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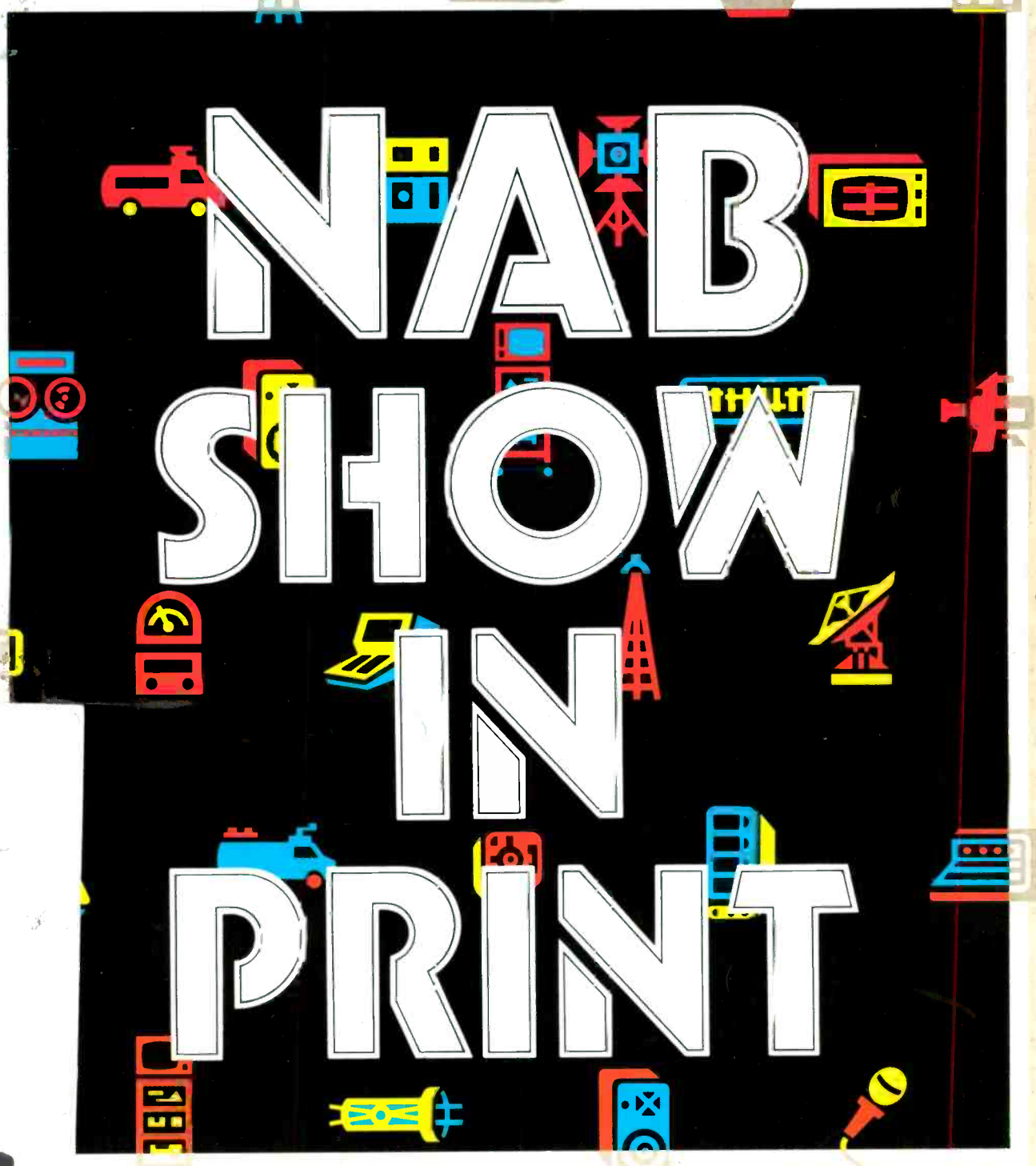

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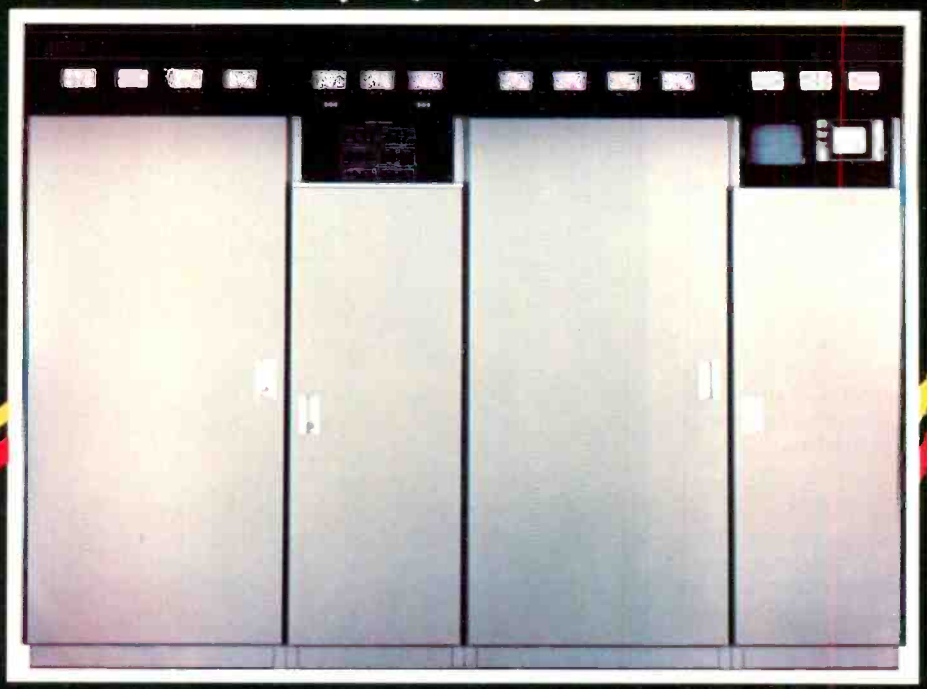
Simply Superior



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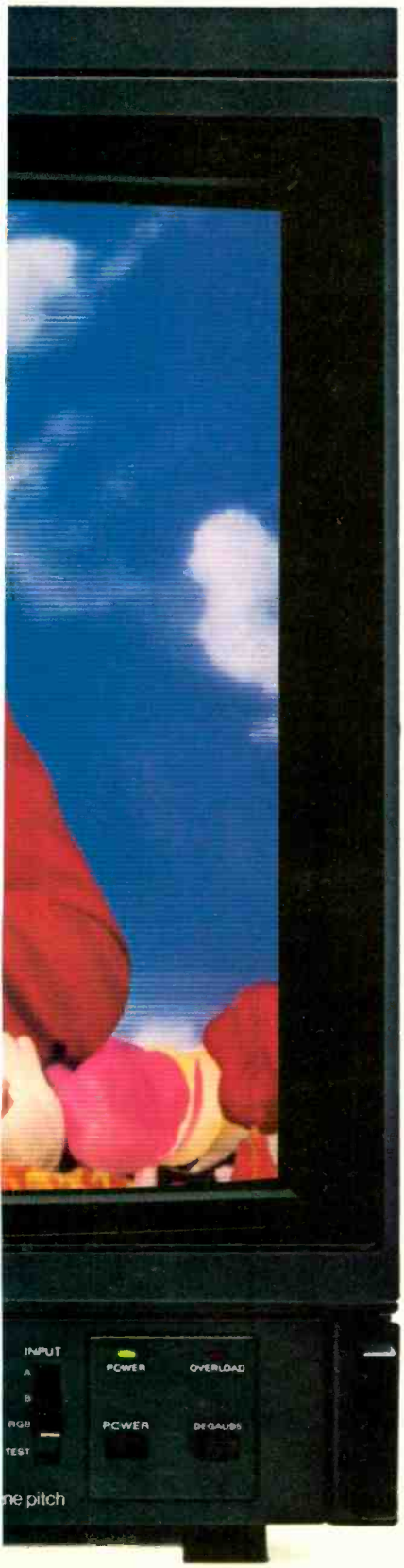

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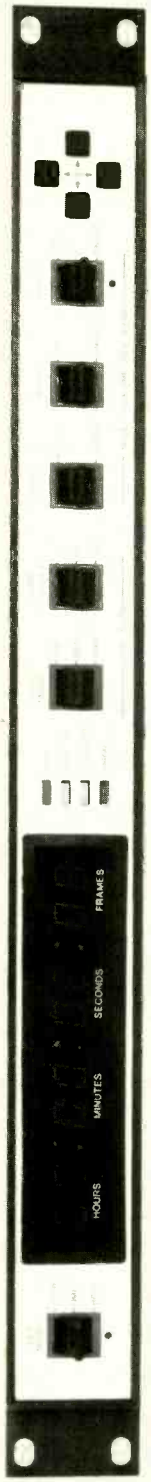

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Shure's new FP31 Mixer takes a big weight off your shoulders.

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Every channel has a mic/line level and a low-cut filter switch. And to prevent overload distortion, there's a built-in limiter with adjustable threshold.

The FP31 can be powered by two internal 9-volt batteries, or from an external 12-volt source. A green LED flashes to remind you that the mixer is on. Phantom and A-B power are also provided to operate lavalier and shotgun microphones.

A slate tone can be laid down on the tape for locating specific takes, and there's also a built-in mic for voice slating.

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BROADCAST MANAGEMENT/ENGINEERING
JUNE 1984 VOLUME 20/NUMBER 6

NAB '84 SPECIAL REPORT 39

What were the significant advances in audio, video, RF, and T&M? BM/E's editors distill the meaning of the NAB show.

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COMING IN
JULY
SPECIAL REPORT:
FIELD PRODUCTION
CABLE LOCAL
ORIGINATION

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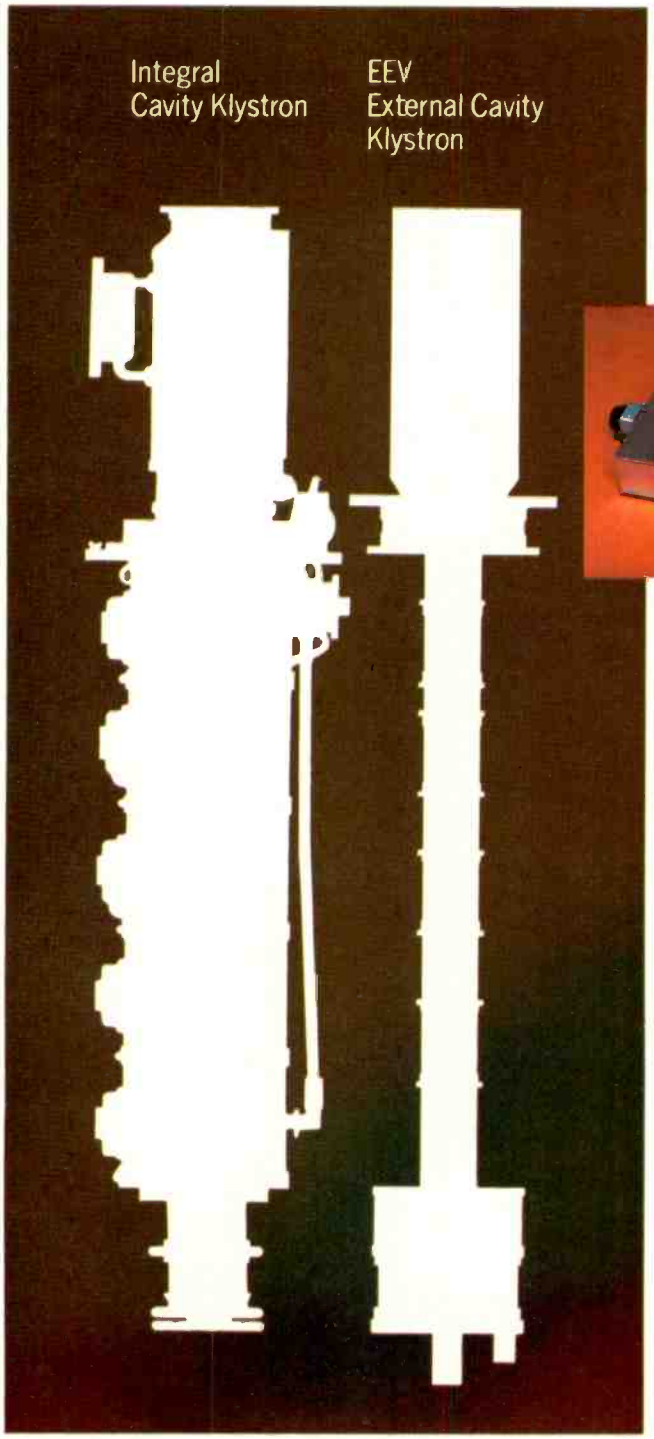

How are you shaping up on reducing your UHF transmitter operating costs? Not as well as you should be if you aren't yet using EEV external cavity klystrons.

The latest external cavity klystrons from EEV are achieving major savings for an increasing number of users.

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All this adds up to a package which could pay for itself within three years and is easy to install. Simple on-site tuning of these alumina ceramic external cavity klystrons allows greater efficiency than the pre-tuned integral types.

This is why we believe EEV external cavity klystrons are the shape of things to come.

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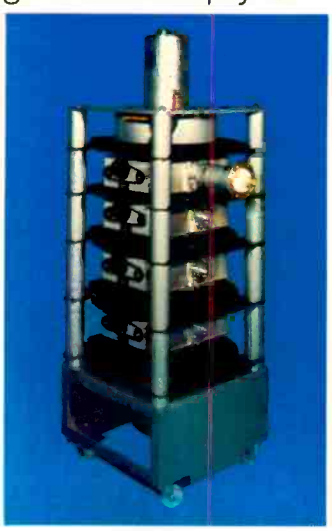

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EEV Klystrons

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EDITORIAL

Keeping Up To Date

The display of broadcast industry technology at the NAB Convention was truly awesome. More than one weary attendee wondered aloud how it is possible to keep up with all that is new. Some even expressed the wish that the manufacturers should slow down and take a breather, to give broadcasters a chance to absorb the significance of the new systems. This breather, of course, will not come about, because technology is a runner's treadmill that never stops.

