. Both provide a quantitative value of average surface roughness.

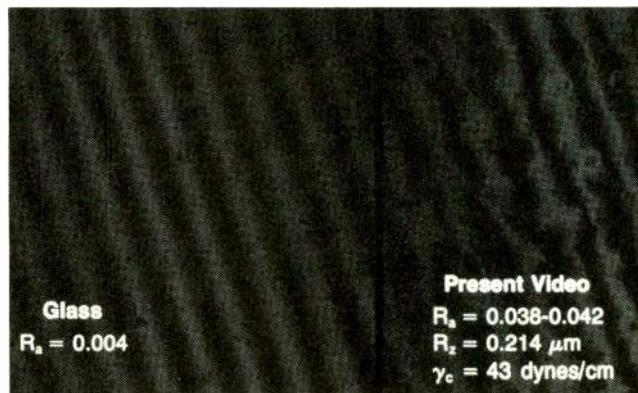


Figure 1.

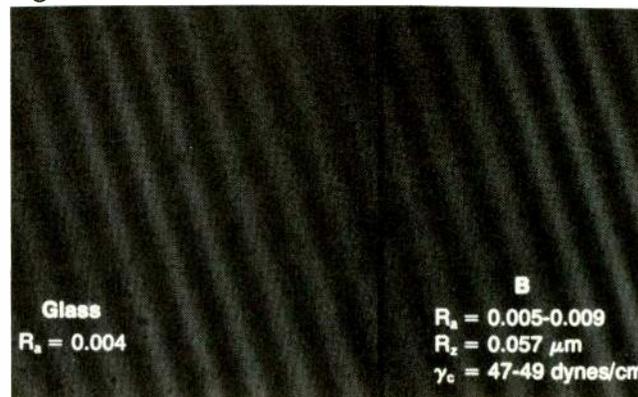
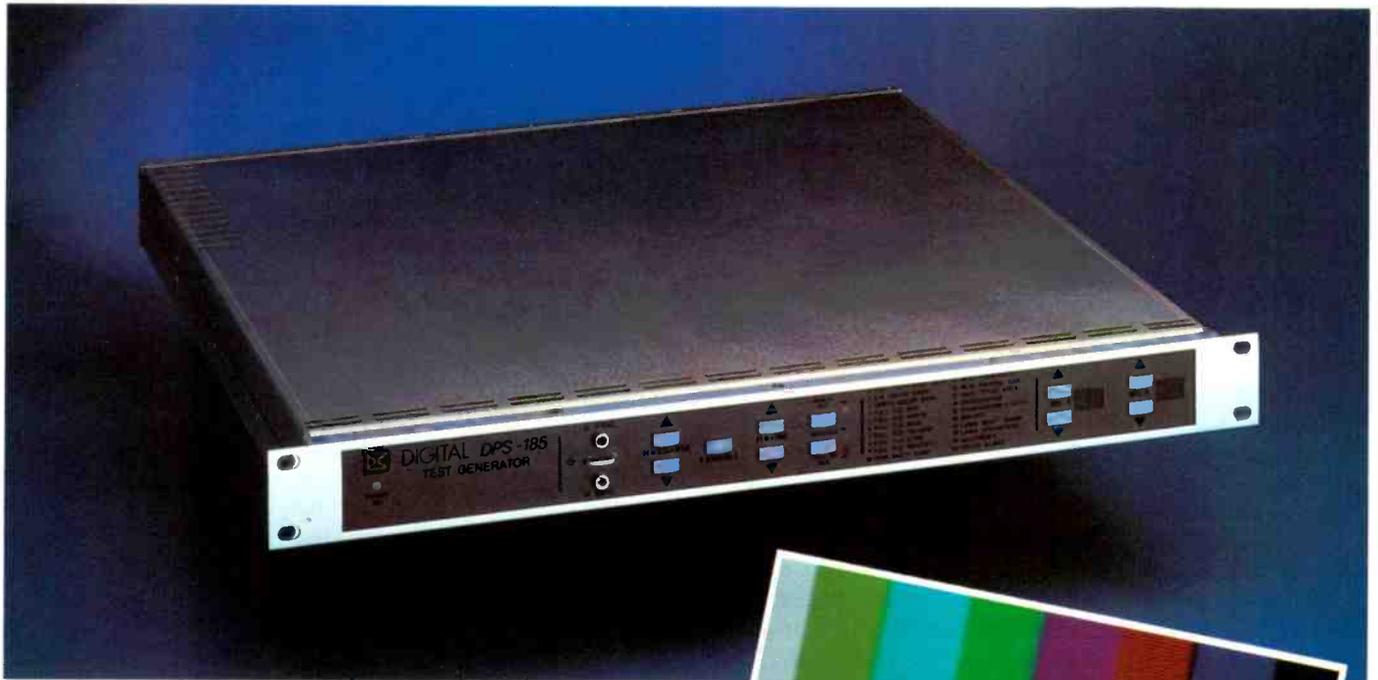


Figure 1 presents a comparison of the surface of a glass plate, the present video film surface, and an advanced video substrate. Note that the interference fringes from the glass plate are straight and smooth, and show no structure, while the currently-used film shows substantial roughness. The film is a relatively smooth surface, but far from a polished optical flat. The distance between the fringes is about $0.29 \mu m$. The numbers reveal more about the surface. $R_a = 0.004 \mu m$ is the centerline average obtained from Talysurf. R_z is the average of the five highest peaks and adjacent valleys on the surface that the stylus has traversed. γ_c is the critical surface energy as measured by contact angles and provides a figure-of-merit on how liquid solvents used in magnetic coatings will wet the film. The value of 43 dynes/cm is typical of polyethylene terephthalate film.

In the new advanced video PET substrate, labeled "B," the fringes reveal that the film is flat, structureless, almost as smooth as glass, and with solvent wettability in the region compatible with current magnetic coating formulations.

The advancements in polyester film for video applications are providing new substrate technology which is essential to the development of 8 mm video. Additionally, hybrid video substrates have provided spinoff opportunities for the data market designed to meet the higher density storage requirements of computer tapes and floppy disks.

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The Making of Videotape

By James W. Hegadorn III
Technical Service Manager, Fuji Magnetic Products Division

Fuji Photo Film's history of chemical production and film coating techniques led the way in developing Japan's first videotape products in 1959. While most manufacturers trace their beginnings to the production of audio tape, Fuji's roots are planted firmly in the broadcast videotape industry.

Magnetic media, whether video, audio, computer tape, or floppy disk, begins with the mixing of raw materials to create a dispersion of fine ferric oxide and binder material. Fuji's proprietary ferric oxide Beridox particles or iron nickel particles in the case of metal tape, are needle-shaped and coated with a cobalt-modified layer. The cobalt-modified layer increases by two the coercivity factor of the particle.

The dispersion is then decontaminated; dried; heat processed; milled with sand, stones, and smooth balls; filtered; and remixed under pressure to create the coating material.

The magnetic dispersion is now used to coat the base film, a tensilized polyester sheet which will vary in thickness from 14 microns for half-inch ENG tape to 20 microns for one-inch broadcast tape. The first step is to apply an adhesive undercoating less than 1-micron-thick to the base film. This serves to enhance the bond between the high density Beridox magnetic layer and the tensilized polyester base. The magnetic coating is now applied to the base film under constant pressure in order to form a magnetic layer which is smooth and even. The thickness of this layer is 6 microns. It is important that the mixture of binder and magnetic particles is as smooth and as even as possible.

The coated film is now moved through a magnetic flux field to position the needle-like magnetic particles in a longitudinal direction. As the particles are magnetically positioned, they must not touch or interfere with each other in order for the orientation process to yield the maximum magnetic properties. It is for this reason that the dispersion of oxide and binder is so carefully formed and evenly distributed on the base film.

Now we apply our proprietary Duroback coating. This backcoating is important in providing a strong, pliable underlayer to the base film to prevent stiction and reduce friction for better runability.

The tape is now ready for its final drying stage. The coated sheet passes through a highly regulated hot air chamber. The dried sheet is now rolled on giant reels where the product is cured before calendaring. In calendaring, the cured tape sheet passes between heated rollers to finish the formulation process. This final treatment is key to insuring surface smoothness for greater signal-to-noise performance and magnetic capability. The polished reel is now ready for slitting into necessary production widths and lengths.

Understanding Tape Specifications

Tape specs fall into three main categories: 1) physical properties; 2) magnetic properties; and 3) performance. The physical properties are the tape's width, thickness, strength and mechanical tolerances.

Magnetic properties are measures of the tape's ability to store and hold a magnetic charge. *Orientation* is the direction in which the magnetic particles face. *Intrinsic coercivity* is a value which is determined by the amount of opposing magnetic force needed to reduce the magnetism to zero from its saturation point. The *Retentivity* spec pertains to the material's capacity to hold a magnetic charge after the source of the charge has been removed.

The performance numbers are average values, usually given with respect to the manufacturer's reference tape. Both *Video* and *Chroma signal-to-noise* indicate the difference between production tape and reference tape in performance, a standard which can be derived by using the formula: 20 Log (.714/RMS Noise).

The *Stop motion* and *Tape life* specifications are both machine- and environment-dependent. The figures are based on extensive laboratory tests on commercially available videotape recorders. *Failure* is defined as either a significant increase in dropout activity or binder degradation resulting in a minimum of 6 dB less RF signal output.

The properties of *Runability* and *Durability* along with advances in manufacturing technology add up to increased reliability for tape products. "Performance with unsurpassed reliability" is what we at Fuji are continually striving for.

SPECIFICATIONS: H621 E

	Backing Material	Black-Coated Polyester
PHYSICAL PROPERTIES	Thickness	Backing 22 UM (0.87ML) Nominal Coating 5 UM (0.20ML) Nominal Total 27 UM (1.07ML) Nominal
	Breaking Strength	137 Newtons/25.4 MM (31 Lbs/inch)
	Yield Strength	58 Newtons/25.4 MM (16 Lbs/inch)
	Orientation	Longitudinal
MAGNETIC PROPERTIES	Intrinsic Coercivity	660 Oersteds
	Retentivity	1 200 Gauss
	Video S/N (Monochrome)	+2 dB
PERFORMANCE	Color S/N	+2 dB
	Dropouts	Less Than 15 Per Minute Average Throughout Reel
	Stop Motion	Capable of Exceeding 1 Hour
	Tape Life	Capable of 2 000 Passes
	Audio Sensitivity	0 dB
	Audio S/N	+2 dB
	Audio Output Uniformity	± 1 dB

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3M

Laser Detection Improves Process Control

By Lee Marks, Technical Service Manager,
3M Video Products

Probably the greatest single enhancement in quality of magnetic tape over the past five years comes from laser detection. The laser detector scans tape surfaces for coating streaks and other irregularities, automatically identifies them, and marks them for an operator. In the next step, an analyst microscopically examines the sample of the defective area. Because we can find defects and identify them, we can feed the information back into the process and correct it.

3M first used the laser detection method on its professional quadruplex videotape. Over the past five years, the technique has been refined and perfected for better process and quality control. Today it is possible to detect defects in the two to three mil size range, and 3M has expanded the technique for use on audio as well as videotapes.

Computer-based microscopic interferometry and laser scanning interferometry, related technologies, are important measuring techniques for analyzing surface uniformity of the finished tape product. Computer-based microscopic interferometry with proprietary computerized data collection, analysis, and graphical presentation produces a three-dimensional representation of the tape surface which can be reconstructed and examined from virtually any viewpoint. Laser scanning interferometry scans a moving tape, comparing a reflected laser beam to a reference signal, to produce a two-dimensional surface profile. Vertical resolution is approximately half a nanometer (5 angstroms).

Research and development of these interferometry techniques has been important for monitoring a variety of surfaces, not all of them related to magnetic media. Many other 3M products—from recording heads to photographic films—are also based on coating technologies.

As the industry looks ahead in magnetic media, it is apparent that the trend is toward thinner coatings. That means the interfaces between the video head and tape become more and more critical. Surface characterization is going to be essential in producing high quality magnetic tape.