Besides the excitement on the show floors, there was a definite improvement in the quality and breadth of the engineering program starting with the pre-show sessions on Saturday. In short, NAB '84 was a winner for all attendees.

But out of all the splendor we wonder about the "missing majority," the many engineers who "did not get to go." This situation is particularly troubling for radio stations although engineering attendance has been increasing. Some radio executives have complained that the NAB Convention is primarily a television show. We believe that this approach is a short sighted one by radio station management. The exhibits and technical sessions are a once-a-year opportunity to catch up, to get first hand experience with new equipment, to exchange ideas.

At any rate, radio broadcasters in a few months will have another opportunity to exercise this catching-up process in the form of the newly-combined conventions of the NRBA Convention and NAB Radio Programming Conference, September 16-19 in Los Angeles.

The new meeting is aptly called, "The Radio Convention." Now that the two radio groups have achieved detente, this convention should provide a single, recognized meeting ground for all of radio.

We applaud the long-overdue co-sponsorship and urge the two groups to complete the burial of their past differences. If the joint effort is to succeed, it will require the support of radio broadcasters from all markets, large and small. One thing is certain: this September convention cannot be criticized for "too much television."

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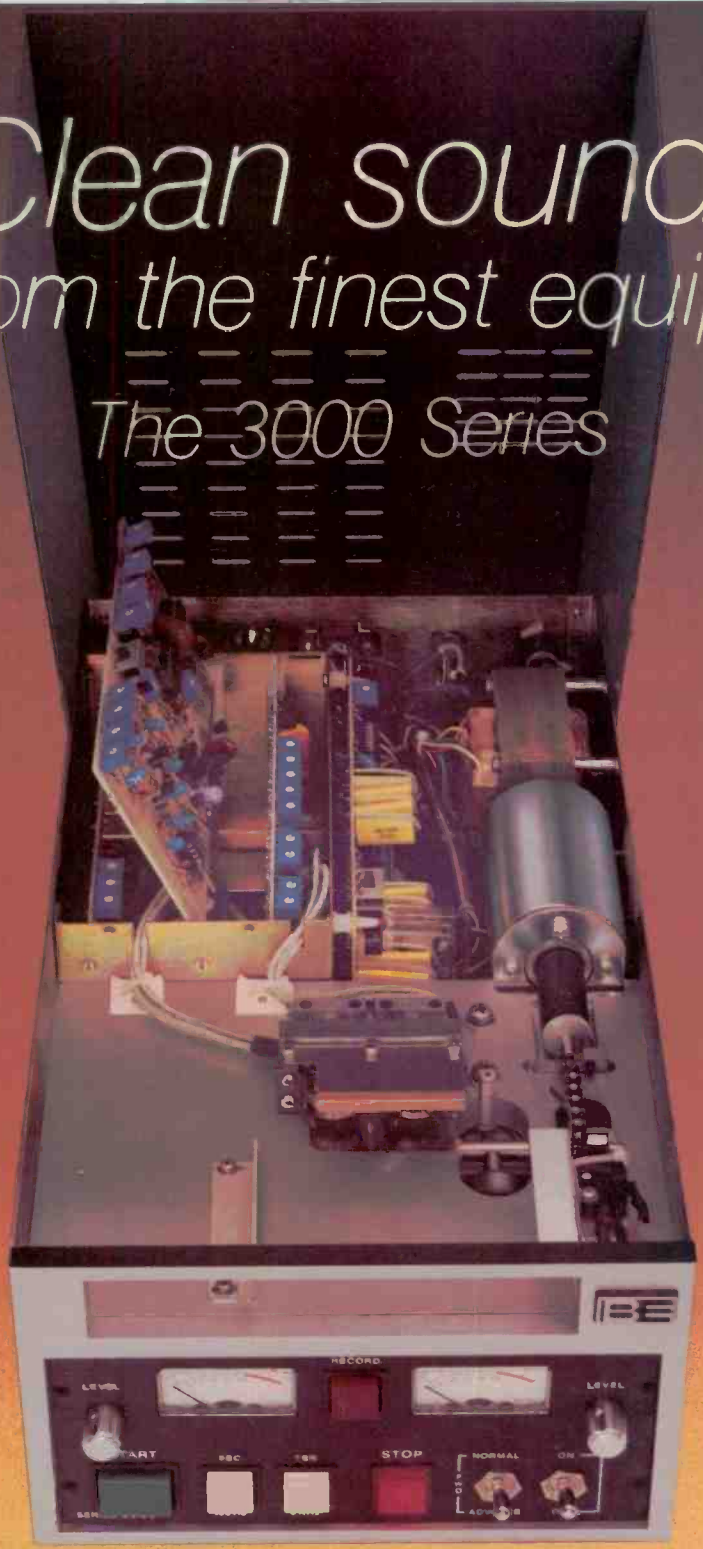

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Because, at Midwest, we only put in the best parts, like the Ikegami HK-322.

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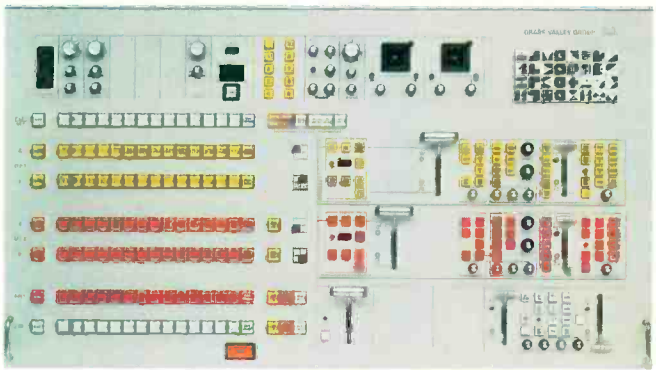

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Regional Concentration Rule Repealed by FCC

Citing large growth in the number of media outlets, the FCC has repealed the regional concentration of control provisions of its multiple ownership rules. This action is widely considered to herald the loosening of the 7-7-7 station ownership restrictions.

The regional concentration rules have prevented any broadcaster from owning three stations within 100 miles of each other and with overlapping primary service contours. Their purpose was to prevent any regional owner from achieving "undue sway over public opinion," but the FCC finds this concern to be no longer valid. The increased number of broadcast stations and new forms of media, it says, have "diluted the potential influence of multiple ownership."

Reasons for repealing the rule, the FCC found, include the savings broadcasters can realize on multiple ownership in a smaller area. At the en banc meeting in which the rule was eliminated, commissioner Henry Rivera asked for figures enumerating the "substantial" cost reduction, but the FCC staff did not supply any.

The Commission further said that these "economies of scale" will make regional owners more likely to upgrade facilities and take advantage of unused allocations. Commissioner Rivera has argued previously that few allocations lack applicants.

Finally, the FCC hopes that permitting station groups to be more geographically concentrated will give rise to regional networks.

Rivera cast the only vote against dropping the rule, voicing objection to the "all or nothing" nature of the action.

The NAB embraced the Commission's decision, saying that it will "pave the way for greater opportunities for group ownership in limited geographic areas." In 1977 the association had filed the petition on which this deregulation was based.

As for the future of other provisions of the multiple ownership rules, Commission chairman Mark Fowler said that those governing local markets, such as duopoly and one-to-a-market, are not being considered for alteration. The 7-7-7 rule, however, has already been the subject of an FCC proposal to deregulate and is likely to be next.

NAB Honors Freeman With Engineering Award

Otis S. Freeman, director of engineering for the Tribune Broadcasting Co. and senior vice president engineering for WPIX, Inc., New York City, was the recipient of the 1984 Engineering Achievement award from the National Association of Broadcasters. Freeman accepted the honor at the NAB's engineering luncheon on Tuesday, May 1.

Credited with leading the move to erect the transmitting tower atop New York's World Trade Center for improved area reception, Freeman also developed the genlock device, which allows pictures to incorporate a signal from a remote location. He helped design and build WPIX, where he became chief engineer in 1953. In addition, he is president of the Television Broadcasters All-Industry Committee, composed of 10 New York City TV stations, and is a member of IEEE and SMPTE.

The NAB convention also feted Stanley E. Hubbard, chairman and founder of Hubbard Broadcasting, who received the newly created Spirit of Broadcasting award at the television luncheon April 30. Peter B. Kenney, former vice president, Washington, for NBC, received the 1984 Grover C. Cobb Memorial award for unusual dedication to improving broadcasting's relationship with the federal government.

Freeman accepts NAB's 1984 Engineering Achievement award.

FCC'S Fairness Inquiry Proceeds with Caution

If the FCC is treading on unsure ground in its recently begun inquiry on the Fairness Doctrine, it is doing so with all due caution. Any anti-fairness doctrine bias on the part of the Commission, and especially its chairman, Mark Fowler, has been carefully worded out of the inquiry report, itself a model of fairness.

Described by the FCC as "the most searching and comprehensive reexamination of the fairness doctrine that this agency has ever had," the inquiry asks for comment on several aspects of the rule and its ramifications. It questions not only the need for the rule, but the intentions of the lawmakers who enacted it 30 years ago and its current effect.

According to the FCC, developments and changes in the electronic and print media over the past 10 years "may call into question the necessity of the doctrine." The Commission also ventured to suggest that, in the face of recent legal developments, "continued adherence to the doctrine might be contrary to the public interest and constitutional principles." For example, it asked if new electronic services such as teletext and home computers could blur the lines between print and electronic media in such a way that the fairness doctrine could become untenable. It also asked about the doctrine's effect on debate of public issues.

As part of the inquiry, the Commission plans to hold at least one open en banc meeting "or other oral proceeding" for interested parties to air their views and provide information. Given the strong emotions engendered by the fairness doctrine, that meeting could be a stormy one. Already House Commerce Committee chairman John Dingell (D-MI) has expressed his opposition to repeal of the fairness doctrine, and some legal experts challenge the FCC's suggestion that it may be able to modify the doctrine in compliance with the Communications Act. Even within the Commission, agreement is not unanimous. While no commissioner voted against issuing the inquiry,

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Over 100 patterns are keypad selectable. Pattern borders can be hard, soft, soft colored (halo) and half-halo, a feature that allows a pattern to have one hard edge and one soft edge. All pattern borders can vary in width, color, luminance and saturation. These capabilities coupled with the AVC's exclusive pattern modifiers can produce a dazzling array of effects and effect combinations. Try rainbow border, pattern border hues that vary over time and with position, rocking and spinning patterns, even effects combining all these variables.

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With all their innovative technology, AVC Series switchers are easy to operate, thanks to logical and familiar A-B operation and simplified controls. Pushbuttons are used exclusively instead of knobs for fast, simple setup and to let you set virtually every switcher adjustment from one compact central panel.

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AVC switchers from Ampex are designed for state-of-the-art on-air, production and post-production systems. RS-422 serial communications capability assures easy interface with other compatible equipment. Many users have teamed the AVC with an Ampex ACE editor, Ampex VTRs and ADO for an unbeatable system with completely compatible software throughout.

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Henry Rivera expressed "reservations" about whether the issue fell within the FCC's scope. Both Mimi Dawson and James Quello questioned parts of the inquiry, although concurring with most of it.

Kluge's Metromedia Buyout Okayed by FCC

Metromedia has received FCC approval for chairman John W. Kluge's purchase of most of the communication company's stock.

Kluge, 69, plans to increase his share of Metromedia voting stock from approximately 26 percent to 93 percent, which will also give him 76 percent of common stock. To assume this greater control, classified as *de jure*, he needed the FCC's go-ahead; as a stockholder and officer he has held *de facto* control for 25 years. The other seven percent of voting shares will be owned by Kluge's three vice presidents.

Station-holding companies wanting to transfer control are usually required by the FCC to file a long form application, but the Commission has told Metromedia that since the stock purchase will not involve a "substantial change of control," only a short form application is necessary.

Metromedia says that before the leveraged buyout can be conducted—it is the largest in corporate history—other arrangements must be made, including getting stockholder approval and settling financial arrangements.

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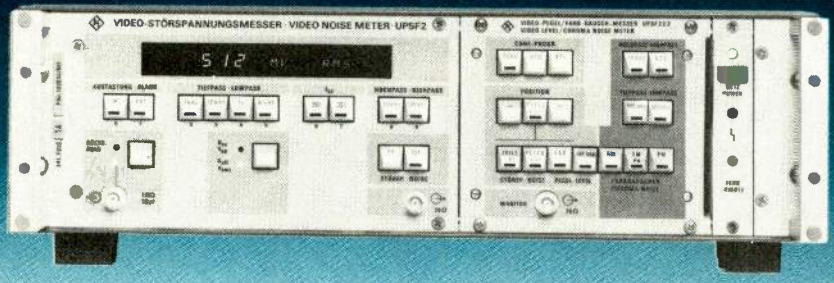

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Wheeler Leaves NCTA; Mooney Will Step Up

Thomas Wheeler has resigned as president of the NCTA, effective in July. James Mooney, currently executive vice president of the cable association, will succeed him.

Wheeler, 38, gave notice at a meeting of the NCTA's board of directors, who later chose Mooney to replace him. Wheeler joined the association eight years ago as executive vice president and became president in 1979. On leaving he will become president and CEO of the U.S. division of the Nabu Network, a new Canadian company that sells personal computers and monthly software packages to subscribers via cable.

James Mooney, 40, has held his current title at the NCTA since 1981. He heads up the association's lobbying effort and thus should ensure continuity to ongoing negotiations for the cable bill in Congress.

The NCTA's directors also elected Edward Allen as chairman of the board for the 1984-85 term. Allen is president of Western Communications, which is owned by Chronicle Publishing of San Francisco. The voting between Allen and outgoing vice chairman Gustave Hauser reportedly was quite close.

Grass Valley Acquires Dubner Computer

Grass Valley Group, a major producer of television production switchers, has bought Dubner Computer Systems for an undisclosed sum, Dan Wright, general manager, has revealed. Dubner will be operated as an autonomous, wholly owned subsidiary of the Grass Valley Group, which in turn is a subsidiary of Tektronix, Inc. The merger was

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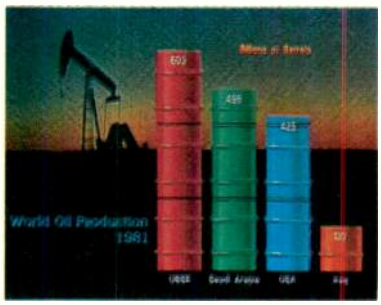

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made, according to Grass Valley, because the computer graphics systems made by Dubner would provide "a great synergistic effect with the television production systems that Grass Valley makes. More can be offered to our customers in one package."

Henceforth, all Dubner products will be sold and supported by Grass Valley. Both companies expressed possible plans for having Dubner products manufactured by Grass Valley as well. Harvey Dubner, founder and president of Dubner, will continue in his present role.

Katz Buys Christal, RKO Radio Sales

In a major move making it the biggest rep in radio, Katz Communications, Inc. announced agreements to acquire The Christal Co. for over $18 million and RKO Radio Sales for approximately $3.5 million. With this $22 million merger, total billings for Katz are expected to top $220 million.

Under the terms of the agreement, Katz Radio, representing stations in 140 markets, Christal, in 90 markets, and RKO Radio Sales (to be renamed Republic Radio), with clients in 22 markets, will be combined as independent subsidiaries of the Katz Radio Group. Ken Swetz, president of Katz Radio, will also serve as president of the new division. The principals of Christal and RKO Radio Sales will continue in their present capacities. Personnel at Christal will continue to work at their present offices, but RKO's personnel will move to existing Katz Radio offices. Though each subsidiary will have its own nonwired network department, there will be a combined nonwired network sales team for Katz Radio Group.

Daytimers Get Another Evening Power Boost

Class III daytime stations have received blanket approval from the FCC to broadcast until 6:00 p.m. using a minimum of 100 W, with even more power approved for many stations. The only exceptions are those whose signals would interfere with foreign stations.

The new power limits are based on calculations of full-time signal strength occurring 30 minutes after sunset, rather than the signal that is available two hours after sunset.

This new formula, the FCC reports, will allow "many more stations" to use 500 W or their maximum daytime power. For those still below 100 W, the minimum limit will "provide effective post-sunset service," if they do not interfere with foreign stations.

Last fall some daytime stations were given two hours of post-sunset time with up to 500 W of power, but many broadcasters were disappointed by small or nonexistent increases. The Daytime Broadcasters Association requested that the FCC reexamine its calculations and put in a bid for 500 W minimum for all Class III stations until 6:30 in the evening.

The association also asked for a second power boost for Class II stations. However, the Commission found that such a move would cause "devastating interference losses to both groundwave and skywave services" and thus refused to take any across-the-board action in that area.

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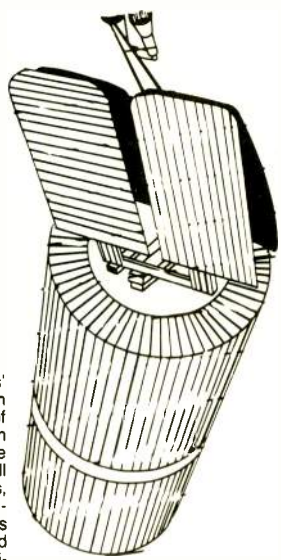

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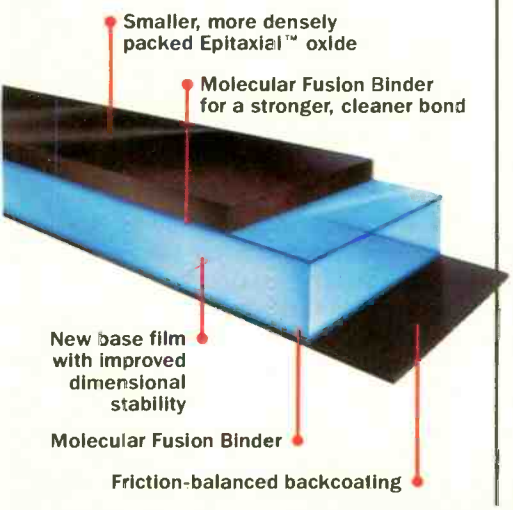

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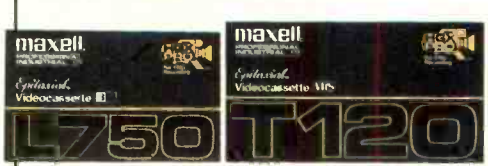

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NEWS BRIEFS

SMPTE's ¼-inch Working Group has tentatively agreed on a compromise draft for a **standard ¼-inch ENG format**. The proposed format allows 20 minutes of recording per cassette; oxide tapes are being sampled. The group says it needs more time before it will finalize its decision . . . . KSL-TV of Salt Lake City plans to begin **transmitting in stereo** soon. It has already equipped and wired its studios for the change.

The New York State Broadcasters Association has formed a political action committee. It says this is the first **state-level broadcasting PAC** . . . . **Dennis R. Patrick** has been confirmed as FCC Commissioner by the Senate Commerce Subcommittee. Patrick was appointed by President Reagan as a replacement for former Commissoner Anne Jones and so will hold the seat through the end of her term, June, 1985. Subcommittee chairman Barry Goldwater (R-AZ) had held up Patrick's confirmation hearing in an attempt to get White House action on another appointment.

The FCC has changed **donor and underwriting acknowledgement** policy for PBS stations. Such spots may now contain locations, non-promotional logos or slogans, value-neutral descriptions of product lines or services, and trade names, product, or service listings. The Commission also clarified its prohibition on replacing regular programming for non-station fundraising . . . . The FCC refused, however, to give **noncommercial educational television** stations blanket permission to offer STV services. Several public licensees had requested the rule change but were told that only individual waivers would be considered.

Class IV AM stations will probably have to wait till near the end of this year if not later to broadcast with **1 kW of nighttime power,** though a go-ahead could conceivably be ready by fall. The FCC says it sent out Show Cause orders so that a starting date can be set as soon as possible with Canada and Mexico after an agreement with Mexico has been arranged.

The FCC has preempted state and local regulation of **FM subcarrier use**, in response to an NAB petition . . . . The NRBA plans to conduct its second annual **survey of nationwide SCA** use and is asking members to suggest topics for inclusion . . . . The FCC denied the Moody Bible Institution's request for **expanded FM translator services**. The Institution wanted to broadcast programs beamed to translators via microwave and satellite, but the Commission said it first wants to install Docket 80-90 stations and clear up channel 6 interference questions.

Taft has agreed to sell **WGR/WGRQ** in Buffalo to CRB Broadcasting. Taft recently completed the acquisition of **KEX/KKRZ**, Portland, OR, from Golden West Broadcasters.

AMIP, the American Market for International Programs, will hold its second annual convention on November 17-20 in Miami . . . . The Western Association of Broadcast Engineers and the Canadian Association of Broadcasters will hold their **first joint conference** in Edmonton on October 21-23.

Turner Broadcasting has won two Peabody Awards, one for CNN's programming and another for a WTBS documentary.

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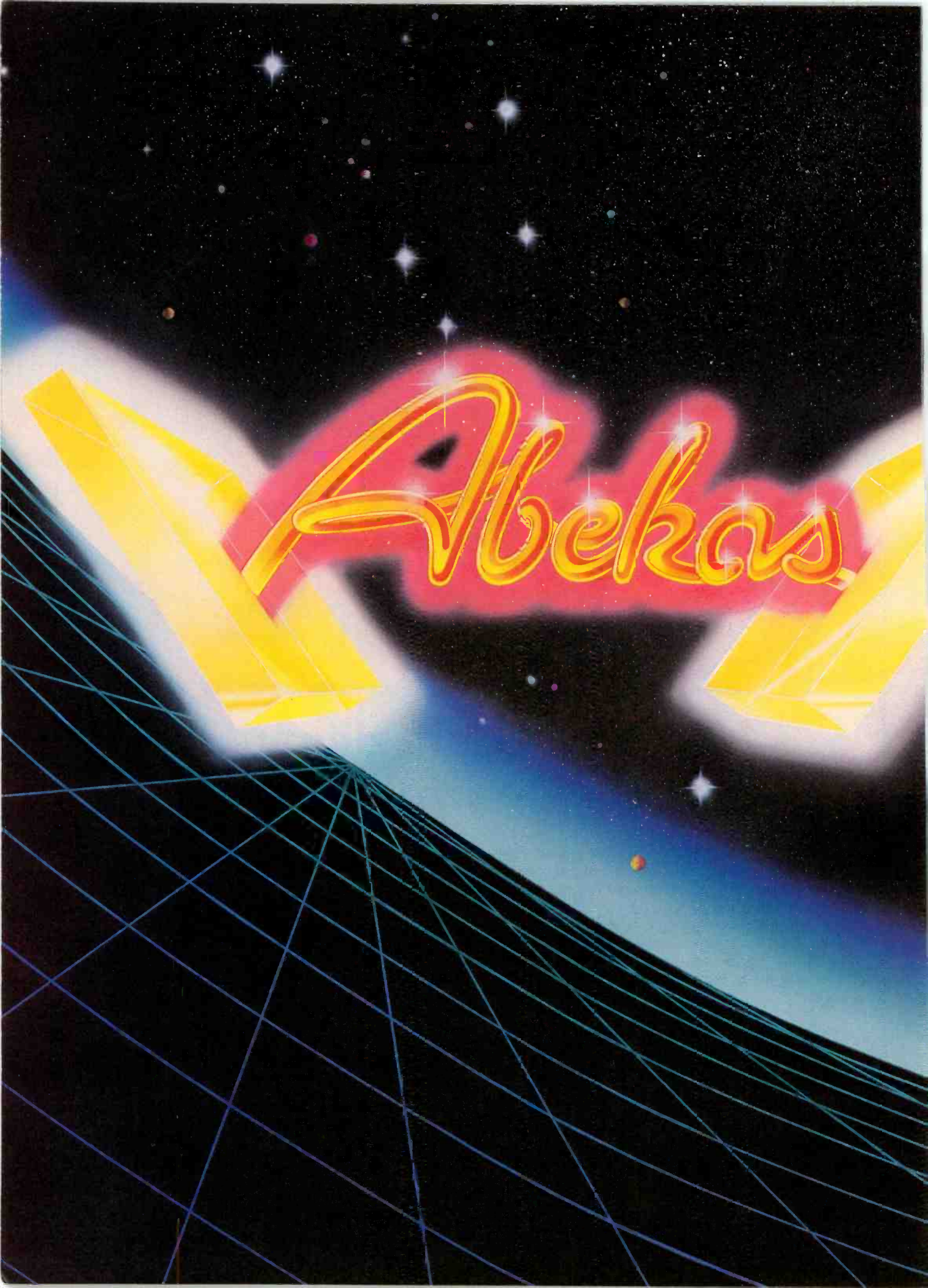
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2. "As you can see, THERE IS SONEX EVERYWHERE!" says Tom Hannaford, of Dixieland Productions in Atlanta, Georgia.

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4. For Scharff Communications' (New York) video music truck, SONEX cuts down early reflection, flutter from high frequency drivers and tightens the stereo prospective, says Bob Aldridge. "It's excellent." He designed the acoustics for the truck, which has been used for the RCA Red Seal 32-track digital recording of "Live from Lincoln Center" television productions.

5. Multi-Images Resources in Dallas uses SONEX for sound-proofing one wall of a "cavernous" presentation room. "SONEX is above reproach," says George Minton.

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CHR Syndicator Turns to CD Quality

The compact audio disc, with its top-flight sound quality, has an obvious appeal for audiophiles and sound purists of every stripe. Sophisticated listeners are hardly limited to the ranks of classical music listeners, however. Compact discs have been delighting more and more rock fans for some time now.

With more radio stations starting to broadcast music from compact disc, it was only a matter of time before radio syndicators discovered the discs' quality. One such syndicator is IS Inc., San Francisco-based producer of the RKO-distributed *Countdown America with John Leader*. This four-hour, weekly program runs down each week's Top 40 CHR hits, as reported in *Radio and Records*. The host, John Leader, is senior editor at *R&R* and the voice of Drake-Chenault's XT-40 format. He has been a well-known national radio host and commercial reader for the past decade.

Quality has been a concern at IS Inc. since the company's inception three years ago, and is the moving spirit behind *Countdown America*. According to vice president and general manager Rob Sisco, who founded IS Inc. with Jo Interrante, "When you're making a radio program, you have certain things you want to be aware of—to be loud and crisp, stand out and have presence on the dial, but also keep the cleanest sound possible. For a commercial radio station it's not always possible to sound like you're coming straight from the tonearm to the air, but you can come close in radio production. We're very careful about the elements that go into our masters."

First-generation quality

As much as possible, those elements come from the compact disc. "The idea is that we try to keep everything as close to first-generation quality as is humanly possible and practical," Sisco explains. The show eschews carts entirely, originating all material from clean discs, CDs, or tape masters supplied by the record company. "In probably 90 percent of the cases we go direct from CD or disc to master," Sisco says.

Hubbard's small but well-equipped production room in San Ramon, CA, has an Audio Arts console and Otari ATRs. Sony CD players are visible just above the turntables.

The percentage of the show that originates from CD varies from week to week, depending on who's made it to the Top 40. "Quality-wise, if we could take everything from compact disc it would be best," Sisco states. The reality faced by IS Inc., and any other producer using CD material, is that production of CDs often trails the hit parade. In any given week, Countdown America's CD content could be as high as 50 to 60 percent or as low as 10 to 15 percent.

"As soon as the product becomes available on compact disc, we switch," Sisco states. "But the list is so new that current product often lags behind it. In the past year so many new acts have hit the charts—it's going to be quite a piece down the line before they appear on CD." The commitment to CD remains, however, and Sisco asserts, "If it's available on CD, we use it."

Countdown America is produced for IS Inc. by Ron Hummel out of his radio production studio, Ron Hummel Productions. (Hummel also produces *The Hot Ones*, another RKO-distributed series.) In anticipation of "wall-to-wall CDs," Hummel has purchased two Sony 200 compact disc players, which he describes as "the one I'm happy with after experimenting with a few models." He expects, however, that it will be another year or more before the record companies produce CDs in sufficient quantity for an all-CD show.

Cleaning up

The push for a clean sound extends to all material in the show, however, not just that produced on CD. Hummel's studio is well equipped to remove any extraneous noise from both the music and the voice track, which is recorded separately at a San Francisco studio. The Audio Arts Model 44 console has four EQ controls for each of its 24 channels, and Hummel uses the EQ to obtain a more consistent sound from the various music sources. He also has outboard processing equipment (most notably a UREI 1178 compressor, Biamp stereo equalizers, and a Biamp reverb unit), but these are used with discretion. An SAE impulse noise reduction system is used to make sure that music originated from LPs is as clean and noise-free as possible, and a Dynex

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noise depresser removes any unwanted hiss or noise from the voice track.