X-ray fluorescence is another valuable analytical tool for process control, because it offers highly accurate analyses of coating dispersions. Although ingredients are preweighed and assembled on palette, X-ray fluorescence serves as a backup to ensure that dispersions contain the appropriate components in the correct proportions.

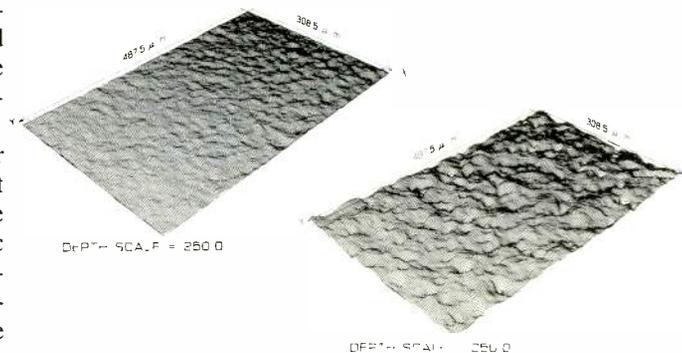
This type of analytical tool eliminates potential trouble, because it adds to the system of checks and balances that show if a process is in control. By using more analytical equipment to monitor processes, we can produce high quality tapes more efficiently and in higher yields.

Among the most important monitoring steps are those related to the actual coating procedure. A computerized system maintains complete control of the coater by monitoring speed, flow rate, tension, and temperature. The result is greater tape consistency and uniformity by virtually eliminating operator error, because the computer prevents an operator from altering any of the system variables without approval from a process engineer.

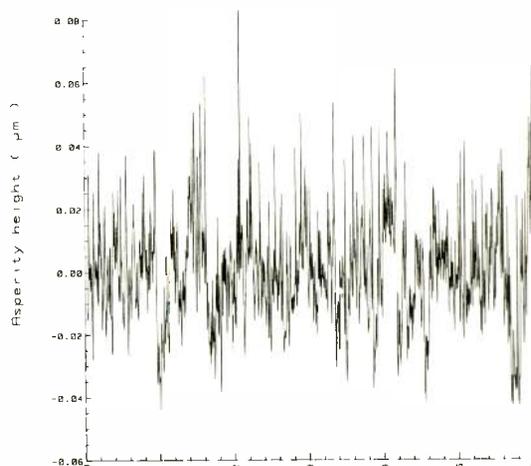
Potential for contamination will always be critical to tape technology. To reduce airborne contamination and resulting dropout on tapes, 3M has made clean-room standards even more stringent. Increased automation in assembling and loading cassettes reduces contamination for handling—besides improving mechanical reliability.

Static control in cassettes, shells, bodies, leaders, and packaging is the focus of a number of proprietary technologies at 3M. Anti-static treatment is a major production step in 3M's newer cassette products.

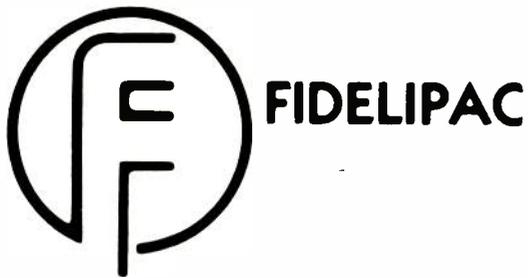
3M's broad involvement in the audio and video industry means that improvements in one tape type will be reflected in other tape types. Audio tape has definitely benefited from the effort that has gone into making and perfecting videotape. That would not be the case if 3M were making just videotape. There are principles we learned and processes we perfected in making audio tape that have significantly contributed to video.



Computer-based microscopic interferometry provides a three-dimensional representation of a videotape surface. At left, an experimental tape sample with an exceptionally smooth surface. At right, a conventional videotape surface.



Laser scanning interferometry was used to produce a two-dimensional surface profile of a videotape with a relatively rough surface.



Designing a Broadcast Tape Plant

By Gary Gresham, Fidelipac Corp.

Beginning in 1982, Fidelipac designed, constructed, and staffed a new magnetic tape manufacturing facility, the first ever dedicated exclusively to serving the specific requirements of the broadcast industry. What considerations led to this unprecedented investment?

Fidelipac committed to manufacturing high-grade, back-lubricated 1/4-inch audio tape because the historic suppliers, such as Ampex and 3M, abandoned the product in 1978 and 1979 as the eight-track cartridge was replaced in the consumer market by the cassette. Large-scale tape manufacturing facilities generate tremendous volume and must utilize capacity to remain economical. Major tape producers seek large, growing consumer markets such as videotape and floppy disks in favor of diminishing mature markets. By 1983, the surviving tape producers were record companies providing prerecorded music under their own labels on eight-track cartridges, but this tape did not satisfy the demands of the professional broadcaster.

Introduced in early 1984, Fidelipac's own Dynamax brand of recording tape was formulated and processed precisely to the requirements of the broadcast industry: higher output, greater saturation offering more headroom, and superior physical life.

The company laid the groundwork for this venture by purchasing a new, modern 44,000-square-foot manufacturing plant. Experts in a variety of disciplines were recruited from all over the country. State of the art equipment was installed. And a spectrum of the latest high-performance raw materials and chemistry systems were analyzed and evaluated.

In addition to chemical and processing considerations, original equipment selection was determined in accordance not only with present and anticipated reduced market size, but also to assure a maximum of control. For example, the 12-inch coating line is better designed to control and minimize transverse thickness variations in the oxide coating than are larger lines.

Two years were devoted to research and development, testing formulation upon formulation for magnetic properties, electronic response, and physical life. Recent laboratory evaluations of modified and enhanced product yielded such consistently excellent results that earlier products lines have been replaced by new tapes with different designations.

In order to obtain the best possible overload characteris-

tics, the maximum oxide/binder ratio of 82 percent is utilized. To prevent degradation of frequency response caused by densification, Fidelipac incorporates a more advanced particle in terms of cleanliness: size, shape consistency, and surface treatment. Particle consistency maintenance results from multiple processing by a sandmill; after each pass, particles are microscopically examined and magnetically analyzed to attain maximum potential.

It is equally important to select the optimum system to hold the particle in such a dense suspension. Many trials were required to select a resin binder to optimize maximum loading of the oxide along with other support pigments. Also, the resin binder must exhibit excellent durability. To enhance durability, a very sophisticated combination of lubricant additives with excellent slip characteristics is employed to avoid gumming at the heads. Finally, the integrity of the entire coating is assured by chemically cross-linking the resins.

Fidelipac currently offers two new types of back-lubricated magnetic tape. Dynamax Series 400X tape, for general-purpose recording applications, is compatible with other standard level tapes. When the highest level of audio performance is desired, such as recording music from compact disc to cartridge, Dynamax Series 500 FX high output tape is recommended.

Series 500FX reaches a three percent third harmonic overload 12 dB above 160 nWb/m, while Series 400X only provides 8 dB. While Series 500FX requires more bias than Series 400X, the superior performance justifies recalibration of all recorders. The 4 dB additional headroom improvement may be utilized as a 4 dB improvement in S/N (while retaining 8 dB headroom) if the recorder's "0 VU" record level is increased from 160 nWb/m to 250 nWb/m. Figures 1 and 2 show the frequency response of Series 500FX at -10 VU and 0 VU (250 nWb/m) respectively. The frequency response remains flat up to 15.5 kHz at 0 VU, clearly demonstrating the tape's superior performance. In addition to high overload and an excellent frequency response, Series 500FX is extremely linear, with only 0.3 percent third harmonic distortion (1 kHz) at 250 nWb/m.

Both of these tapes utilize a superior gravure coated lubricant. Extensive testing has resulted in 4800 mean plays before mechanical failure in the case of longer length music cartridges, and 14,400 iterations for short spot lengths. Moreover, all Dynamax tape is slit extremely precisely, with virtually no weave, resulting in stable and accurate cartridge performance.

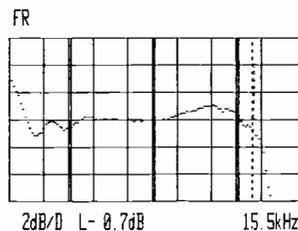


Fig. 1.
Frequency response of Series 500 FX at -10 VU.

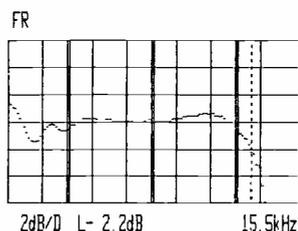


Fig. 2.
Frequency response of Series 500 FX at 0 VU.

SONY

Increasing Density of Magnetic Recording Tape

By Kunio Kobayashi, Director of Technical Operations and Shuichi Homma, Technical Manager, Sony Tape Sales Company

Over the last few years the consumer audio and video magnetic tape business has experienced escalating price competition. In the professional tape business, however, there has been another kind of competition—namely the race of technology. Although the consumer tape price competition has reached a saturation point, competition in the professional business continues to be waged. Sony Tape expects this to become more severe for several years to come.

Most recently, much research and development has been devoted to the improvements in U-matic videocassettes to keep pace with the upcoming generation of U-matic SP VCRs. In the very near future, Sony Tape will provide U-matic SP videocassettes to the market with high resolution performance characteristics.

Beyond improvements in existing formats, the digital VTR is on the horizon, requiring the development of a new kind of tape to abide by the recent SMPTE standardized 19 mm format. To enhance all of the attributes of clean, digital processing, the DVTR tape recently developed by Sony is composed of special cobalt particles for high coercivity. It is particularly designed to store the digital information with a low error rate, high output, and high precision performance.

There have been great advances in recording density concurrent with the development of the video recorder. The recording density has been increased approximately 100 times since the four-head broadcasting VTRs were first introduced in 1956.

Historically, tape's improvements have related to how the recording signal wave length has been shortened. In order to record shorter wave signals, we have to increase the coercivity (Hc) to minimize the self demagnetization between particles (or recorded signals).

Several kinds of magnetic materials for tape are used. Y-Hematite (Y-Fe₂O₃) is a classic and popular particle with the highest coercivity (less than 400 Oe), so it is used for standard audio cassettes.

For high density professional videotape (also for half-inch home videotapes), chromium-dioxide or cobalt-ferric oxide (Co_xFe₃O_{4-x}) have been used.

Cobalt (ferric oxide) can be divided into two types:

- Co-doped—Co-atoms are distributed uniformly in the particles.
- Co-absorbed—Co-atoms are located just on the surface of the particles.

By controlling the amount of Co atoms, it is relatively easier for Co-particles than chromium to be adjusted in Hc.

Adjusting the Hc for increased coercivity is the primary reason why professional videotape is most often composed of cobalt particles.

Among many important characteristics of magnetic particles are the temperature dependence of Hc, the thermal demagnetization, and the stress demagnetization. In all data, Gamma-Hematite appears the most stable but as mentioned before, because of its low coercivity, it can't be applied to professional high-density videotape.

The most stable material besides Hematite, Cobalt-absorbed particles, is used for high-end videotape, such as Sony Tape's 3/4-inch K-Series, half-inch Betacam HG Series, and new one-inch V1-K tape.

To obtain a high performance picture of low noise and high signal-to-noise ratios, the smaller the size of the particle the better. Following is the basic equation for the magnetic recording theory:

$$S/N = k \times V (W \cdot n)^{1/2}$$

V: relative speed between tape and head

W: track width

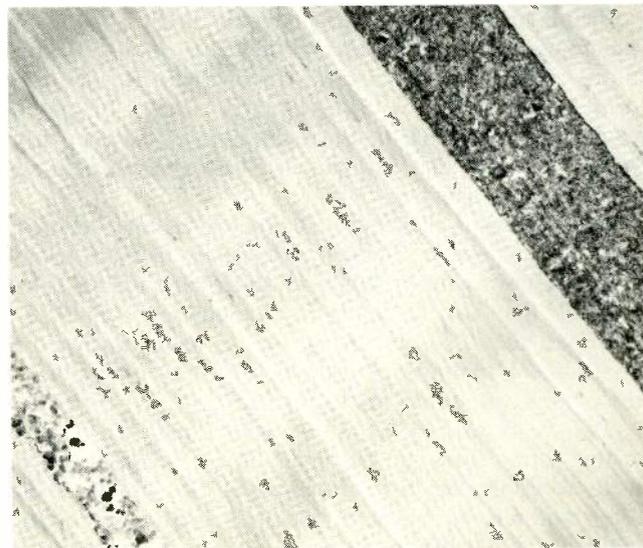
n: number of particles in unit volume

When V and W are the constant, the larger "n" is almost equal to the uniform and smaller particles.