"A lot of shows process before going on disc," Hummel relates. "What we send out is pretty much exactly flat. It's as clean as the original record would be." Each four-hour show takes about 10 hours to produce, according to Hummel. *Countdown America* is mastered at 15 ips on an Otari MTR-10. Other production equipment used for the shows includes an eight-track Otari MX-7800 deck and four Otari 5050B reel-to-reel production/playback machines, plus Technics 1200 Mk II turntables.

Countdown America is not the only IS Inc. program to use the compact discs. In fact, another IS series, *The Hot Ones*—a one-hour, weekly artist profile special distributed by RKO to over 280 affiliates—just completed its first installment with all music from compact disc. The show, a look at the popular group Culture Club, used material from the group's two albums, both available on CD. Hummel says *The Hot Ones* takes about 10 hours to produce, the same as the four-hour *Countdown America*. "A countdown show is a little easier to assemble," he explains.

The quality push for *Countdown America* doesn't stop at the production stage. RKO's extensive satellite system allows the sound quality to reach affiliates in as pristine a state as possible. According to Sisco, large-market affiliates nearly all receive the show via satellite, either airing it live or recording it for later broadcast. Affiliates who still lack receive dishes take the show on high-quality 12-inch discs, pressed at Location Recording in Los Angeles. RKO distributes *Countdown America* on a network barter basis, under which RKO retains 50 percent of the commercial spots within the program, leaving the remaining spots for the affiliate to sell.

CDs on the charts

The percentage of CD-originated material in this year-and-a-half old program, then, provides a revealing chart of public acceptance of compact discs and their promotion by the record companies. While that percentage may vary considerably from week to week, the overall trend is toward increasing amounts of material on compact disc. And with each new release, more and more radio listeners stimulate demand. **BM/E**

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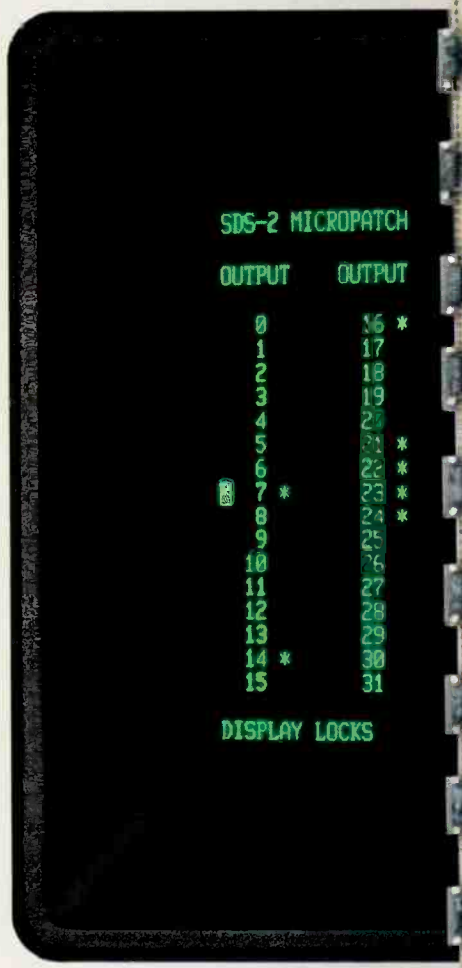

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Test for a Teleproduction Facility: Make Firefox into an Arcade Game

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You see, you are now the pilot of a Firefox, a high-tech aircraft you stole from inside the Soviet Union. They're after you with MIGs, missiles, gunshots, and other Firefoxes—and they're tracking you with radar. You must avoid detection and, at Mach 5 speed, escape along your chosen path or you've had it: You get blown up and lose 50 cents playing Atari's first laser disc-based arcade video game, Firefox.

The game, like the Clint Eastwood movie on which it is based, is about adventure and individuality. Alone behind enemy lines, you must fly through alien territory overcoming unknown, monumental obstacles. In a number of ways, the production of Firefox was also an adventure into the unknown—or at least the uncharted. In creating its first laser disc game, Atari married movie footage to digital graphics, video special effects, and interactive videodisc technology in a unique, unprecedented way. The production team also introduced a new editing technique—interleaving—to the video game world. This frame-accurate technique creates constant, though unseen, disc interactivity, making for an unusually wide variety of action for the player.

Atari personnel at the facility's main console. Moe Shore, manager of video edit lab (left) and Chris Crummet.

Atari Teleproductions

The production of Firefox coincided with a somewhat adventurous business venture for Atari—the building of a full-blown production/postproduction facility in Milpitas, CA, named Atari Teleproductions. Now about two months old, the facility was designed and installed by A.F. Associates primarily to produce video premasters for Atari laser disc-based video games. (The discs themselves are being pressed by 3M.) Atari Teleproductions is also functioning as an in-house corporate facility. There are two off-line rooms with Sony ¾-inch BVU-800 recorders and a Sony BVE-800 editor, along with a Panavision/CEI camera for the corporate operation's use. Also available to them, but used primarily by the game production people, is an array of high-end Ampex gear—four VPR-3 1-inch recorders, an ACE editor, AVC switcher, and ADO—as well as an Otari 24-track MTR-90 audio board in a separate audio room. There is also a separate graphics room featuring a Quantel Paint Box.

The facility, while up and running now, was not available for the video portion of the Firefox production. Positive Video, in Orinda, CA, was used instead. The choice makes sense: Positive's hardware configuration is very similar to the new Atari setup; and Positive is very experienced in disc premastering. Also, Joe Opeka, Positive's director of engineering, was familiar with Atari Teleproductions—and some of its key personnel—since its inception. In fact, he advised them, informally, on what equipment to buy.

The production was a collaboration between Opeka, who acted as special effects coordinator, his staff of editors and Paint Box artist, and three key members of the Atari staff: game designer and project leader Mike Hally; Moe Shore, Atari's video edit lab manager, who acted as supervising editor; and computer software man Greg Rivera.

In many ways it was a project a Clint Eastwood fan would appreciate—an open-ended, creative undertaking that started with a videotape of the film, a storyboard, and a few rough ideas. As Joe Opeka says, "They came down here with a concept, and we helped them develop it from there. A lot of the game was developed as we went along.

Working together we'd sometimes stumble on an effect that changed the course of the game itself."

As Moe Shore relates, there was a period of experimentation at Positive, during which long perspective shots were selected from the film, and ideas for effects were tried. But once the effects were, for the most part, chosen and creative decisions made, there followed a month of grueling work, in which the Paint Box, ADO, and VPR-3s were almost never turned off.

The production

Step one was the choosing of 24 different point-of-view film clips. Firefox is based around these shots: You, the pilot, are looking out the cockpit window as you fly through the clouds or along the ice-covered ground, for instance. (Incidentally, you won't see all 24 scenes in one or two plays—it takes quite a number of quarters to see them all.)

Incorporated into this footage—which serves as the game's background—are a number of enemy Firefoxes. This effect, in which the planes seem to be flying through the background terrain and then twisting away from the player, is one of the technical highlights of the game. How was it done? According to Joe Opeka, "They [the Atari team] brought in models of the Firefox [on slide] and we shot them with a camera and stored them in the Paint Box. Roger Mocenigo, our staff artist, would then go in and do a stencil of the aircraft. And with that stencil he would create a working model that we would take out of the Paint Box and feed into the ADO. That way we could get the ADO to simulate real flight."

In other words, the ADO was used to do "travelling mattes." As Opeka explains, "We made a matte key out of it, so we could use an external key coming out of the ADO itself. That way we were able to key it in—matte it in, essentially—and use the ADO to take the aircraft and give it the perspective of doing rolls and diving into clouds, and so forth."

The Paint Box was pressed into service for the creation of most of the other major effects—the fiery, colorful explosions and the circular, digital graphic "enemies." The explosions were the most painstaking, because they are animations, built one frame at a time, 30 frames long. According to Opeka, "Roger Mocenigo would start with a frame of video wherever the explosion was going to be. Over a period of 30 frames, with each frame the explosion would get larger and larger."

Using a cell animation-type approach, the explosions were taken out of the Paint Box memory and edited, frame by frame, onto a submaster. Then, as Opeka says, "If they were happy with the effect, they would squeeze it down with the DVE and matte it into the program—the master."

The sound in Firefox is no less state of the art than the video effects. Recorded at Eureka Teleproductions (which was recently bought by Positive Video) in San Carlos, CA, the 24-track stereo sound has a number of components. There is original sound from the movie, sound effects of the planes and the explosions, newly composed music, and 24 spoken phrases by Clint

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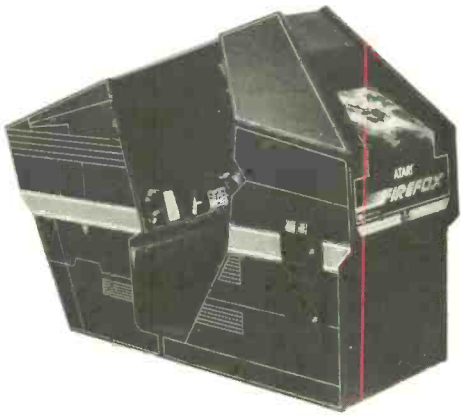
Eastwood. The effects were created with a Synclavier synthesizer, and the music was performed in one of Eureka's studios by an orchestra. According to Moe Shore, Clint Eastwood's phrases were digitized and stored on a computer chip so they could be called up at the appropriate moment. If and when you are detected by radar, for instance, Clint says, "They've got me locked on." The completed soundtrack was layed back at Positive with the company's MCI JH-110 layback machine.

Interleaving

The editing technique, interleaving, is in a sense the heart of the game, though it is transparent to the player. With interleaving, four parallel paths are built. Moe Shore calls them sky composite, sky explosion, ground composite, and ground explosion. When the player is on the sky composite path, he is seeing one of the 12 sky shots and there are no explosions. In sky explosion, the player sees a sky shot with explosions. The same holds true for the two ground paths. The player, therefore, is always in one of four modes, or paths.

It is the way these paths were built, however, that creates fast, varied action, and sophisticated interactivity with the Philips disc player that the game uses. Each path is laid down, frame by frame, in 30-frame segments. First, 30 frames of path A were put down, followed by 30 frames of B, C, and D. This pattern was repeated consistently for the entire length of the premaster—except when the transition shots are inserted, or when the regular pattern of play is interrupted by moments when you must make strategy decisions.

Generally speaking, though, if you are in sky composite and do not fire a shot, the disc player will play 30 frames, then skip 90, then play 30, jump 90, and so forth. And it will happen instantaneously—the game player cannot see the jumps. If you do fire a shot, the disc player simply jumps to the sky explosion track (which is adjacent to sky composite), you see a one-second animated explosion, and then the disc returns to sky composite. The



The Firefox arcade video game is built around laser videodiscs.

advantage of this technique is speed—every second something new can happen without delay.

Also, technologically, "You are getting more interaction out of the disc," according to Moe Shore. "Every second, minimum, you're interacting with the disc—you're jumping. And it depends on what you do. If you shoot at something in that one second—whether or not you hit it

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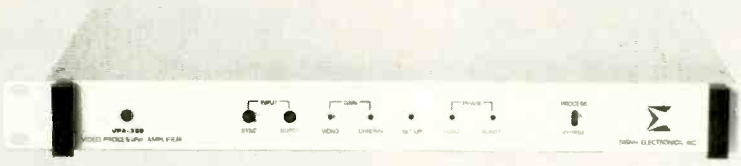

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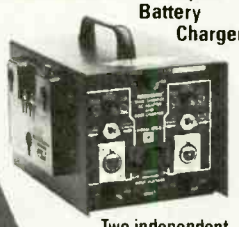

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you're still jumping. But you don't see it. You're not aware of the jump, because it's a matched-frame cut."

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Going digital

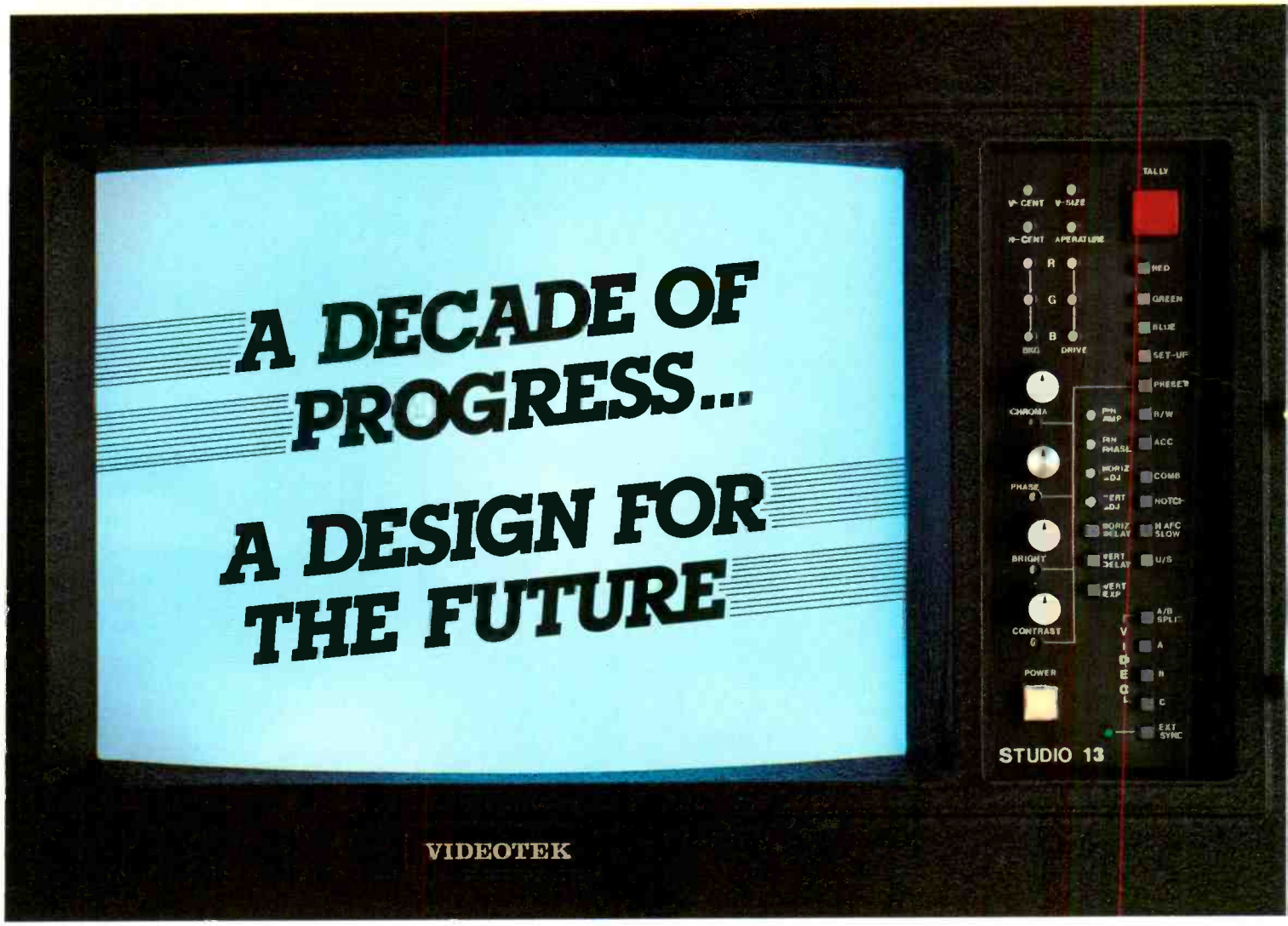
Once the editing was completed, the video phase of the production was done and the Atari team returned to its new facility for the last stage of production: the digitizing of the premaster. As Moe Shore describes it, "After making the videodisc, with all the frames on it and all the explosions on it, we came back to our own place and digitized the x-y position of every frame.

"All that information is stored in the computer program, so that when you are shooting, the program knows that your cursor is pointed at the appropriate x-y coordinate and that you've made a hit."

It would be at that point that the disc player, acting on instructions from the computer, jumps to the explosion path, stays on it for 30 frames, and then either jumps back to the composite path or stays on the explosion if you've made another hit.

Firefox, thus far, has hit the arcade marketplace convincingly—some would say explosively. What's next on the Atari Teleproductions flight plan? Moe Shore is reluctant to divulge what they might have planned. Certainly, there will be a steady flow of laser disc-based games. And since Atari is owned by Warner Communications, Warner Brothers movies could provide some material.

There will also be some further advances in the effects and applications of editing techniques. Moe Shore says that Firefox is a very conservative example of what can be done with interleaving. For now, it might be wise to leave your headphones and a stack of quarters in a handy spot. You never know what you might be going up against next. **BM/E**



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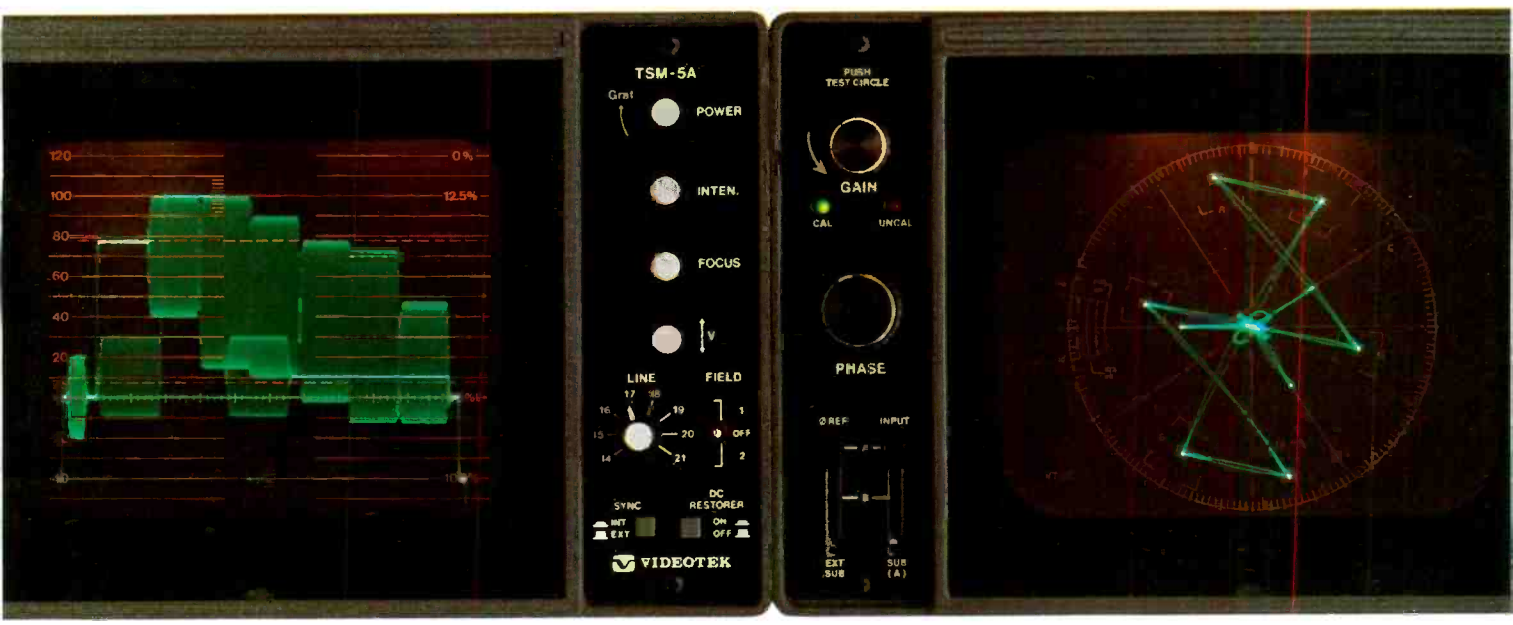

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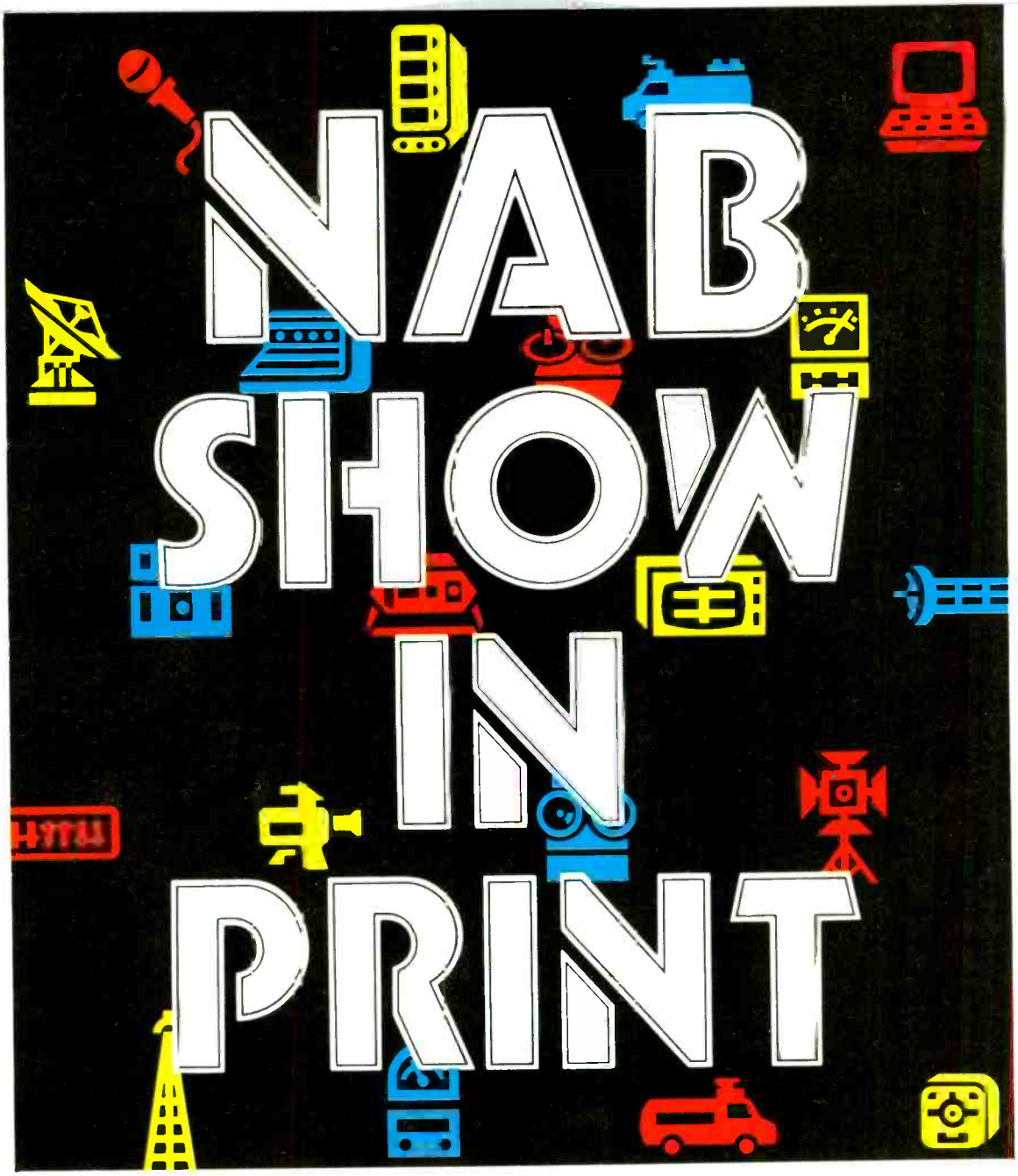

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TV AND VIDEO DEVELOPMENTS

ABC's Julie Barnathan is said to have left NAB this year with the feeling that he had wasted his time being there—that there was nothing new to see. In his case, it's probably true. He already has his Paint box and Mirage. He already has all the latest mobile vehicle technology. He's already preparing the network for teletext and multichannel audio.

But for the other 34,999 attendees at this year's show, nothing could be further from the truth. In fact, everything was new, everything was exciting, everything pointed to the fact that, for the first time in several years, the broadcast industry is recovering from its economic slump. You could see it on the faces of the manufacturers who were reporting a land-office boom—business up over 100 percent according to some. And you could see it on the faces of those who were attending from stations and production facilities. There may not have been quite as many people at the show this year, but those who came came ready to buy, and buy they did.

True, Barnathan may have been disappointed that research and development on those items which a network BO&E president might find exciting have temporarily been put on hold. But the rest of the industry, those who in previous years could only look at the glittering product developments and dream, this year found products they could afford. And manufacturers have never been more aware of the need to develop products for small and medium market stations. R&D has already been spent developing the technology. Now, in the words of Reaganomics, it's ready to trickle down to the less capital-rich segments of the industry.

Besides the specific technological

trends at this year's show, a comprehensive analysis of which follows, there were also a number of major business-related developments.

- ADDA Corp., just prior to the show, announced it has acquired Control Video Corp., manufacturer of video editing systems.
- Comark, at a press conference during NAB, announced that it has signed a letter of agreement to purchase Acrodyne. The two companies' product lines are said to dovetail perfectly.
- Grass Valley Group, itself a subsidiary of Tektronix, has bought Dubner Computer from Harvey Dubner. Again, the two companies' product lines appear a perfect match.
- Leitch, just after the show, announced it would buy Hughes Electronic Devices Co. (HEDCO) from Oak Industries. HEDCO offers a line of routing switchers developed along some well-respected high-tech ideas.

New Technology Invades Camera Market

After this year's NAB show, the question in many people's minds seems to have shifted from whether CCDs will replace pickup tubes to when. RCA's introduction of its CCD-1 solid state ENG camera has convinced many in the industry that the CCD is, in fact, a serious contender, at least in the ENG market, and camera and tube manufacturers are preparing themselves for its advent. While the CCD-1, at $37,000 without lens, is no cheaper than comparable ENG cameras, its highlight handling, dynamic resolution, lag, and burn-in performance are demonstrably better. It boasts an S/N of better than 62 dB and low light sensitivity of 3 fc. The CCD's advantages should prove especially attractive to news crews, so often faced with low light conditions and moving targets.

Those advantages are not without attendant disadvantages, however. RCA, with 10 years' CCD experience under its belt, is working to address these problems and was showing an experimental EFP-quality CCD camera in a technology suite at the Riviera. In a presentation at the suite, RCA engineers described several methods for dealing with aliasing, mostly involving varying arrangements of offset sensor arrays and prisms. The experimental camera produced excellent detail with no apparent aliasing, as well as excellent matting performance (often problematic with offset sensors).

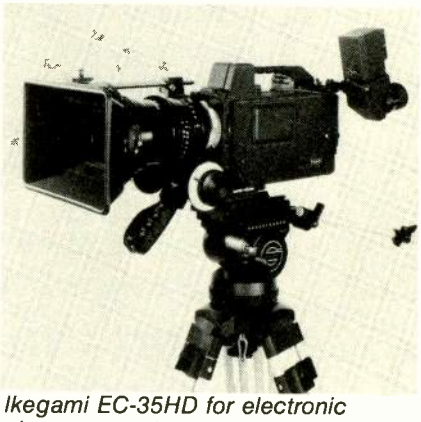
RCA's new CCD camera.

As an added attraction, RCA had fitted the camera with a special 1/500 second shutter (special optics were provided by Angenieux) that almost entirely eliminated blurring of moving objects, in live as well as taped demonstrations. It rendered legible the writing on a moving soccer ball, for example. While the idea is not new (RCA showed a similar device years ago for its TK-44), it has not gained acceptance due to the light loss inherent in the system. The CCD's greater sensitivity, however, may rekindle interest.

RCA, of course, was not the only manufacturer with a CCD camera. NEC's SP-3, shown in prototype last year and formally introduced as a product at SMPTE, has already been sold in the U.S., primarily for nonbroadcast uses. Without lens it is priced in the $20,000 range. A company spokesman concedes that horizontal resolution of the SP-3 is less than for tube cameras, but points out that VTRs resolve fewer lines. The camera uses two of its three CCDs for the green signal to maximize resolution and minimize aliasing.