For quite some time, engineers have been trying to prepare smaller and more uniform particles. Recently, Sony Tape made a major breakthrough on this technology, and applied the smaller, more uniform magnetic particles to several of its professional videotape models.

To improve the noise and output level, the surface roughness of the magnetic layer must also be reduced. To ensure a smooth surface, special technologies for base film and binder as well as the mixing process, coating, and calendaring are critical for quality results.

And, as the surface gets smoother, the runability and durability characteristics become harder to achieve. A new development on which Sony has focused provides highly crosslinked binders and lubricant. The tough and flexible crosslinked binders maintain a constant volume of lubricant on the surface.



Cross-section of newly developed Sony one-inch tape.

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AMPEX

Incoming Raw Material Control for Magnetic Tape Manufacturing

By J. David Settle and Walt Sims, Ampex Corp.

Most people may not realize that a magnetic tape product is a precision coating of a carefully balanced formulation of chemicals on polyester film. The coating contains high quality metal oxides such as iron, chromium, and cobalt; lubricants; resins; dispersants; head cleaning agents; carbon black; solvents, and fungicides, each serving a specific function in the final end use of the product. Some of these, such as lecithin dispersants or polyurethane resins, are commodity off-the-shelf chemicals that were not developed by their manufacturers specifically for their use in magnetic tape.

Other chemicals, such as cobalt-doped iron oxides, were developed for use in magnetic tape only. In recent years, however, due to the rapid growth of the tape market, chemical manufacturers are developing more products specifically for tape requirements and rely heavily upon feedback from tape manufacturers as to what performance requirements must be met. Both parties then agree upon the raw material specifications based on the manufacturing process capability as perceived by the vendor, tape performance data, laboratory to laboratory test data and methods correlation, and reaction to any processing problems.

It is the job of a quality assurance department to insure that the incoming lots of raw materials meet these specifications. At Ampex each chemical lot is subjected to a battery of analytical tests performed by the Quality Assurance Chemical Lab using standard gravimetric, volumetric and colorimetric tests plus state of the art instrumentation tests.

The analyses performed include gas chromatography for solvent purity; infrared spectroscopy for qualitative and quantitative analysis of all organics, matching their "fingerprint" spectograms to a computer library of standards; high-performance liquid chromatography to determine molecular weight distribution of resins and lubricants; specific surface area of oxides and carbon blacks by B.E.T. method; vibrating sample magnetometer to check the magnetic properties of oxides; carbon, hydrogen, nitrogen elemental analysis for organic residues on oxides; oil absorptometer for dispersant absorption characteristics of oxides and carbon blacks; multiple internal reflectance infrared spectroscopy for cross-linking agent capability; x-ray fluorescence spectroscopy for oxide dopant content; and an assortment of digital pH meters, balances, water baths, ovens, muffle furnaces and centrifuges for sample preparation. Use of these instruments requires highly trained chemists and technicians.

To assure a high confidence factor for test results, Ampex uses the following procedure. We identify the high volume and dollar usage materials having higher reject rates to work on first. A large quantity of one lot of the material is taken as the sample to eliminate lot-to-lot variation. Six laboratory technicians each run three groups of 10 samples from this

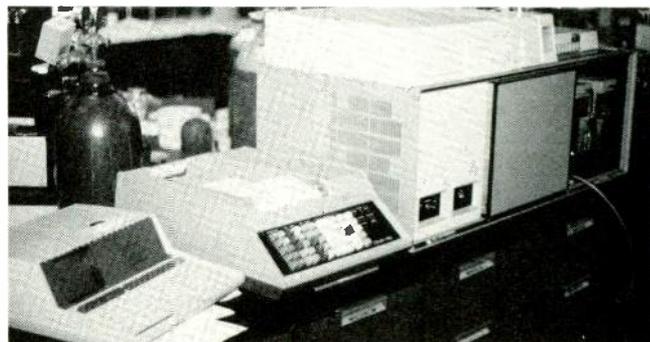
quantity over a period of a month to include any time function variables. The standard deviation σ and \bar{x} are determined for the 180 total test results for *each* test method. Also, each technician's data distribution is checked for normality. For a few tests some abnormal distributions are found, and the technician then locates the cause for the biased test results.

Choosing two standard deviations as a 95 percent confidence level, the z value is obtained from tables to be 1.96. The predicted range for each test is then calculated by the equation $\mu = \bar{x} \pm \frac{\sigma}{\sqrt{n}} 1.96$ for various values of n or test number. (Texas Instruments TI-55-II, *Calculator Statistics Manual*.) Test number can change when a sample is retested. A chart is then made showing all ranges for each test for the laboratory clerk to use as a confidence interval for the mean of the test results to compare to the specifications. For example, if specification of pH is 6.0 maximum, μ equals 0.18 and test results average equals 6.17, then the lot should be accepted if the specification has not already been adjusted for the confidence interval.

With this statistical database, which requires many months of technician labor to establish, the laboratory can stand on much firmer ground in its rejection of a lot both with vendors and with production control within Ampex.

Once we establish a higher degree of certainty that test results—acceptance or rejection of the lot—are correct, the next step is to prevent receiving deviant lots in the first place.

The main point is that quality assurance is a comprehensive program that starts with the incoming materials, and often starts before the materials reach the manufacturer. After all, a tape product can be of no higher quality than the materials used to produce it. Quality assurance is an attitude and a discipline that begins at the beginning.



Hewlett-Packard 1082B high-performance liquid chromatograph measures molecular weight distributions of resins and lubricants.



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Quality Control Techniques Vital to Tape Performance

By Forrest J. Watson, Manager, Video Products Quality, Video Technology Center, Eastman Kodak Company

One of the purposes of the Video Technology Center, which Eastman Kodak Company operates in San Diego, is to certify the quality assurance testing performed at the factory where Eastman professional videotape is manufactured. Certification is done in two distinct steps. First, we retest production sample tapes to verify that we are able to duplicate the data for dropouts, chroma, and luminance signal-to-noise ratios, and other characteristics achieved during factory quality assurance testing.

Next, we sample Eastman videotape after it has been delivered to a distribution center. This audit process guards against mishaps which could occur while the tape is in transit. For example, heavy vibration could affect the performance of some cassette mechanisms.

The Video Technology Center also supports Kodak's Consumer Electronics Products Division, responsible for marketing the Kodavision 8 mm video system, which includes several models of a very compact camcorder and a variety of playback accessories. This division also sells Kodak videotapes in all popular half-inch formats and sizes, and 8 mm Kodak videocassettes.

The 8 mm MP (metal particle) tape provides one of the keys to the design of an 8 mm video camcorder that doesn't sacrifice operating features to achieve compactness. The 8 mm MP Kodak videotape is a very high-density recording medium because the formulation contains much more metal than conventional iron-oxide tapes.

A good rule-of-thumb is that Kodak videotape MP is capable of recording as much as 350 percent more information than a similarly-sized oxide tape. However, there is also an invariable rule of physics that says the denser the signal, the closer the head must be to the tape.

There is one other very important job done by personnel at the Video Technology Center, "failure mode analysis." A more positive way to describe this investigative process is "product reliability studies."

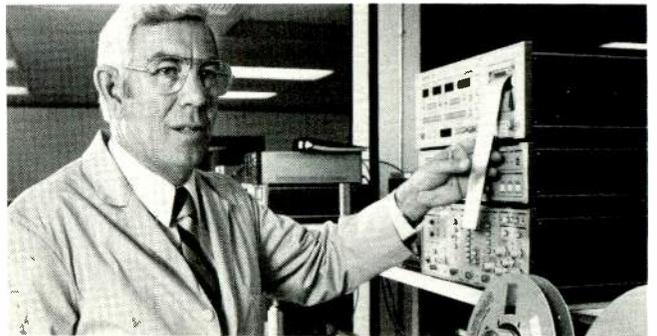
The purpose of failure mode analysis is to push to the outer edges the testing of product reliability under the most extreme conditions and circumstances. For example, if we want to study the reliability of a certain type of tape at high humidity and temperature, the tape inevitably will fail if the test is carried on long enough. And it's at this point where failure mode analysis comes in. We have to ask ourselves these questions: What factor, or factors, caused this tape to fail at this particular point? Was it the tape, or a particular

system component used in these unusual environmental conditions for a particular period of time? Is there a remedy?

Failure mode analysis, as we do it, is nothing less than a torture chamber for videotape. The product is spared no test—heat, cold, humidity, continuing operation, and long periods of freeze-frame. The only limitation to this unique brand of testing is the depth of our own imagination. If we can imagine an extremely adverse condition, or a set of circumstances, for handling and using videotape, we use that situation to test the reliability of our products in that environment.

We also expose competitors' tape products to the same analysis. If someone else is making and selling videotape that stands up to adversity longer or harder, we want to know why and how.

Incidentally, failure mode analysis should not be confused with research and development. That is a totally separate function. Kodak Research Laboratories is focusing some very substantial resources on magnetics research and development.



Forrest J. Watson, professional video products quality manager at Eastman Kodak Company's Video Technology Center.

We undertake analyses ranging from how the high humidity increases the abrasiveness of the tape surface, which consequently affects head life, to studying the condition of videotape after it has been left in the still-frame mode for many hours. We also have set up analyses to determine exactly how recording current affects dropouts.

Many of the failure mode analyses are complex and take a great deal of time to complete. If we're studying how tape wears heads, we have to run many thousands of feet of tape before we start getting any measurable wear on heads.

And, analyses that examine how recording virtually affects dropouts are an ongoing study, since virtually every one of the recorders that we have tested is measurably different from the next. However, the deeper we probe into this area, the better our body of information becomes, making it more useful.

All of this might seem like somewhat of a big bite for the "new kid on the block" to swallow. After all, Eastman videotape has only been on the market for just over a year. However, that doesn't tell the whole story. Starting with film, Kodak has played a leadership role in the evolution of imaging technology for more than 100 years.

Our scientists were actively providing technical data to the then-embryonic television industry in the 1930s, and from the start, right up through today, we have played a key part in the evolution of telecine technology. Today, it is as important as ever, since as much as 80 percent of prime-time evening network programming is produced on film and transferred to tape, and the same holds true for as much as 70 to 75 percent of national and regional commercials.

maxell

Improved Binding Process Enhances Tape Durability

By Ed Havens, Maxell Corporation of America

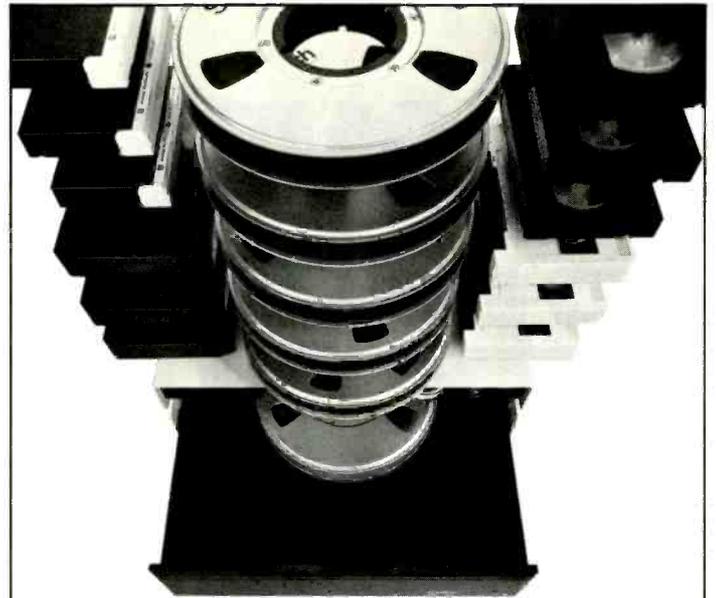
The binding process by which most magnetic tape is manufactured has remained virtually unchanged for decades. The magnetic layer, consisting of the magnetic particles along with the various adhesives, plasticizers, solvents, and wetting agents in the binder complex, is coated onto the surface of a tensilized polyester base film. A back coating may or may not be applied to the opposite surface of the base film. The finished product in cross-section exhibits a sandwich-type construction with several distinctly separate layers of materials.