Interest is also picking up in the HDTV area, with both Sony and Ikegami showing systems for the studio and for electronic cinematography. In addition to the HDK-1125, an NHK-standard studio camera with a full complement of automatic features, Ikegami introduced the EC-35HD, a high-definition ⅔-inch tube camera designed for electronic cinematography. (The original EC-35 is still distributed by Cinema Products.) Like its predecessor, the EC-35HD uses film-style lenses and focus knob, with special circuitry to approximate film gamma curves. It offers 900-line resolution and has microprocessor-controlled auto setup and registration.

Sony, whose HDTV equipment heretofore has adhered to the NHK standard, has been an active member of the ATS committee and is maintaining a neutral stance on HDTV formats. Company president William G. Connolly stated, in fact, that Sony's sale of HDTV gear "should not imply Sony's endorsement of any particular high definition standard" and carried the caveat that the equipment "may become incompatible with future systems." In addition to a complete studio HDTV system, Sony showed a three-tube HDTV camera for electronic cinematography, complete with fixed and short zoom lenses, digital image enhancer, and digital registration.

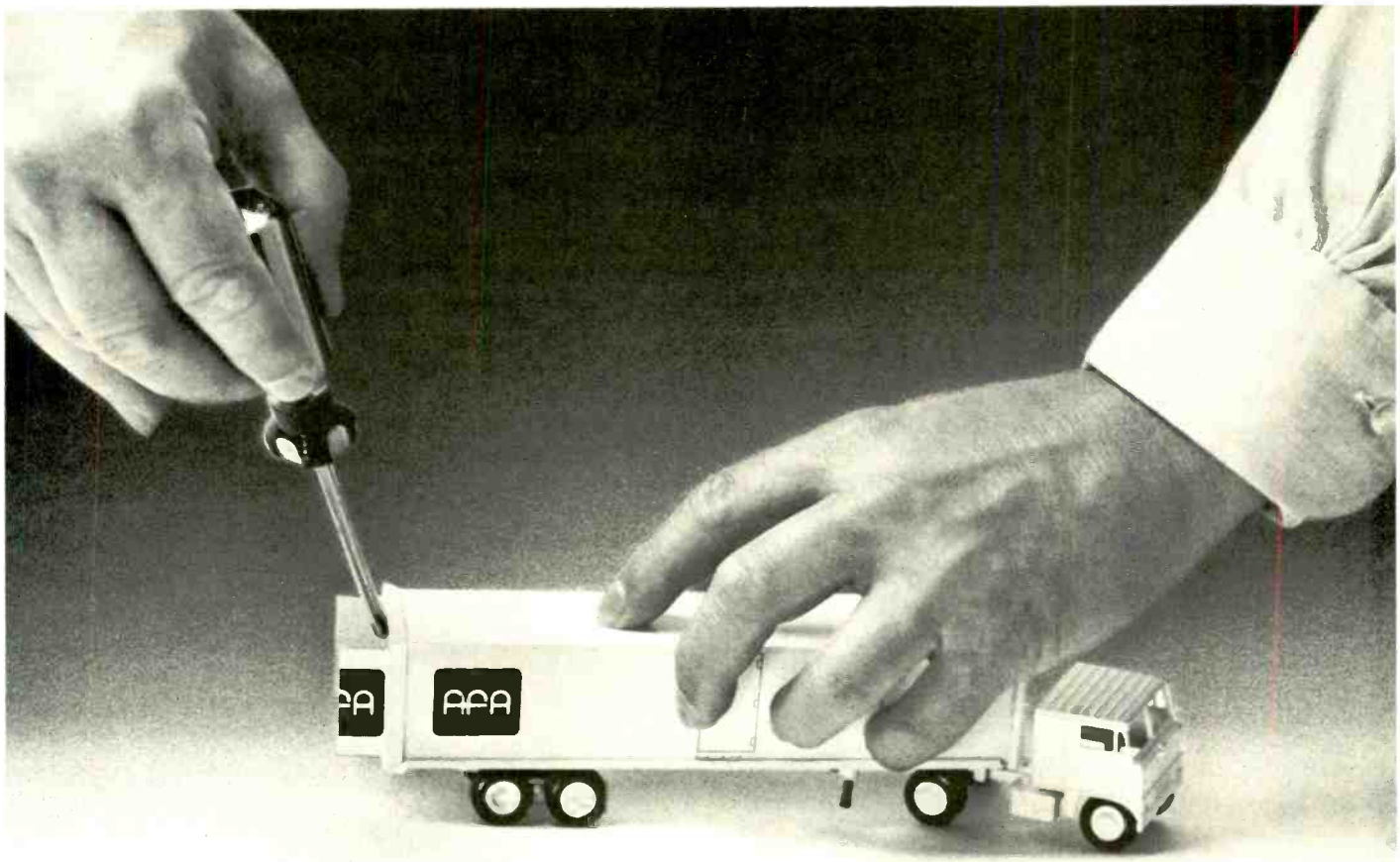


Ikegami EC-35HD for electronic cinematography.

Studio advances

Camera technology is continuing its advance in the studio area, shown by several companies' enhancement of their top-of-the-line cameras. RCA's TK-47, which has set the industry standard for automatic studio cameras, has now evolved into the TK-48 and incorporates several new features. Primary among these is factory preset dynamic lens correction, which compensates for lens errors during zooming. Also new is an intelligent viewfinder system, with functions selected by 12 membrane-type pushbuttons. The system can set and store box cursors, control the motorized filter wheel, monitor R, G, and B signals, and display a large number of lens and camera parameters.

Philips's LDK 6 now presides over a



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Emerging Formats for Video Recording

What was the most significant development in video recording at the show this year? The Betacam versus M-format wars? The arrival of full-scale quarter-inch recorder/cameras? The announcement by SMPTE that agreement has been reached between Bosch and Hitachi on a new quarter-inch format? The agreement among U.S. manufacturers on ¾-inch rather than one-inch recorders as the standard for a digital tape recorder?

All these developments are highly significant, of course. But the most important announcement wasn't made publicly, and can't really be attributed yet. It is that the 8 mm tape format, the one agreed to by the entire Japanese electronics industry (including manufacturers of both Beta and VHS formats), will almost certainly become a professional product, and before too long.

Kodak, which is the first company to introduce 8 mm to the home market in the U.S. (it is importing the Matsushita-manufacturered package) says that development of a professional recorder/camera—one that would weigh significantly less than current half-inch systems—would not be surprising."

Additional confirmation is provided by a spokesman from Matsushita itself who says that a lot of money was tied up in the development of the 8 mm format, but that it is going to take at least five years before 8 mm makes a significant impact on the VHS market. "We're not going to just sit around with all that R&D and wait for the market to catch up with us," he explained. "Of course we're working on a professional version of the 8 mm format. We're going to adapt it for broadcast use in the same way that we adapted VHS into M-format."

And despite the rumors that the current 90-minute cassette could yield only 10 minutes of recording time if a broadcast-quality bandwidth were accomodated, the same Matsushita spokesman pointed out that there is "a world of difference between metal partical tape and evaporated metal tape—a difference which should make it possible to record at least 20 minutes on a standard consumer-grade cassette if the VCR's writing speed is modified for the broadcast signal.

The question any serious broadcaster must ask is whether any of the current half-inch formats will indeed be in widespread use for more than another five years. Perhaps it is significant that several of the new multi-event cassette players introduced this year have facilities for changing the VCRs that act as their playback units, insuring that if the format changes in the future, the station has not condemned itself to an obsolete VCR.

All these upheavals in video recording have the net result of giving the broadcaster and producer an overwhelming number of choices. Competing half-inch and ¼-inch are battling with ¾-inch for lines on the ENG budget, while one-inch Type C remains firmly entrenched in the production area, with Type B on the scene but not a strong contender in this country. The one major new development in the one-inch arena at NAB was Hitachi's HR-230, which features a retracting entrance, exit, and main erase head. The supply tension arm and audio shield cover also retract. The company claims these new features help minimize wear on heads and tapes alike, along with easing tape handling. Hitachi apparently is positioning the HR-230 for sports work; the deck recues a 30-second segment in 3.5 seconds and has minus one to plus three times fast/slow motion range, providing real time reverse and field/frame still motion, along with programmable time compression and expansion.

Formats battle at NAB

The SMPTE Working Group's failure to write a single half-inch VCR standard early in 1983 initiated significant directional and tempo shifts in the dormant camps of the digital component and ¼-inch analog VCR camps. Continuing research in head, tape, and

Studio deck for Bosch Quartercam system.

New HR-230 Type C VTR from Hitachi.

encoding technologies established a faint hope among optimists that a practical digital recorder might not be five years to a decade away. Thus, two of the potential DVTR developers, Bosch and Sony, demonstrated their latest engineering models at widely separated, invitation-only demos at the Hilton and Tropicana hotels. They both make fantastic pictures, according to invitees. But they're incompatible to each other and to Sony's impressive four-track, one-inch component analog HDTV recorder shown on the NAB floor.

In an NAB Television New Technology Session paper, SMPTE's VRRT (Video Recording and Reproduction Technology) Committee chairman Bernard Dickens suggested that first deliveries of production model DVTRs might be made in late 1985 or early 1986. He then chided American broadcasters for their lack of involvement in these crucial stages of standards development.

The standards-setting/product development conundrum is being repeated in the other format area directly affected by the half-inch standardization effort failure. A joint announcement rereleased at the close of the 1983 NAB by ¼-inch broadcast format developers Bosch and Hitachi, and supported by Philips, stated their collective intention to standardize by working with a specially appointed SMPTE working

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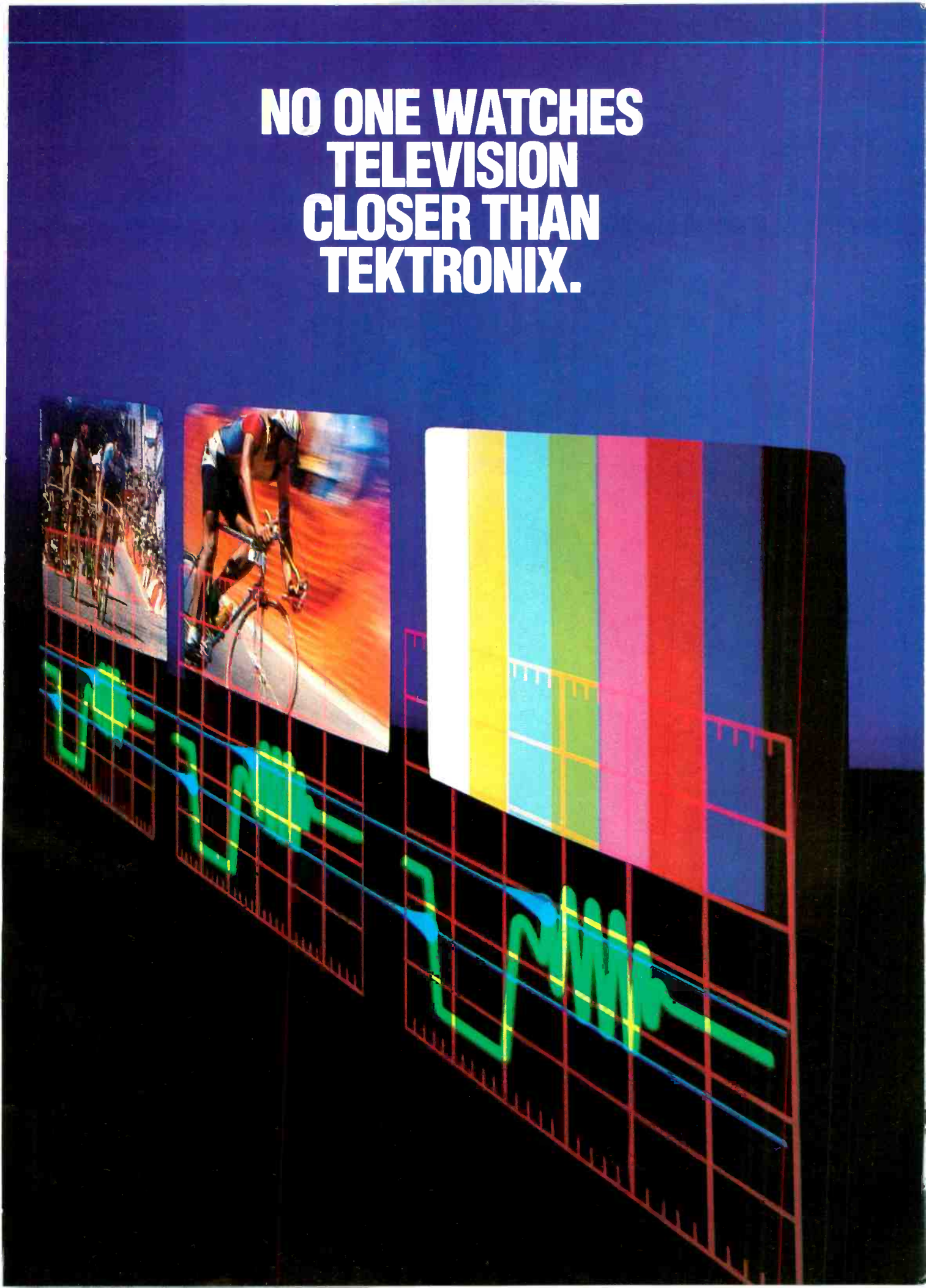

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1740 Waveform/ Vector Monitor (Right) Tek's new waveform/vector monitor saves space, power consumption and cost. Both dc power and battery pack options are available. It's ideal for mobile vans and field applications.

118-AS Audio Synchronizer (Above) No more lip sync problems! Tek's new 118-AS provides a practical solution to the audio-to-video delay caused by four-field memory video synchronizers. The 118-AS features wide dynamic range, low distortion and automatic and manual delay correction.

1980 Automatic Video Measurement Set (Top center) Tek's Answer System permits continuous, unattended monitoring of all your incoming and outgoing video feeds. It generates complete reports automatically, alerts you when measurements exceed specified limits, and can be programmed to meet your changing needs.

Tek's newest product for television:—new measurement capabilities detailed on the following page. Take a look!

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PICTURE OF YOUR SIGNAL WITH TEKTRONIX!

2445 Portable OsciLoscope TV System (Left) Tek's state-of-the-art 150 MHz, 4-channel portable scope now offers a TV option with backporch clamp, display and readout of any line or field. Also available: a fully-programmable GPIB option.