Within the past few years, improved types of polyester base films have become available which provide microscopic surface smoothness. This characteristic allows superior tape-to-head contact and boosts signal-to-noise ratio. It also makes the binding process more complicated, since the smoother the surface the more difficult it is to achieve proper adhesion of the magnetic layer. At least one manufacturer has developed an "undercoating" as a separate adhesive layer between the magnetic coating and the base film.

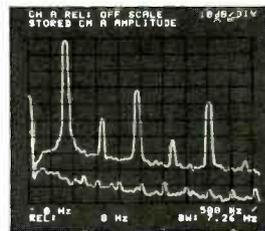
Hitachi Maxell Ltd.'s recently developed Molecular Fusion Binding process, however, eliminates the need for such intermediary steps and greatly simplifies the tape manufacturing procedure. The following is a basic description of the process and the factors that had to be considered.

The polyester base film used in tape manufacturing is normally an impregnable material in that it is not easily combined chemically with other materials. Previous attempts to chemically join the base film and magnetic layer resulted in a permanent softening of the base film and an unusable finished product. The key to developing a successful process is achieving a controlled reaction in which only a portion of the polyester film is altered. This is analogous to the cobalt ion absorption process utilized with gamma ferric oxide particles to alter their coercivity. In both procedures, the depth to which the material is acted upon by the outside agent is the most important factor.

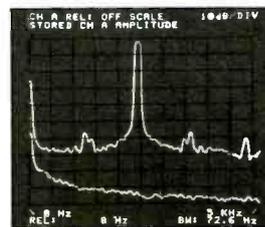
Hitachi Maxell Ltd. has formulated a proprietary activator chemical which is added to the slurry along with the magnetic particles and binder complex. When the magnetic coating is applied to the base film, this activator forms a molecular link between the two layers. The reaction occurs to a precisely-controlled depth and is terminated during the drying process. It is therefore a permanent bonding of the layers which combines them at the atomic level. Because it is a one-time reaction, the finished product will retain its structural integrity indefinitely. The magnetic coating and base film become more of a single layer and less of one material applied on top of the other.



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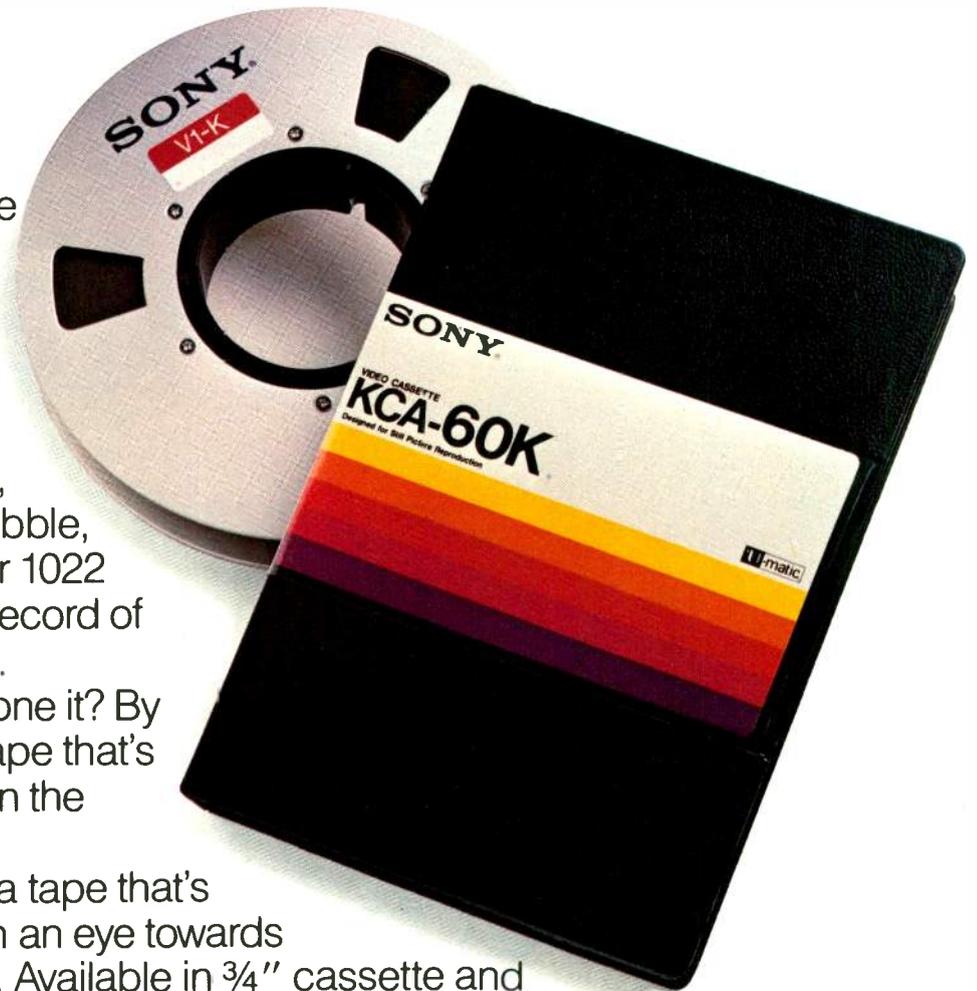
The K-Series is a tape that's been developed with an eye towards perfect coordination. Available in 3/4" cassette and 1" Type C format, its top players are uniformly dispersed, highly packed and well-oriented magnetic particles.

Complementing their strengths is the binder that distributes them evenly. And a unique surface treatment completes the team.

Then, to ensure that there be no technical fouls, Sony subjects the K-Series to pre-game check-ups lasting over 1000 hours.

By the time the K-Series makes it to the court, it's ready to turn in record-breaking audio and video performances. Play after play after play.

And that, after all, is the point.



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AGFA VIDEO

Noise Improvements in Magnetic Recording Tape

By Rudolf Muller and Werner Singhoff, Agfa-Gevaert AG

The size and size distribution of magnetizable particles has a well-known influence on bias noise of magnetic tape. Tape roughness and friction, however, cause noise of the playback head itself. The reduction of this "microphonism" on the head manufacturer's side, together with reductions in surface roughness and friction by the tape manufacturer, could lead to a further optimization of S/N in analog recording.

The signal-to-noise ratio of typical duplicating tape (PE 619) is given in Table 1 as a base for discussion. The measurements were performed on a Studer A 80 QC recorder equipped with IEC heads, and a 4 μm gap length recording head. These main parameters describing tape performance are well accepted and will be sufficient for the major part of duplication applications. Nevertheless, the S/N—specifically for high frequencies—could easily use some improvements for high-quality programs.

There has been a lot of discussion about the filtering and rectifying characteristics of noise measurement. Three filtering methods are commonly used: RMS quasi-peak rectifying, NAB filtering curve, and CCIR weighting network. The IEC has standardized the NAB filter in combination with RMS rectifying as the preferred method; however, for this noise evaluation the peak method is necessary and the CCIR network seems to be more suitable. Therefore, we used the CCIR network and quasi-peak methods for the rectifying noise measurements.

Traditionally, the system noise in replay mode consists of the combination of the replay chain of the recorder and tape noise. It was observed that the noise of the replay channel was heavily influenced by playing back a nonmagnetic-coated leader tape. Table 2 illustrates this influence. It is obvious that the noise deterioration of 7.3 dB by the leader and 1.1 dB by the base film is generated by the roughness of the surface of the tapes and/or by the friction between tape and head. Both effects generate noise in the head material due to magnetostrictive forces—more or less a microphonism of the head.

Noise in magnetic tape must be separated into two areas: noise generated by pigments and noise generated by roughness. Because it is not possible to measure the two sources separately, their individual influences had to be calculated. For this calculation, it was necessary to assume that the ef-

fective roughness and friction of a magnetic layer is approximately in the same order as that of the base film.

Table 3 shows the measured values and calculated results for two tapes, PE 619 and Magnetite 12. The noise of the two virgin tapes shows a difference of 2.6 dB. Magnetite 12's improved noise performance is a result of its smaller particle size.

If we return to Table 3 and compare the noise voltages of the base film—caused by friction and roughness—with the calculated noise for the magnetic particle powder, we can see that further improvement of pigment noise will result in only significant S/N improvement because of the roughness noise. In a comparison of PE 619 with 4.01 mV and Magnetite 12 with 2.5 mV, the ratio of the two pigment noise figures is 4.1 dB. The smaller difference between pigment noise and roughness/friction noise of Magnetite 12 reduced the difference in virgin tape noise to 3.6 dB, proving our point.

The calculations for powder noise and roughness/friction noise were based on the assumption that for a normal tape, the microphonism of the base material to head contact equals that of the magnetic layer, which might be the best case. If one bears in mind the microphonism of the leader, with an influence of more than 6 dB on the noise of the system, it is quite clear that not only must the tape manufacturer look hard for the influence of friction, but also that the head manufacturer should strive to reduce the microphonism effects to make further improvements in magnetic powder effective.

In addition, it should be noted that not only the playback head influences the noise. The same microphonism occurs in recording heads, and the roughness/friction noise generated in the core of the head is recorded with the normal bias at the trailing edge of the gap.

Further research into roughness-generated noise and head microphonism by tape and head manufacturers alike should result in a quieter recording that will benefit all users.

Table 1
Noise of PE 619 Duplicating Tape

Equalization 3180 and 120 μs	
Reference level 250 nWb/m	
MOL 3%	+ 4 dB
SOL 10 kHz	- 8 dB
Bias Noise	- 52 dB
S/N Low Frequency	56 dB
S/N High Frequency	44 dB

Table 2
Noise Influence From Leader Tape Playback

	Vpp/mV	dB
Noise voltage replay without tape	2.15	0
Noise voltage replay—leader tape	5.0	7.3
Noise voltage—base film	2.45	1.1

Table 3
Calculation of Pigment and Roughness Noise

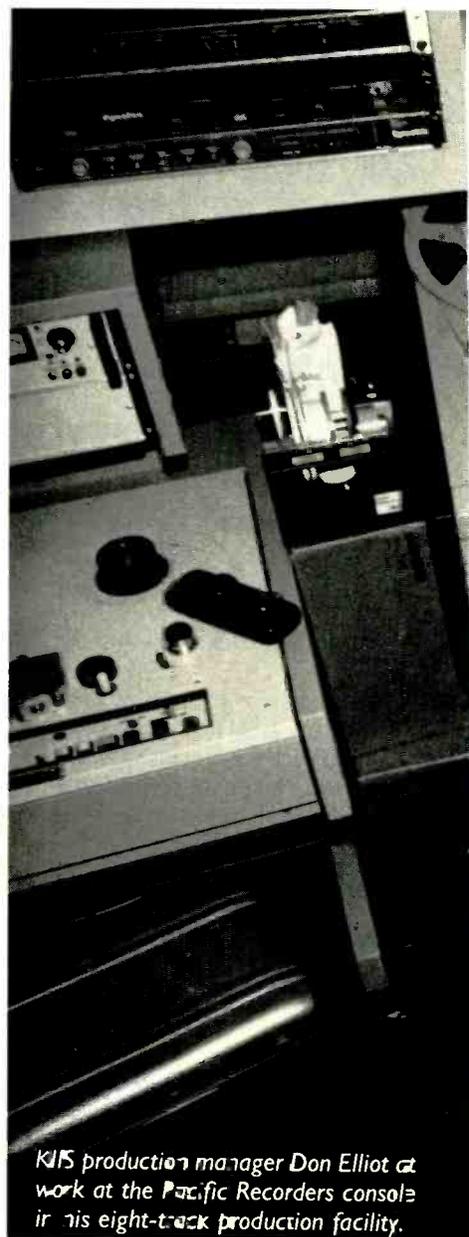
Replay	Measurement Noise	From Replay, Noise Separated	Calculated Pigment Noise
A 80 QC	Vpp/mV	Vpp/mV	Vpp/mV
Replay channel	2.15	—	—
Base film	2.45	1.17	—
Virgin noise			
PE 619	4.7	4.18	4.01
Virgin noise			4.1 dB
Magnetite 12	3.5	2.76	2.5

Editor's Note: This article was excerpted from a paper presented at the October 1984 AES Convention in New York City.