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494/494P Spectrum Analyzer (Above) An unprecedented value! Counter frequency accuracy, baseband through microwave coverage and unique HELP mode to guide less experienced users. Store up to nine displays and ten set-ups in non-volatile memory. Portable and rugged, the 494 is backed by a three-year warranty!

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THE NEW TEKTRONIX 1750: HEADS OFF PROBLEMS YOU DIDN'T KNOW YOU HAD...UNTIL IT WAS TOO LATE!

Our new 1750 signal monitor gives you a unique, dynamic display of SCH phase relationships.

You can see at a glance if a video signal is properly SCH phased... or just as easily, compare two signals for color frame matching.

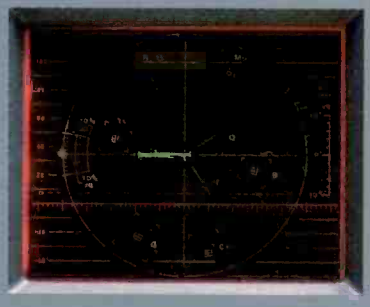
Hit-or-miss SCH phasing may have been tolerated in the past—but now it's costing you time and money every day.

The Tektronix 1750 can help you regain control. By maintaining consistent SCH phase ...or by seeing potential problems *before* a glitch occurs, you'll avoid the frustration of multiple passes and enjoy getting it right the first time. Saving time saves you money and makes the best use of your valuable resources.

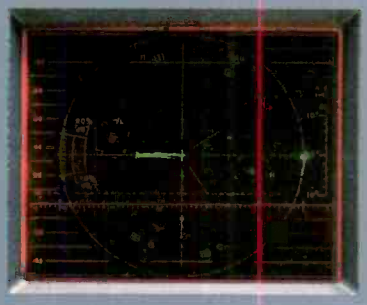
SCH phase, of course, isn't the only parameter you need to keep on track, and SCH display is only part of the 1750's comprehensive signal monitoring capabilities. At the push of a button it also displays vector mode...or waveform mode, enhanced by digital line selection through the vertical interval ...or R-Y/sweep mode for easy interpretation of differential phase distortions.

Whether used for monitoring video in production and editing environments, or for making fast and accurate measurements during equipment maintenance, the 1750 Series is a new benchmark for comprehensive performance in both NTSC (1750) and PAL (1751) standards.

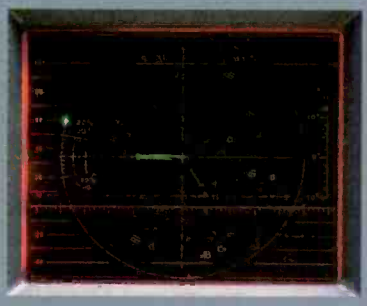
A compact 5.25 inch package, mechanically interchangeable with many other "half-rack" packages, allows easy installation in new or existing facilities.



Correct SCH phase relationship is clearly displayed on the 1750 when dot on the calibration circle is aligned with the vector on the −x axis.



Dot placement on the −x axis indicates an error in the color frame matching of two signals.



This 17-degree offset, indicating a 17-degree SCH timing error, would be impossible to perceive on an ordinary waveform monitor display.

If you see the advantages of comprehensive signal monitoring, you'll like what you see in the 1750.

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group on a ¼-inch cassette-based VTR format. Meetings have been held almost monthly since then under the chairmanship of ABC's Bob Thomas.

A user subgroup, chaired by Westinghouse Group Four's Charles Magee, prepared a target performance specification against which manufacturer members have been shaping a single draft standard. In an NAB press release, 3hitachi stated it is "proceeding to manufacture equipment using the agreed-upon format."

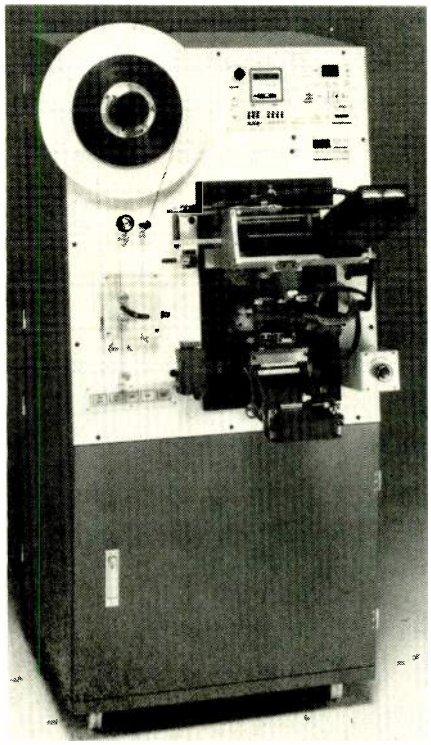
Meanwhile, Hitachi's proprietary format, introduced as a prototype at NAB '82, was in evidence as a production model, already in use in Japan. The product family includes the recorder/camera, field playback unit, field editor, studio recorder/player with editing, and a commercial cassette recorder player. The two-ounce cassette provides 21 minutes of recording time. Shooting package weight is 18 pounds, compared to 22 pounds for a Betacam system and 45 pounds for an HL-79/BVU-110 system, all weighed with lens, 20-minute tape, and battery.

Down the aisle, Bosch was also promoting ¼-inch business as usual, showing several LDK-54 units in operation in its booth and around the town.

Bosch's system components at the show included the KCF-1 half-inch Plumbicon-equipped camera, a Lineplex portable recorder/player BCF-9, and a studio recorder BCF-10. Both will accept Lineplex, component, and composite analog input signals. Both also offer full editing facilities including visible search, jog mode, and stills. Selectable video output options are head to head (RF) component and Y/C dubbing, and baseband component analog and NTSC composite signal outputs for post-production processing and airing.

The innovatively packaged BCF-20 field editor allows direct plug-in of two BCF-9 units for immediate editing at the scene of a shoot.

Because of the one and a half times longer recorded wavelengths in this proprietary design, Bosch claims that the Quartercam system "can also meet the more stringent requirements of the 625/50 market, and therefore for NTSC applications, it has sufficient headroom to allow its use for documentaries and for electronic field production." Quartercam system deliveries will commence in the fall of '84, according to a Bosch spokesman, and ABC will be field-testing units during the Summer Olympics. In the Philips booth, international camera products marketing manager Gerry Spencer emphasized that the camera in its LDK-54 recorder/camera system "is far more camera than we need to feed the ¼-inch recorder." It uses Amperex Type XQ 4187 HS ⅔-inch diode gun Plumbicon tubes. "The high-stability tubes give the LDK-54 camera performance capabilities so good that we're planning to market it as a portable companion to the LDK-6," Spencer added.



Otari VL 800 8mm videocassette loader.

Philips people on the floor emphasized the versatility of the recorder products developed by Bosch. The Bosch BCF-9/Philips LDL-2000 on-camera VCR puts out a CVBS signal simultaneously with component analog, has built-in genlock, and offers two full audio bandwidth tracks. Longitudinal time code from a built-in generator is integrated on a longitudinal control track. The LDK-54 price is $42,000 including zoom lens, VCR, and battery. All products in the LDK-54 camera family are now entering production, with deliveries scheduled to start in late 1984.

"Business as usual" proceeds on two incompatible ¼-inch VCR formats. Firm prices and deliveries are offered by three manufacturers offering three different cameras. Will the SMPTE working group have a chance to slow that marketing momentum to a stop and new restart, regardless of how many new user voices chorus, "We're not going to buy without a standard because it's too risky!"?

By June, the working group will have met and may have announced a firm agreement—or they will be considering disbanding because the two key format proponents can't find a middle ground of technical agreement. However, it now seems clear that if Hitachi and Bosch can't agree on a compromise format, there will be no broadcast industry sales potential for ¼-inch.

Besides its own problems, ¼-inch must also face the specter of the 8 mm consumer format, which may well appear in the broadcast industry when tensilized metal particle tape hits shelves as a supply item. (One sign that the broadcast industry is preparing for 8 mm came from Otari, which introduced to NAB attendees its VL-800 automated 8 mm blank videocassette loading machine, a $32,890 unit available now.)

If that day finds 8 mm backing a single, firmly entrenched ¼-inch format for ENG and EFP, the new competition will benefit broadcasters. The consumer-driven pricing of 8 mm will establish it as the new economy ENG format, continuing the downward price pressure on ¾- and half-inch hardware and tape.

MERPS battles

Nothing related to the basic format design, or the availability of portable recording and editing suite interface equipment, seems to indicate one-sided superiority in either direction. This year's battle is therefore being waged on the MERPS front.

The Type M camp (vendors of the Matsushita VCR models—Panasonic Recam, RCA Hawkeye, Ampex ARC) believe they will win because of the competitive availability of their interchangeable products. However, the Betacam format, now officially designated ANSI Type L, is no longer available only from Sony. "Thomson-CSF has a license to produce Betacam equipment, and does, not only in Europe, but they're offering it for sale in this country under their own name," Sony Broadcast president and CEO Bill Connolly said.

Convenience in editing from either format to any other format, using any of the leading computer-based editors, is evidently no longer a problem. A real

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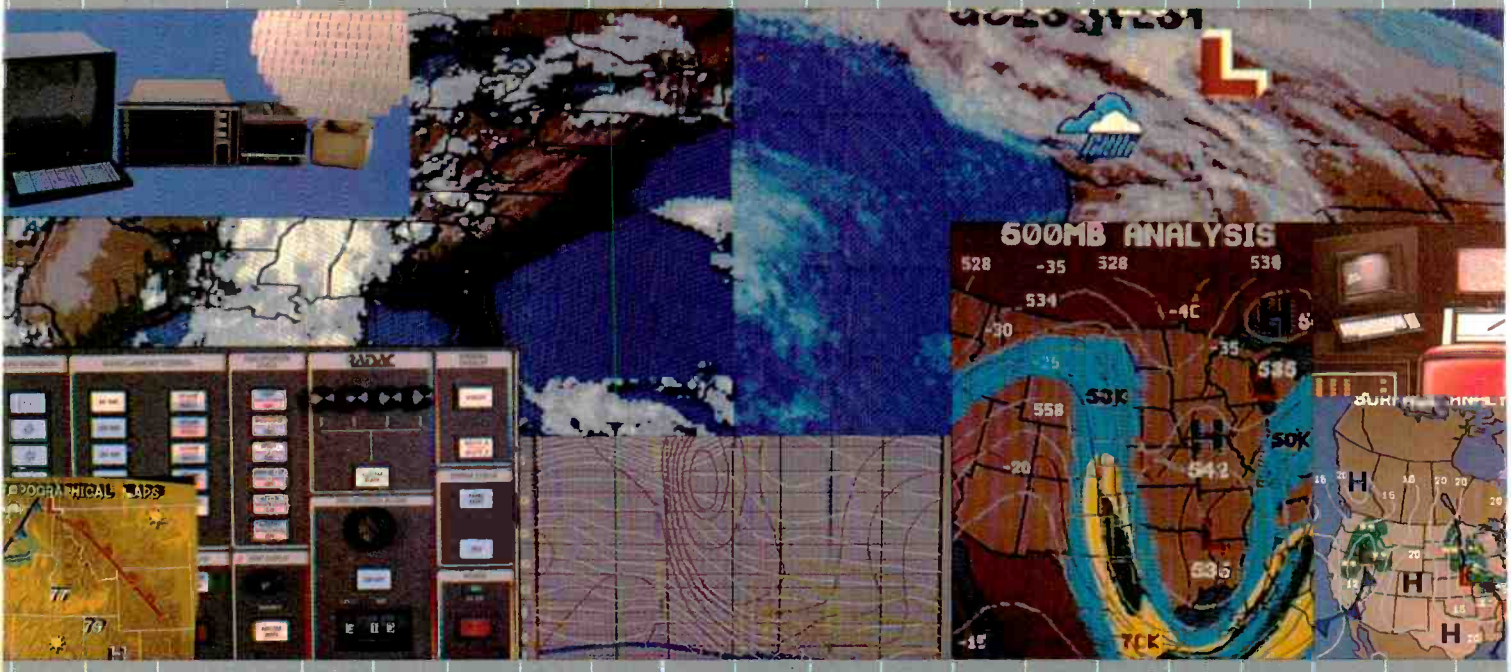

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Crowds gather at Sony Betacart demonstration.

concern was raised at NAB about the adoption of component analog to replace NTSC throughout a station or production house.

This was addressed by MERPS committee chairman Rupert Stow (CBS Operations and Engineering, New York) in a detailed progress report on needs identification at the NAB Monday Television Engineering session. Salient among his points is the absolute requirement that there be one recording format on a medium encased in an interchangeable cassette. It is easy to infer that the medium will be magnetic tape. However the report's language does not rule our either a disc format or a recording means other than magnetic. But the medium must be recordable while installed in the automated system.

The cassette design must eliminate the current labor, equipment, and time required for multiple handling and tabbing of a commercial from edited master to aired copy, which the report estimates now casts a typical station $250,000 a year. Recording quality of the playback to air must be as good as, or even better than, signals currently aired from Type C machines.

How does the MERPS need relate to all the contentions and confusions about emerging formats? CBS senior staff engineer Bernie Dickens expressed a CBS official position, stating, "Digital is the way to go. Component analog for the audio is possible, but its cost-effectiveness does not appear as good as digital for equal performance. The component analog machines will cost more, and cost more to keep running. The digital machine should be knob-free."

Walking the exhibit aisles, it was quickly obvious that the distance that currently separates the MERPS needs list from the several playback automation systems on display is wide and deep. Sony currently stands alone in its Betacart system design with four recording decks fed by a 40-cassette magazine. Its recording format is component analog, and maximum playing time is 20 minutes.

Asaca's ACL-3000 Automatic Random Access Cart System has storage for 300 half-inch cassettes, either Beta or VHS/M format shells. Eight cassette transports can be installed, either Betamax or VHS color under units (up to several hours playing time), or Betacam or M-format component analog units (up to 20 minutes playing time). It's not clear whether transport types can be intermixed to create a system.

Panasonic and RCA displayed expandable M-format automation systems. Panasonic's MVP-100 is available in configurations of eight, 16, and 24 computer-controlled transports. Its sophisticated operations controller was designed and will be manufactured in the U.S. by Merlin Engineering. Individual cassettes can store up to 20 minutes of individual messages—all the spots of one sponsor, for instance—to minimize scheduling problems. The seventh and eighth decks can be programmed to build spot reels for backup redundancy.