Radio Tunes in to Local Commercial Production

In-house radio commercial production is flourishing, with the creative union of new equipment and local talent establishing new station revenue centers.

By Judith Gross
Associate Editor



KIS production manager Don Elliot at work at the Pacific Recorders console in his eight-track production facility.

An FM station in San Francisco has just spent considerable time and money installing a brand-new eight-track commercial production facility. An AM station in Louisville urges local advertisers to take full advantage of its stereo production studio. A classical AM/FM station in New York City recuts commercials, replacing rock and new wave backgrounds with Mozart and Beethoven.

In spite of the availability of audio production houses, often with more elaborate and more state of the art equipment, radio stations in big and small markets are holding on to that one element of their local identity which cannot be duplicated en masse: namely their own commercial production, custom tailored to local advertisers.

Local advertising accounts for about



75 percent of a medium- to small-market station's ad revenues, according to the Radio Advertising Bureau; for major market stations, local dollars account for about 65 percent. Profit alone could be a strong motivation for heavy in-house production, but stations that are leading the pack in production have many other reasons for spending the time and money on equipment and talent, not the least of which is the station's image, or identification with the surrounding community.

Commitment to local production

Radio stations, both AM and FM, that have a heavy production load, have several important elements in common. Station management is unusually committed to local production and to

achieving quality, and is willing to spend money to back up that commitment. It's not uncommon, at such stations, to find more than one production studio, each with recent, if not state of the art equipment that is well-maintained by the station's engineer. Such stations usually have one or several people on staff devoted solely to production, and both engineer and production director play crucial roles in the overall team effort.

At KIIS-AM/FM, the Los Angeles superstar station, production manager Don Elliot literally "lives" radio production, with his own "do-not-touch" studio at the station and one at home. His production setup is the largest at the studio, and it's a multitrack, with a Sony/MCI eight-track, minus the noise reduction, because "if you put a recorded tape with effects added through

noise reduction it tends to expose the effects," Elliot maintains. His room also has a Sony/MCI two-track master, and a Tascam two-track. His Pacific Recorders eight-track console is "hot-rodded" to run backwards at normal speeds—not for special effects but for timing.

Although Elliot works closely with engineers and technicians on the staff, he prefers to follow his instincts rather than always going by the book.

"Engineers always tend to want an answer that's a formula. But the real answer is a 'feel,'" Elliot is fond of saying. Elliot tends to play it by ear, or by sound, at the Los Angeles station where no less than five production studios turn out a heavy load of promos, commercials, and such slick programming as Rick Dees' show.

For processing, Elliott has an Even-

tide Harmonizer, an Orban stereo synthesizer, and Dynaflex noise reduction. Elliot also has added an additional "toy"; a Thomson Vocal Eliminator takes the vocal track out of songs, allowing him to increase a music bed to fit commercial copy or create funny versions of existing songs.

One of the important benefits Elliot gets from his elaborate production setup is efficiency of time. He says he can produce a spot in two or three hours, which would usually take an agency two or three days. He is reluctant to give away his trade secrets, but his production technique is carefully planned and thought out from start to finish.

"It's got to start with a good mic sound, and a good voiceover performance," he says. From there, he might add music, from a record, or from one of his market-exclusive music beds supplied by Dallas-based Jam. He treats promos very differently than commercials. "Commercials are made to stand on their own, but a promo should always foresee what comes before and after." One of the techniques Elliot uses to make a promo stand out from the surrounding music is to punch up the beginning by recording the first few seconds in mono. Since most commercials and all music is in stereo, a mono beginning will make the promo appear to sound louder.

"The biggest trick in any production room is to develop an ear reference between on-air and production room sound. I do my own record carting because it sounds different to each ear," he says.

He is ever-cautious of what the station's listeners will hear. "One of the concepts I like to use is 'Mabel'—the listener out there who just hears the finished product and isn't in on the process. I ask what it sounds like to Mabel. Some problem that she can hear, but which an engineer can't measure, still has to be fixed."

Creative freedom

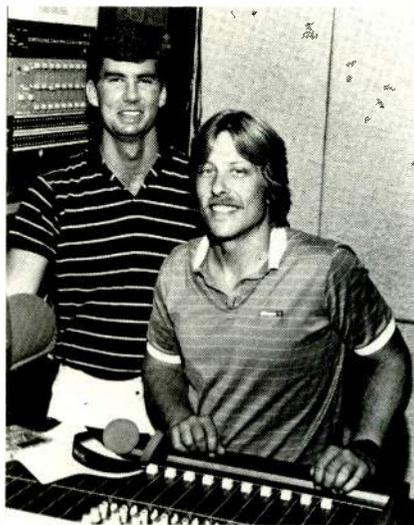
In terms of actual production, the term most often quoted by radio production directors is "theater of the mind." To achieve the illusions they seek, a variety of new digital effects and reverb machines are on the market, but most production people caution against overkill, so effects are used sparingly.

Stations that make production an important part of their operation are also heavily committed to on-air promo-

tions, contests, and boosting their image. These stations are not afraid to experiment or break new ground, and they often give their talent and staff a great deal of leeway at the creative end. One station even has its own in-house comedy duo, whose routines are becoming legendary among the local radio community.

Talk of comedy teams usually brings to mind Abbott and Costello or Martin and Lewis. But in Palm Springs, CA, KPSI-AM news/talk and FM adult contemporary have Doyle and Lasby.

Production director Mike Doyle and continuity director Dave Lasby do more than just splice and write copy. The two create humorous routines and assorted odd characters, and while Lasby works out the voices and con-



Mike Doyle and Dave Lasby, KPSI's comedy production team.

cept, Doyle adds the music and special effects.

The success of the team has brought the station new advertisers and earned the two a nomination for an International Radio Festival of New York award for a *Star Trek* parody that used five voices, music, and space-like sound effects.

Creative production isn't just a nine-to-five proposition for the two. Lasby and Doyle are also housemates, and often end up trying out skits and funny lines on each other well into the night.

It's the Eventide Harmonizer, along with a Delta Lab Digital Delay unit, that changes voices so that the two comedians can sound like the entire crew of the *Starship Enterprise*. "We call it the 'supertoy,'" says Lasby of the Harmonizer.

Doyle lays the voices, music and effects onto an Otari four-track and mixes

the spot down onto two-track Sony/MCI machines through a 10-channel Audiotronics board. Lasby exhibits a knack for imitating voices, and for suggesting unique uses of existing effects. One such example was a "cone of silence," which would be nearly impossible to create on radio if not for the far-reaching minds of its creators. The team used the pitch-changing and repeating sound feature of the Harmonizer to devise an effect that illustrated a cone of silence.

Doyle and Lasby are aware of the possibility of overdoing effects and even comedy, but right now advertisers are requesting the production team when they buy time on the station.

In addition to the digital effects, the two also use a music library, but are just as likely to come up with new ways to get the results they seek. They recently used the sound of one person running, fed through the Harmonizer and repeated, to duplicate a stampede.

Doyle and Lasby aren't only making money for the station, they are also having a great deal of fun producing spots and promos for KPSI. And station management seems willing to let them be their creative, crazy selves.

As KPSI's philosophy demonstrates, creative freedom reaps its own rewards, and the benefits of in-house commercial and promo production are numerous for a station and its advertisers. A big plus is that it allows the station to maintain quality control of what goes on-air. It also means more efficient use of time, person-power, and equipment, and sparks the creativity and versatility that are at the very heart of good radio.

Quality in-house production brings in additional ad revenues, and can give a station an edge in a competitive market. For the client, it means less expense and less time from idea-to-air than dealing with an agency, since most stations charge nothing extra for the recording of a commercial if the client has bought time on the station. Working with a good station production team can also strengthen ties between station and advertisers. As one production manager explains, "If a client likes what you give him, he might spend all his radio ad dollars with you."

Advances in technology

The days when commercial radio production had to be limited to a one- or two-person voiceover ended with recent advances in audio technology. Re-

verb is now digital, and digital effects, stereo processing, and new compressors and graphic equalizers have created a much more sophisticated sound for spots and promos. Multitrack recording, once in the exclusive domain of music recording studios, is fast becoming a commonplace radio technique.

When San Francisco's successful FM K101 decided to install new production facilities, station personnel immediately thought "multitrack." Chief engineer Randy Pugsley ended up with two newly-outfitted studios, a traditional two-track, and an eight-track one-inch facility.

"One-inch is a trend that's developing in larger stations," Pugsley explains, "it gives us the better quality and benefits electronic editing has over splicing." Pugsley echoes the station's sentiment that good equipment and quality production is a must to attract new advertisers and effectively promote the station on-air.

The two production rooms are equipped with what sounds like a radio engineer's "wish list." Two Otari two-tracks and a Pacific Recorders BMX console highlight the two-track room, with an Auditronics 300 Series mixing

console, an Otari MX70 one-inch machine and two Sony/MCI two-tracks in the eight-track room.

Compression/limiting is accomplished with Urei 1178 dual models, one in each facility, and there is a Biamp 220 graphic EQ and an Orban reverb. But K101 has yet to add any digital effects equipment.

"We wanted to concentrate on the basics right now," says Pugsley, adding that the station rents digital effects equipment when it's needed.

Keith Smith, K101's production director, says the station does extensive commercial and promo recording, and also dubs commercials for distribution to other stations. Smith thinks the new eight-track room will give the station an edge in the highly competitive San Francisco market at the same time it will give him the flexibility to do more complex recording.

"I used to do a lot of splicing and editing and use all the available equipment all the time," says Smith. "But with the eight-track, I could use two tracks for a stereo music bed, one for voice, two for sound effects, and still have tracks to edit them all together." He says it will greatly speed up his pro-

duction time as well.

While K101 is not yet equipped with digital delay or other types of effects units, Smith is trying out a drum machine and a music synthesizer, experimenting to create promos and some original music. But he maintains that effects only work when done in moderation.

"It's not the amount of 'Star Wars' effects you use, it's the quality you put into it," Smith explains, "and that's a combination of picking the right music, having the right voices, good copy, and careful editing."

Music is the message

The latest pieces of equipment to be added to the radio production room are music synthesizers and digital voice processors, which can provide the equivalent of an orchestra-backed choir in any configuration imaginable. These new "toys" have enticed even more stations doing their own in-house production, and many stations, especially in medium and large markets, are finding creative ways to use the available equipment resources.

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commercial radio production, and stations still rely on music libraries, although the synthesizers, once found only in record studios, are making inroads into radio. The crucial factor in music selection seems to be the station's format.

In Baltimore, the hot hits format of WMKR-FM is the basis for heavy on-air promotion.

"Two years ago we went from beautiful music to hot hits. Now it's important that everything on-air sounds like it's headed in the same direction, upbeat, and full of energy," says Davy Crockett, WMKR production director. Crockett is very concerned that commercials and promos reflect the station's image. "You don't want to sound like a different radio station each time you air a spot," he says.

For that reason the station relies heavily on music beds in its production, both those obtained from music libraries, and those Crockett selects himself. He stays away from instantly recognizable tunes, or from hits on the station's current playlist.

Crockett records and edits on two Sony/MCI two-tracks, and also has the use of a Sony cassette deck, Sony turntable, and ITC 99 triple-deck cart machines to add voices, music, and effects. His EQ is Orban's, and the station also has an Eventide Harmonizer for digital effects, with which he does a good deal of experimentation.

"You really don't know the extent of it until you try it out," Crockett explains. "But it's important to keep the tape running as you try things out, because you may hit upon a great effect that you won't remember how to duplicate." With the Harmonizer, Crockett



Elliot Lifson, WQXR engineer, controls production recording from a McCurdy console.

creates computerized voices, flanges, delay echoes, and pitch changes. But he, too, is careful not to overdo it.

More than half of all of WMKR's commercials are produced in-house, Crockett says, and he believes the finished product is as much a team effort as anything.

"It has to start with a good piece of copy, and our ad people are very creative," Crockett explains. "Ninety percent of it is imaging. You can take the worst commercial and make it sound good if you come across with a positive image.

"The idea is to always have variety. I watch how many of each type of commercial we air, how many have music, how many have a voice only, to keep it sounding varied." But the bottom line, according to Crockett, is serving the client, and custom-tailoring the copy and the sound to each individual advertiser, something which he feels radio in general, and WMKR in particular, is uniquely qualified to do.

"You sell to the client," he says, "and though the format change two years ago might have lost us some advertisers, in the long run we gained others, and we think we have the best production team in town."

Recutting for classical

Blending pieces of classical music into one production, or seeing to it that station promos flow into and out of the mellow, sophisticated sound of WQXR-AM/FM are the most challenging tasks faced by director of operations Tony Rudell. The programming is simulcast on both stations, and the AM is in stereo, which makes it easier to produce spots that will sound good on both.

At WQXR, you will not find the high-powered, severely compressed and equalized splashy promos of a hot hits or adult contemporary station. In fact, Rudell says the station is frequently faced with the task of recutting spots with a more suitable music bed. A recent example was a yogurt account, which bought time on a local oldies station and WQXR. The copy was similar, explaining how music played while cows were being milked made for a better tasting yogurt. But while the oldies station played good old rock and roll, WQXR blended Beethoven, Mozart, and Haydn, which Rudell cross-faded onto two tracks and assembled with a voiceover read live onto tape.

WQXR CE Zaven Masoomian has equipped the station's three production rooms with two-track Studer and Ampex machines, McCurdy consoles, Audiopac cart machines, and Ursa Major reverb. Because of the station's classical format, more attention is paid to factors such as tape quality and miking techniques. As might be ex-



WQXR program director Tony Rudell tapes a syndicated program with stereo mics for AM and FM.

pected, the format does not lend itself to unusual digital effects, and other than the Ursa Major, special effects are used only sparingly, if at all.

A large part of WQXR's production consists of syndicated music programming produced in-house.

Rudell says he tries to use music in his syndicated programs, as a metaphor, the way a station with a punchier format might use sound effects. "In our productions, we have art imitating music, music imitating life," Rudell says, explaining a recent example of a biographical program on a musician illustrated with excerpts from an opera that paralleled the artist's life.

Rudell has recently begun experimenting with compact discs in his production. CDs currently comprise about a third of the station's music playlist, and their use is on the increase at classical stations. He often uses a CD player instead of a turntable or reel-to-reel for his music beds, because CD machines can be cued to a more specific place in a lengthy piece of music, and they start up without the "wow" of a turntable or the "clip" of a tape player.

"CDs give us the capability of laying down the music bed and having it all come up clean," Rudell says. And at a station where the music is the message, that is an important effect in itself.

Producing for AM stereo

FM stations are used to recording commercials in stereo, but for AM stations it's something new. Some AM stereo stations are taking full advantage of two-channel sound while trying not to alienate their mono listeners.

Everything in the production studio at WHAS-AM in Louisville, KY is geared towards taking advantage of the AM stereo sound, but without ignoring those listeners without AM stereo receivers.

"I know I'm going to an awful lot of trouble for those few with stereo radios, but I want every new listener to be impressed," says John Polk, WHAS production director. Yet Polk listens to the finished product both in mono and in stereo, to insure that the voice is not overpowered by the music bed, or the music by the effects, on mono radios.

Going stereo has meant a switch in mixing techniques for Polk. Now, he says, he has to achieve the correct balance in everything that gets recorded, whereas before all he worried about was how loud each separate element was. But he feels the extra trouble is

worth it.

"For those who do listen in stereo, we really give them something to listen to," Polk explains. "Almost all our promos have separate effects on the left and the right channels, and separate music effects."

Polk and his crew have grown used to working with two channels for AM. Polk works with an Otari four-track and mixes down to Otari two-tracks. The added tracking gives him enough room to plan for stereo. A Ward-Beck board has pan pots which allow for stereo recording, and Polk frequently does dual-tracking of voices. Symetrix compressors are chain-linked to add compression when spots are dubbed to cart, and all cart recording, on ITC Delta machines, is in stereo.

Polk is another production director who doesn't believe in overdoing special effects and processing, although he does like sound effects. The AM production studio is equipped with a Urei dual graphic EQ and Urei stereo compression, the four Symetrix compressors (two for each channel), and an Eventide Harmonizer. For music beds, he prefers movie sound tracks, because "they tend to be dramatic but not over-

ly familiar."

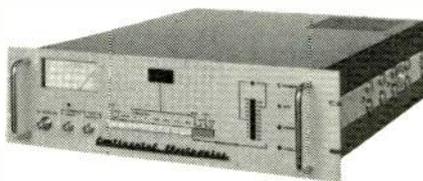
He rarely uses much compression on music. "I don't like to compress music because it's already compressed when it's first recorded. But you have to compress the voice or you won't hear it over the effects and the music," Polk says. One other strong reason for compressing voice, according to Polk, is to compensate for poor quality AM receivers.

Polk is especially pleased with the speed with which the station can turn out a finished product while an agency might take three times as long. And he says one other advantage to in-house production is being able to give an important advertiser individual attention.

Polk and the station copywriters sometimes create characters for a particular client, and have been so successful with a local lighting company's mascot that the character they created with the pitch changes and varied voices of the Eventide Harmonizer has found its way onto billboards and in print advertising.

"If a client is that happy with your production," Polk concludes, "he will generally spend all his ad dollars with you." **BM/E**

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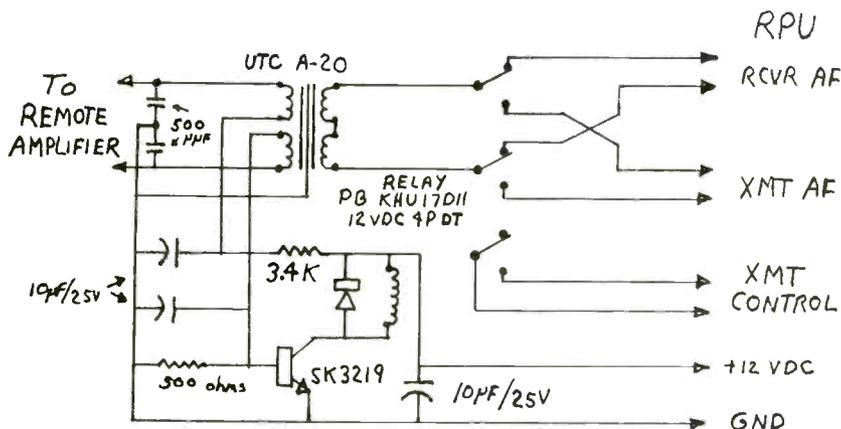
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GREAT IDEA NOTEBOOK

A Remote RPU Transmitter Adapter



By Ronald Balonis
CE, WILK
Wilkes Barre, PA

Remote broadcasts are a way of life for many radio stations and for many advertisers who use them to reach a station's listeners instantly and directly. At WILK, as at most stations, engineering remotes has always been a challenge. But now, with deregulation of the telephone companies, the challenge is even greater than before, since the loop's cost went up and its quality went down. So, like many other stations, to keep a remote's costs in-check, an RPU transmitter, when possible, now serves as the method of choice to get a remote on the air for us.

With an RPU transmitter, however, you lose some of the flexibility of a wired connection. You can't always set the remote up at the location that's best for the advertiser or best for the station. Sometimes, in some places, there's no power available for the transmitter, or it won't work from the location. In our case, the RPU transmitter is mounted in a van, adding a further restriction as to where the remote location can be.

Invention, of course, follows a need. So, to overcome these restrictions I

constructed this adapter that lets us remote control the van RPU transmitter by wire. The adapter frees us from RPU location restrictions by giving us a wire connection to the studio from the remote.

The RPU remote-control adapter connects to the RPU transmitter and receiver as indicated, and a line—telco wire if you like—runs to a remote amplifier at the remote location. To put the RPU transmitter on the air, just complete the dc path by connecting the remote amplifier.

The parts listed in the diagram were chosen not for technical characteristics, but solely because of their availability in our junk box. Others will work just as well. **BM/E**

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BT-S702N Studio Dual/Rackmount Color Monitor with Pulse/Cross and Underscan Blue Gun \$807	TR-124M 12" Black and White Monitor \$168
BT-S1300N 13" Studio Color Monitor with Pulse/Cross, Underscan and Blue Gun \$448	WV-5203 Triple 5" Black and White Monitor \$555
TR-930 9" Black and White Monitor \$124	WV-5370 8" Black and White Monitor with Underscan \$185
	WV-5372 Dual 8" Black and White Monitor with Underscan \$382

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T-100 16H Line Window-3.58 MHz Subcarrier Feedback . \$4,595	T*E-120 Digital Effects System Consists of (2) T-120D with E-120 Effects Processor \$17,495
T-120 16H Line Window-Standalone or 3.58 MHz \$5,850	T-220 Format Interchange TBC ... \$9,495
T-1200 16H Line Window-Standalone or 3.58 MHz with Dynamic Tracking \$6,695	Genesis I Digital Effects System \$17,595
S-230 TBC/Frame Synchronizer.. \$10,375	with ACT I control panel \$23,950

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TEKTRONIX 1740 Waveform/Vector-scope Combination \$3359	HITACHI V-099 Waveform Monitor \$930
TEKTRONIX 528A Waveform Monitor \$1855	HITACHI V-089 Vectorscope \$1250
	VIDEOTEK TSM-5A Waveform Monitor \$1659
	VIDEOTEK VSM-5A Vectorscope \$1897

QuickSet

QLT-7 Husky Tripod with Struts and Spring-Loaded Head \$149	SYSTEM I 10 Lb. Capacity Mini Fluid Head, Husky Tripod and Dolly \$399
QLT-9 Husky Trolley, Struts, 3" Wheels and Spring-Loaded Head \$179	SYSTEM II 30 Lb. Capacity Jr. Fluid Head, Sampson Tripod and Dolly \$845
QMT-3 Sampson Tripod with Elevator \$265	SYSTEM III 40 Lb. Capacity Hydro Fluid Head, Sampson Tripod and Dolly \$1,095
QLH-5 Mini Fluid Head with Column Base \$265	SYSTEM 2000 Hydro Hydro Fluid Head, 2000 Tripod and Dolly \$1,185
Q2000T-1 System 2000 Tripod \$375	

SONY

VP-5000 3/4" Player \$1360	VO-5850 3/4" Edit Recorder \$5300	Sony CMA-8 AC Adaptor
VO-5600 3/4" Recorder \$1720	Sony VO-6800 3/4" Portable Recorder	Sony BC-1WA Battery Charger (4)
VO-5800 3/4" Recorder/Feeder \$3290	Includes AC Adaptor/Battery Charger/2 Batteries \$3375	Sony NP-1 Battery
VO-5850PAC Editing System includes VO-5850, VO-5800, RM-440 Controller and Cables \$9590	Sony DXC-M3AK 3 Tube Color Camera with 15X Lens	Portabrace C-6800 VCR Case
	Sony VO-6800 3/4" Portable Recorder	SPECIAL SYSTEM PRICE \$9,899
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KCS-10BRK ... \$11.30	KCS-20BRK ... \$12.60	
KCS-20BRK ... \$12.60	KCS-30BRK ... \$15.32	
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Ultra-Vision 2000 Large Screen Video Projector Includes: • Screen Sizes from 7-10ft. Diagonal • Projects Onto Flat or Curved Screen • Front or Rear Projection	• Floor or Ceiling Mounting • Electronic Range/Finder Facilitates Set-Up • Electronic Border Generator Surrounds the Picture with a Black Frame	• Comb Filter NTSC Decoder with Enhancement Circuitry Provides Crisp Imaging • Internal 5" Loudspeaker with 1.5 Watt Amplifier .. \$1895
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AUDIO

Sennheiser ME-80/K3U Shotgun Mic with Power Supply \$297	Shure FP-31 3 Input Portable Mic Mixer \$599	Sony ECM-50 Lavalier Mic ... \$168
Sony ECM-150 Lavalier Mic. \$59	JVC MK-50U Shotgun Mic. \$195	Shure M-267 4 Input Mic Mixer with Limiter \$319

FORA

FA-400 Standalone TBC with Freeze Frame \$4,815	FA-410 16H Line Window TBC 3.58 MHz or Standalone with DOC. \$6,249	FA-420 3.58 MHz or Standalone TBC with Freeze Frame \$6,995
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KY-210UP Three Tube Color Camera Including AC/Charger, Battery, Cable and Fujinon 16X Lens \$6399	BY 110UL/16A Three Tube Color Camera Including AC/Charger, Battery, Cable and Fujinon 16X Lens \$4125
TBR-160U Portable Presentation System \$1235	GX-S700U Tube Color Camera with Genlock \$1,385

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Increasing AM Nighttime Service

By Harry Cole, FCC Counsel

Just because FM service has been getting a lot of press lately as a result of Docket No. 80-90, you should not think that AM service is being ignored by the FCC. In May, the Commission took a significant step aimed at increasing the availability of nighttime service on certain AM channels. In opening the door for new nighttime operation on certain foreign clear channels, the Commission is again holding out the possibility of increased opportunities for the previously beleaguered daytime-only AM licensee. Further, the FCC has designed an implementation system which, while not necessarily perfect, is certainly aimed at making the licensee's life a little easier.

Under international agreements, 14 AM channels have been designated as clear channels reserved for primary use by Canada, Mexico, or the Bahamas. The Canadian clear channels are 540 kHz, 690 kHz, 740 kHz, 860 kHz, 990 kHz, 1010 kHz, and 1580 kHz. The Mexican clears are 540 kHz, 730 kHz, 800 kHz, 900 kHz, 1050 kHz, 1220 kHz, and 1570 kHz. The sole Bahamian clear channel is 1540 kHz.

Severe restrictions

Because these frequencies have been reserved for primary use by other countries, severe restrictions have been placed on any U.S. station operating on any of the foreign clears. For example, under the North American Regional Broadcasting Agreement (NARBA), none of the Canadian clears could be used for nighttime operation anywhere within 650 miles of the Canadian border, and the Bahamian clear could not be used at night within 650 miles of the Bahamas. The U.S./Mexico Bilateral AM Agreement reached in 1968 was even more restrictive,

precluding nighttime use of any Mexican clear channel anywhere in the United States.

Recently, however, the international scene has been changing dramatically. A new agreement between the U.S. and Canada has replaced the NARBA. The new U.S.-Canada agreement does not prohibit the establishment of U.S. nighttime operations on channels previously designated Canadian clear channels. Additionally, the U.S. and the Bahamas have both signed the Final Acts of the Region 2 Administrative Conference, which similarly eliminates that prohibition relative to the Bahamian clear channel; however, the Bahamas must take one further formal step (which it has indicated it intends to take) before the prohibition will be completely eliminated. Finally, the FCC's team of negotiators has reported "considerable progress" in its efforts to reach a new agreement with Mexico which would, among other things, permit new nighttime operations on the Mexican clear channels throughout the U.S.

With these developments in place, or at least clearly underway, the Commission has adopted a series of changes intended to lead to new nighttime operation on the various foreign clear channels.

The primary regulatory is the obvious one: the Commission will now consider, and grant, applications proposing nighttime service on many of those channels on which such service was previously prohibited. And, once the Bahamian and Mexican situations are clarified somewhat more, all of the foreign clear channels will be available for nighttime service in the U.S.

AM utilization

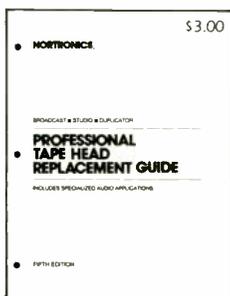
Finding itself with this substantial chunk of AM spectrum ready and waiting, the Commission gave some

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thought to the best way to utilize it. The possibility of using it for brand-new full-time stations was considered. However, in view of the number of daytime-only U.S. stations already operating on the channels in question, it was immediately apparent that new full-time stations would be possible only in limited areas. Nevertheless, where the establishment of such stations is consistent with the FCC's rules, the FCC is willing to consider applications for them. The real beneficiaries of these changes, however, are likely to be the many existing daytime-only licensees on the foreign clears who will now be able to improve themselves to full-time status.

This new opportunity—whether to seek a new full-time station or to upgrade an existing daytimer—may not be as attractive as it might appear at first blush. Even if the foreign clear channels may now be used for nighttime operations, the power available to such operations is still subject to both foreign and domestic protection requirements. In other words, the rules that establish the extent to which existing nighttime signals of both foreign and U.S. stations must be protected will apply to any new U.S. operations on the formerly foreign clears.

Additionally, the Commission recognized the fact that the likely proximity of new stations to one another, and the proximity of existing daytime-only stations which could be upgraded to full-time status, could preclude new nighttime operations unless the power available for such operations was limited. Accordingly, the FCC decided that new nighttime operations on the foreign clear channels would ultimately be limited to a maximum of 1 kW (assuming, of course, that operation of any particular station at that power would be consistent with other applicable nighttime protection requirements). The Commission's idea is to phase in the nighttime operations over a five-year transitional period, during which the power of new nighttime operations on the foreign clears would be limited to 500 W (again subject to other applicable protection requirements).

Protection levels

If the prospect of very low-power limits hasn't phased you yet, let's look at the protection levels which will be afforded the new nighttime operations. According to the Commission's studies, interference from existing foreign and U.S. full-time stations would typically limit the new nighttime services at least to their 10 mV/m contours. Thus, the FCC has decided that the new services should normally be protected at night to their 10 mV/m contours. But there are at least two catches to this. First, during the five-year implementation period, new nighttime services will not be entitled to *any* protection from other new nighttime services. Some protection will kick in at the end of the implementation period, although the precise extent of that protection has not been detailed by the Commission. Second, stations that operate at night with less than 250 W will be accorded no protection at all, now or in the future.

On the assumption that every daytime-only station on a foreign clear will want to add nighttime service, the Commission has designed an implementation system for its new rules which is intended to avoid, or at least minimize, the administrative burdens likely to be generated. In short, following the trend it established with respect to the Class IV AM nighttime power increases last year, the Commission has agreed to do all the work for the daytimers. After considering the possibility of having each daytimer submit an application based on its own technical calculations, the FCC concluded that the best way of approaching the problem would be simply to perform all the necessary calculations itself, with the FCC then notifying each affected station of its right to operate at night at a certain power.

"Order to show"

The Commission's notification would come in the form of an "Order to Show Cause" which would provide that, absent some objection from the licensee, its license would be modified to specify nighttime operation at a certain power. The licensee would then have one year within which to indicate to the FCC its intention to commence nighttime operation, to file certain limited technical information with the Commission, and actually to commence nighttime operation.

During the five-year period following issuance of the "Show Cause" order, the licensee would be authorized to operate with the power specified in the order. The licensee would also be permitted to file an application to increase power up to a maximum of 500 W (or its authorized daytime power, if that power is less than 500 W). In doing so, however, the licensee will have to demonstrate that its proposed operation would provide adequate protection to other full-time domestic and foreign stations; by contrast, it would not have to provide nighttime protection to the new stations to be authorized or to the nighttime operations of former daytime-only stations. At the end of the five-year period, the maximum power would be increased to 1 kW. At that time, however, all nighttime operations of 250 W or more existing at that time (i.e., including former daytime-only stations which have since upgraded) will be protected from additional interference.

One cautionary reminder—for the immediate present, the new rules and procedures apply only to the Canadian clear channels not including 540 kHz. The Mexican and Bahamian clears, including 540 kHz, will not be affected until the U.S. concludes its bilateral negotiations with those two governments.

The Commission's action here is another clear demonstration of its desire to assist AM daytimers and to expand as much as possible the availability of AM service. Given the distribution of stations already on the air and the nature of existing protection requirements, it is possible, if not likely, that the new service potential may fall short of what many affected licensees might otherwise have wished. Nevertheless, it is a start. **BM/E**

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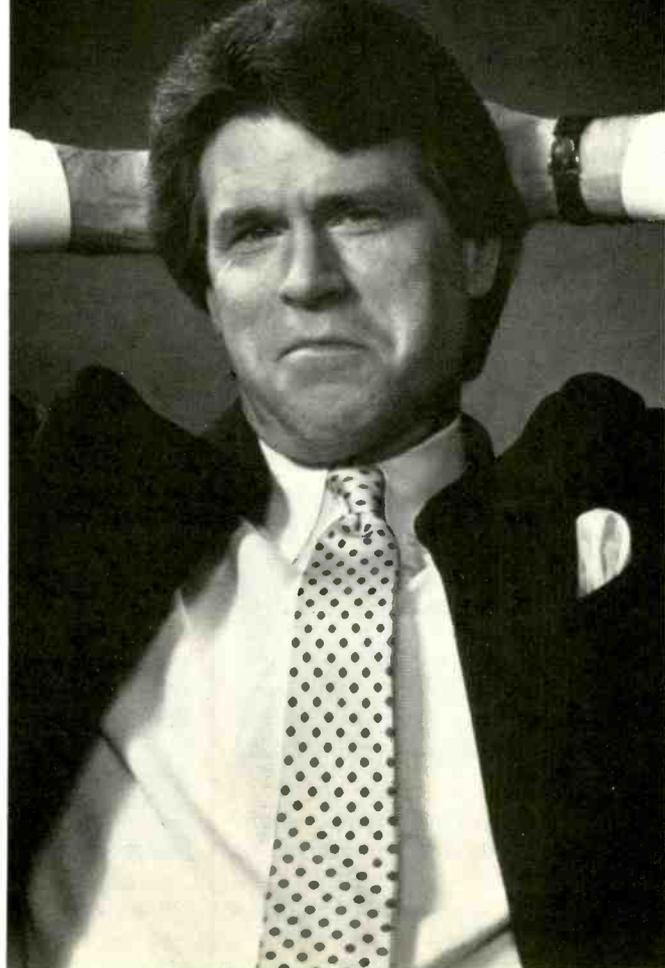
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broadcast EQUIPMENT

Cart Playback System from BSI

Broadcast Systems Inc. has a new semiautomatic multitransport two-channel cart playback system. The NewsCart, with a capacity of 24 transports, allows playback of news stories, opening/closing videos and bumpers.

A remote-control panel features "skip next," freeze, control buttons, and two erasable legend strips, and has a start button for each of the transports. It can play segments ranging from three seconds to one hour per cart, and has a two-second start.

The computer-controlled NewsCart provides two channels of audio playback for natural and edited audio. Included are two high-quality frame synchronizer/TBCs and image processing for video enhancement, ringing suppression, and noise reduction. A clock/character generator is incorporated to provide timed countdown over preview for each playback segment.

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Ampex Introduces New Tape

New from Ampex is the 467 Digital Audio Mastering Tape, designed to perform on all multitrack digital



recording systems without requiring individual tape-to-machine realignments.

The 467 tape, which features a durable oxide and binder system, is

available in half- and one-inch configurations, with lengths running the gamut from 4600 to 9200 feet.

Circle 251 on Reader Service Card

TEN-XT Monitoring Station from Grass Valley

Grass Valley has made available the TEN-XT monitoring station, which allows the combination of the TEN-XL routing switcher with the Tektronix 1740 or 1750, as well as the 528 and 1420 waveform monitors.



The TEN-XT can be used in transmission facilities, and VTR and film chain bridges as an input selector to VTRs or video monitors. Measuring 10x1, the unit is powered by a single power supply, and can be packaged in a Tektronix 016-0115-02 rack adapter or 020-1241-00 portable case (not supplied).

Circle 252 on Reader Service Card

Valley People Model 440 Limiter/Compressor

Valley People's new Model 440 is a single-channel device which offers a peak limiter, compressor/expander



package, and a Dynamic Sibilance Processor section, each controlling a common VCA (voltage-controlled

amplifier).

The 440's compressor control section features continuously adjustable threshold, attack time, and ratio and release time. An interactive expander control is integrated with the compressor control circuitry to reduce residual noise. Special release coupling makes the transition from compression to expansion imperceptible, eliminating problems associated with the use of separate single-function units.

Circle 253 on Reader Service Card

New Porta-Brace Case

Porta-Brace has announced a new line of products for the Sony Betacam and other recorder-camera systems.

The BVW-3 Shoulder Case can accommodate any configuration of the Betacam system, and provides padded protection during transport and field operation.

Porta-Brace also has a new Quick Draw camera case, BVV-1 recorder case, and BVW-20 field player case for Betacam equipment.

The BVW-3 is available now; models for other recorder-camera systems will be introduced in the near future.

Circle 254 on Reader Service Card

Klark-Teknik Introduces New Software

Klark-Teknik now has software for the DN780 Digital Reverberator/Processor.

The software, Version 1.5, further expands the versatility of the DN780 by incorporating new features including gated decay programs, memory lockout, and remote slider update.

Gated decay programs include nonlinear decay, reverse decay, and a program for vocals called "Alive." A memory lockout feature allows a user to protect the settings on one, or a set of memory locations. The slider update permits the user to assign any program function to any fader on the remote control, thus giving the engineer total control from the mix position.

Circle 255 on Reader Service Card

60 kW Antennas from Bogner

In order to help reduce the initial investment for new TV stations, Bogner has introduced two low-cost lines of 60 kW transmitting antennas.

The Model B24US is an upgrade to the 60 kW capacity of Bogner's medium-power slot antenna line. It is available for top or side mounting in all standard patterns, and is listed at \$68,000.

The DUI Series consists of side-mounted versions of the BUI Series of regular high-power antennas, employing the tower as the support structure. The DUI24 is priced at \$79,500; the DUI28 at \$84,500; and the DUI32 at \$89,500 for cardioid or peanut patterns.

Circle 256 on Reader Service Card

New Weather Processor from ESD

Environmental Satellite Data has a new weather data processor called the Front End. It collects and processes ESD high resolution weather images and NWS Domestic Data on an unlimited basis from the Zephyr Satellite Transmission Service off Galaxy 1.

The front End operates on IBM XT and interfaces with Colorgraphics, Chyron IV, Dubner, Vidifont V and other systems. Its continuous feed from Zephyr eliminates delay during peak usage. The processor costs \$7500 plus installation and training.

Circle 257 on Reader Service Card

Studio Technologies Stereo Simulator

A new stereo simulator, the AN-2, was introduced by Studio Technologies for effects and sound processing. It's designed to produce convincing stereo sound from any mono source and can create effects based on stereo simulation.

The AN-2's stereo signal is mono-compatible. A proprietary circuit reduces the harshness of stereo simulation from delay lines.

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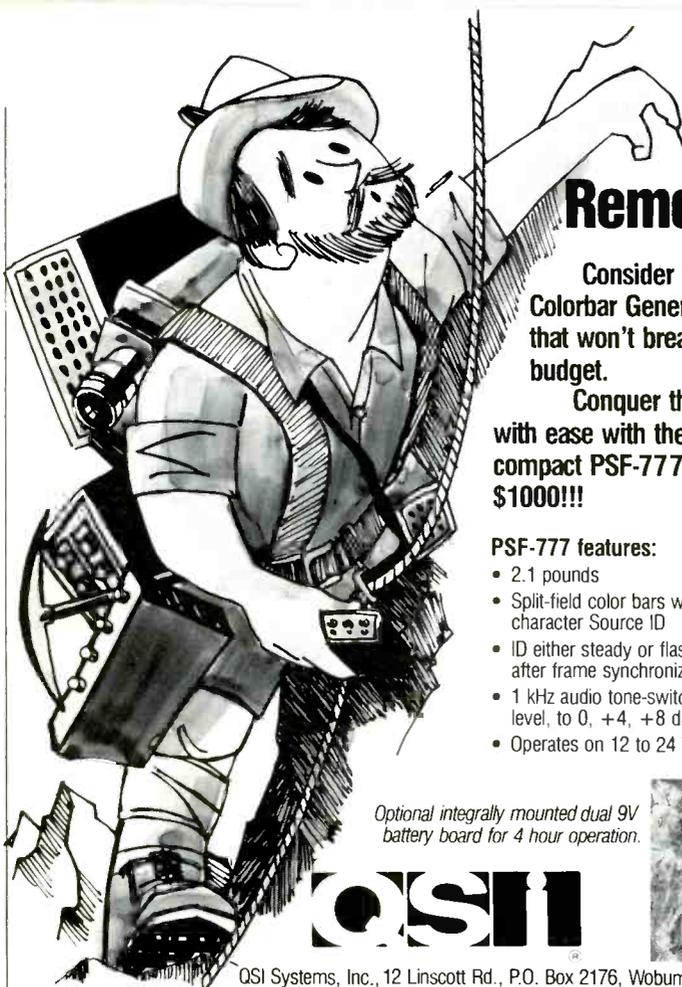
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QSI

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Circle 157 on Reader Service Card



Dorrough Meter Features Dual Functions

The Model 40-A, a new Loudness Meter from Dorrough, features dual functions on a single LED display.

The LED bargraph shows normally weighty RMS material which directs the operator to hold at center 0 dB; a dot mode for Peak indication directs the operator to hold at a normal range of +13 dB, for whichever happens first.



LEDs at the two maximum points allow the operator to adjust levels up. Equal loudness is achieved by riding maximum gain to these points of reference as the program dictates.

The 40-A is available with left and right inputs for stereo summation as a single unit or a rackmount unit. Console panel replacements are also available.

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HME Wireless Mic System

HME Inc. has introduced a new portable wireless microphone system for ENG/EPF and other applications. Virtually any mic can be used with the new System 820, and due to RF shielding and filtering improvements, up to 20 systems can be used compatibly.

The System 820 incorporates HME's Dynamic Expansion II, which allows a useable dynamic range in excess of 115 dB and full frequency response. The system features an ultra-compact transmitter and battery-powered receiver which can also be powered by external dc or available ac adaptor. An "Auto-Lok" discriminator tracks the transmitted RF signal to minimize audio distortion and improve captured ratio performance.

Circle 263 on Reader Service Card

BUSINESS BRIEFS



Smiles abound as Jim Baker, chief engineer for ABC's New York City O&O WABC-TV, holds plaque commemorating the station's purchase of the five hundredth Ampex ADO. Looking on are Mark Sanders (left), Ampex VP and general manager, Audio-Video Systems division, and Max Berry (right), VP of broadcasting engineering for ABC Television.

The item in the May Business Briefs on the SMPTE HDTV working group incorrectly indicated SMPTE's position on the subject. Readers are referred to the lead news story in *BM/E's* April issue.

ADM Technology of Troy, MI has been awarded a \$1.5 million contract by the Board for International Broadcasting in Washington. The contract covers the reequipment of the Radio Free Europe/Radio Liberty broadcast center located in Munich, West Germany. ADM will be responsible for the design, manufacture, and installation of equipment for 30 new radio stations.

Sony Corporation has completed the integration of its MCI manufacturing facility in Ft. Lauderdale, FL. . . . Chicago's **Streeterville Studios** has been chosen for the third straight year as the auditioning site for bands and solo artists competing to appear on the nationally syndicated talent show, *Star Search*. . . . **Arnold-Levin productions**, Waltham, MA, has opened Boston's first interformat Beta-to-one-inch post-production suite. . . . **Counterpoint Studios**, New York City, recently completed installation of two Solid State Logic Stereo Video Systems in its Studios A and B. . . . In its west coast office, **Grey Advertising** has installed an in-house video package which is

based around Sony VO 5600 ¾-inch VCRs, CVM-1900 19-inch receiver/monitors, and custom-designed Mycomp Technologies control panels. Work was done by Shoreline Teleproduction Systems, Los Angeles. . . . **Lawrence & Schiller Teleproductions**, Sioux Falls, SD, has opened a new one-inch computerized post-production facility.

Ikegami has sold 14 cameras to Tribune Broadcasting Corporation. The cameras will be used by Tribune-owned stations WGN-TV, Chicago, WPIX-TV, New York City, and KWGN-TV, Denver. . . . **Ampex** has installed its five hundredth ADO system at ABC New York O&O WABC-TV. . . . **Soundcraft Electronics** has installed a 40-channel TS 24 fully fitted with Audio Kinetics Master Mix automation for Arista recording artist and producer Kashif. . . . **Kavouras** recently purchased a Control Data mainframe computer, which it will use in conjunction with its real-time weather data manipulation. . . . **Television Associates**, Mountain View, CA, has added a Sony Betacam BVW-40 to its list of editing equipment. . . . A special transportable video uplink system built by Cincinnati's **Midwest Corp.** in conjunction with Harris Corp. was recently purchased by KWTW, Oklahoma City, OK.

Patapsco Designs, Frederick, MD, recently acquired all the assets of the BTX Corporation of Bedford, MA. Products formally produced by BTX will now be manufactured by Patapsco. . . . **Eastman Kodak** has signed a two-year "exclusive promotion rights" agreement with NFL Properties, Inc. The agreement covers film, photographic paper, and videotape. . . . **OSRAM Corporation**, Newburgh, NY, has named Video Components of Spring Valley, NY as an authorized national rep for its products. . . . **TVC Video**, New York City, has reorganized, acquiring a new subsidiary, NJ-based **Video Dub**. Don Buck, president of Video Dub, will now become president of TVC Video. . . . Washington, DC broadcast programming consultants **McHugh and Hoffman** has merged with San Francisco-based broadcast management consulting firm **Curran-Victor** to form a joint venture company. The company will provide consulting services to independent and affiliate station and group operations.

ADC Magnetic Controls is changing its name to **ADC Telecommunications, Inc.** . . . A new sales agency, **Light America, Inc.**, will now represent Colortran and Peter Albrecht Corporation.

VideoWorks has completed post-production work on *The Animal Express*, a weekly series produced and created by the Corporation for Entertainment and Learning, Inc. . . . **Image Resources**, Winter Park, FL, has finished taping activities at the Daytona Speedway for a syndicated sports show out of Los Angeles. . . . California special effects house **Colossal Pictures** has chosen Varitel's new Quantel Paintbox to design and create a series of four ID spots for The Movie Channel. . . . The **Computer Graphics New York '85** exhibition will be held July 10-12 at the New York Coliseum.

Among the personnel changes this month, **CMX Corporation** has elected Joseph Scheuer as its director. . . . **Leader Instruments** has appointed Robert Sparks director of marketing. . . . **dbx** has named Gregory Green North American sales manager for professional products. . . . At **One Pass**, Scott Ross has been promoted to VP/general manager.



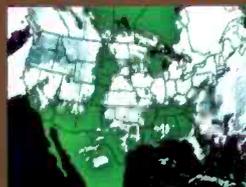
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