RCA's TCR-10B is limited to eight transports. The system's presentation memory has a capacity of 250 events. Specifications for the three systems seem to indicate that although recorded cassettes may be interchanged among them, housekeeping and operations control software and procedures are not compatible in any way.

Elsewhere on the floor, video systems houses Lake Systems and Kavco exhibited multi-cassette playback automation systems that can accomodate either ¾-inch, Betamax, VHS, or M-format decks.

AF Associates demonstrated its multi-functional Protel systems of computer automation for the television industry. The basic system automates the functioning of a set of Type C machines, to create daily spot reels on one machine by randomly accessing spots, promos, and PSAs stored on others.

New frame-by-frame recording capabilities of the Ampex VPR-3 and Sony BVH-2500, coupled with

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EECO's newly announced EECoder system for time-compressing 10 seconds of audio into a 1/30 second video frame, might be a cost-effective addition to the Protel station break automation system. One frame each of a still image and 10 seconds of audio offers a linear tape length reduction of 150 to 1. The 54,000 frames on one 30-minute tape (or videodisc) could accomodate tens of thousands of stills and accompanying messages.

These emerging disc-based video recording formats are almost a collection of Pandora's boxes. Those that were shown at the '84 NAB were each individually different from all the others in all dimensions. It's safe to predict that the models on display next year will be "Mark II" models, supplemented by a load of other incompatible boxes.

Frame-Star is Precision Echo's 200 frame per side magnetic disc system. Three models with various signal processing and interface options are priced in the $5000 range, with interchangeable discassettes priced at $50. Both reflect substantial reductions over the original EFS-1 framestore pricing. Track to track access time is 100 ms, with frame O to 200 jumps taking two seconds. Volume deliveries are scheduled for late 1984.

Panasonic OMDR, which invaded this country in late 1982 as a 15,000 frame color-under still store at $35,000, appeared at NAB as two seemingly similar TQ-2023 and TQ-2024 still/motion picture models. Both units offer "near digital quality audio," with the TQ-2023 evidently accommodating stereo.

Capacity specifications for the eight-inch disk are 15,000 still frames or eight minutes of full-motion video recorded concentrically, or 24,000 still frames or 13.3 minutes of full motion recorded spirally. Product literature allows you to infer that audio can be played back with frame-by-frame video. Frame access time is 0.5 seconds and motion-picture sequences can be played back in five modes.

According to Picture Element LTD. (PEL), its VSP video sequence processor "supports all standard TV formats—as well as HDTV—and standard graphics formats 512 by 512 and 1024 by 1024," indicating that the system's broadcast application is the assembly and variable rate playback of animation sequences. It appears to be a powerful product in this production/post-production application.

The company, however, makes no mention of "sound" in its literature. The recording capacity is up to eight minutes of video image sequences digitally in real time. Recorded sequences can be processed or edited using the imbedded computer or a host computer.

"I saw Henry," said the iridescent orange lapel labels sported by people who were invited to Quantel's Hilton suite annual preview of a possible NAB '85 product. In a word, Henry is a massive digital store (perhaps quite similar in architecture if not in hardware selection to the PEL VSP) that is being developed into a next-generation editing system with full animation capabilities.

The product is aimed at electrifying the film production process, which now requires "rostrum cameras" and animation stands. Its control software, managed by a mouse, allows operator manipulation of images in procedures strikingly similar to the user-friendliness of the Apple Macintosh.

Maximum continuous recording time (i.e., storage capacity in the digital disk drives) is two minutes (i.e., 3600 animation cels). Since all recording and processing is done in the digital components domain, unlimited reuse and manipulation of images into foreground/middleground/background locations is possible. Editing decisions are stored in a 68000-controlled memory as they are made. Each finally edited sequence from the images in memory can therefore be substantially longer than two minutes.

Creative people had many good suggestions on how Henry should be tied to Quantel's Paint Box, and on visuals "realization" techniques that only graphic artists understand. Deliveries will begin within 12 months, at prices "like Mirage."

Trends in tape

Tape has long been cutely referred to as the razor blade that makes or breaks the reputation of the VTR on which it's used. But it's more than that. Bad razor blades damage only your image, not the razor. Bad tape both damages your image and can destroy parts of the machine. Further, without special attention to the razor blade design, "special trims" like stop motion just wouldn't be possible.

Ergo, tape suppliers' energy levels in using the forum of NAB to demonstrate their product improvements since last year are little short of hyperactive.

Ampex's torture test gallery included an environmental chamber testing merits of a VPR-80 as well as the 196 tape, and an adjacent VPR-80 doing a multiple generation test. Across the aisle, a ¾-inch 197 cassette tape stood still while the heads ran and ran and ran. Product managers Morgan Rees and Michael Wilke supplied the following results of the four days of tape torturing: During the environmental chamber test (90 degrees F, 80 percent relative humidity), an Ampex 196 tape shuttled through 690 passes with no stiction buildup. Another Ampex 196 tape shuttled through 1313 passes with only one percent RF amplitude loss, and no dropout buildup (the dropout counter was zeroed after the first pass). In addition, an Ampex 197 cassette was tested in stop mode for nine hours and 56 minutes—or 4,290,200 head scans—with no RF amplitude loss.

3M's Magnetic Audio/Video Product Division introduced new or improved products for all the current and emerging videotape recording formats. For one-inch machines, the new tape is 480 Scotch brand, designed to withstand the demands of handling and edit cycling that can lead to stiction on poorer grade tapes. It is made with a totally new oxide, binder, and lubrication system, resulting in dropouts of 10-per-minute maximum average.

3M 480 is claimed to be capable of over 1000 edits from the same reroll point without significant reduction of picture quality. RF output/signal level remains constant even after repeated use. A proprietary lubricant cuts head wear to as little as 1.0-microinch/hour, and the tape can withstand still frame wear for longer than three hours.

New half-inch VHS and Beta videocassettes for more demanding professional ENG and EFP applications are Scotch brand Professional PB (Professional Beta) and PV (Professional VHS) Super High Grade. They use premium half-inch super High Grade videotape with improved dropout performance and excellent signal to noise ratio, and have color-coded red doors and hubs for ease of identification.

Marketing manager Frank Price announced an agreement with Sony Corporation under which 3M will produce videodiscs to precise specifications and furnish them to Sony on a private-label basis. Sony currently manufactures and distributes videodiscs and industrial videodisc players to a wide variety of industrial markets.

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Colour temperature stability has always been limited by the stability of the CRT, but now BARCO INDUSTRIES Introduces the CTVM 4 range with AKB (Automatic Kinescope Biasing). The AKB system, developed by BARCO INDUSTRIES, automat caly stabilizes picture tube colour temperature and guarantees black levels which remain constant with time, temperature and CRT parameter drifts.

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chosen from an on-screen palette of 2000 colors out of more than 16 million colors total.

Besides basic painting functions, working on a blank screen or an already-digitized image, there is a wide variety of cut-and-paste, scaling, repositioning, and other graphics functions. Once created, graphics can be sequenced on "slide trays" containing up to 100 images each. Mass storage is on 5.25-inch 40 megabyte Winchester disks, each holding 120 frames; addition of a second drive and additional drive storage units brings the total frame capacity to 960. Cost of the framestore addition is $30,000.

Aurora has added several new software packages to its popular AU/100 graphics system. Most interesting is the new 3D transformation program, which takes an object or area of the screen originally drawn in 2D and allows it to be rotated about any axis. Also new, and coming into more prominence as TV's production capabilities increase, is an interface with the Sony BVH-2500 VTR, allowing it to record single frames produced by the AU/100 for animation effects. This capability was demonstrated at the Sony booth, using the new Lyon Lamb VAS-Delta animation controller ($9850) to access the 2500's single framing capabilities.

Dubner continues to demonstrate the kind of effects that even other manufacturers in the business concede cannot be beaten for the price—even if the system is a little slower than real time. Perhaps this is what attracted the Grass Valley Group to purchase Dubner, announced just prior to the show.

Dubner's CBG-2 is now running full speed ahead with a 3D modeling and manipulation program using advanced technology to calculate 3D surfaces by either determining which planes lie behind other planes and drawing the rearmost first, or else constructing them in a real three-dimensional z-axis frame buffer, an extension of Dubner's work with run length encoding. The 3D programs are linked with a 3D curve drawing program which automatically calculates and displays the three-dimensional forms created by curved surfaces. This is also linked to another major new program development—an anti-aliasing feature that insures that the curved lines come out looking smooth and without the staircase-step appearance of many computer graphics outputs. The images, particularly the complex anti-aliased 3D forms, take a little time to reconstruct on the screen, but they are truly awesome in appearance.

As has been the case for several years now, there is also a trend towards using computer graphics programs that run on smaller, business computers, then transforming them for use in the broadcast environment. One of the most active companies here is Combicomp, which offers a three-dimensional solids modeling program that runs on the company's graphics processor hooked up to an IBM PC as the host computer. This is a full framestore system with 512 x 512 pixel resolution and 16 bit processing; 12 bits are used for color, yielding a choice of 4096 colors from a total field of 16.8 million. The modeling programs are nothing less than spectacular, yielding the kinds of images associated wth truly innovative computer graphics. Yet the cost of the processor and software is only $9700 and it can be hooked up to any PC.

A somewhat similar approach is taken by new NAB exhibitor Symtec with its PGS III graphics generator priced at less than $10,000. Hooked up to a PC as a host computer, the system offers a choice of 16 colors from a total palette of 4096. Pixel resolution is 512 x 480. It offers 22 fonts, two image planes with graphic overlays, and relatively rapid image retrieval and loading.

An under-$10,000 price tag seems to be an important feature for many buying graphics systems these days. The PGS III described above, and the Vectrix WITS described with weather systems below, are just two examples. Another is the brand-new Apis Graph-Pac, which offers full-screen color graphics that can be keyed over live video, with resolution less than 20 ns. In addition to basic graphics displays, the system also offers several other useful production tools: a 10-second countdown display, color bars, SMPTE time code readout, and a full-screen slate.

Perhaps the most cost-effective approach of all is to use the basic graphics capability of the PC, made suitable for broadcast use through a genlocking board, together with an off-the-shelf business graphics or interactive drawing/painting software package. This is the approach taken by Video Associates Labs with its MicroKey system—now made compatible for the first time with the 128 kbyte RAM PC (it was previously shown only with Ap-

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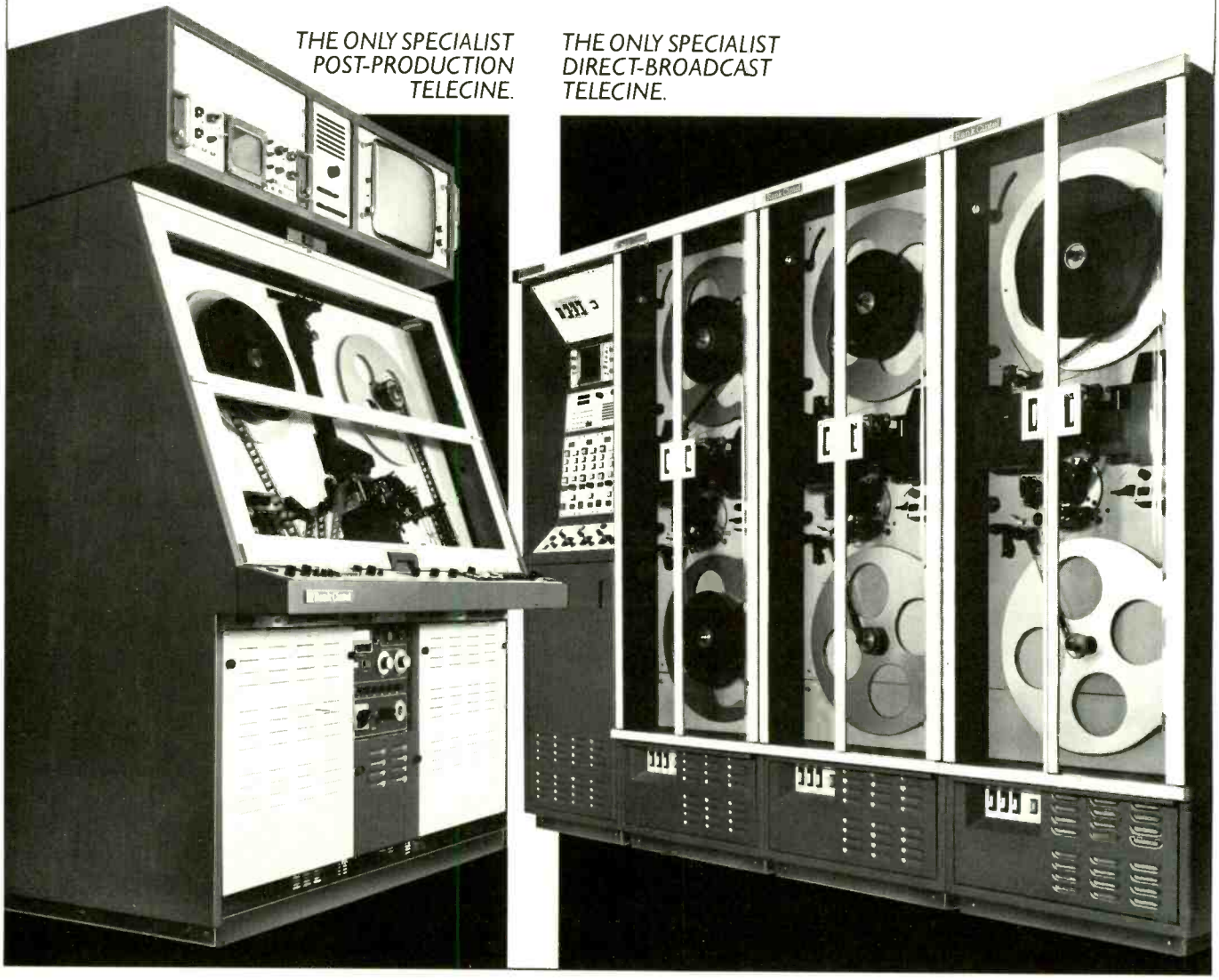
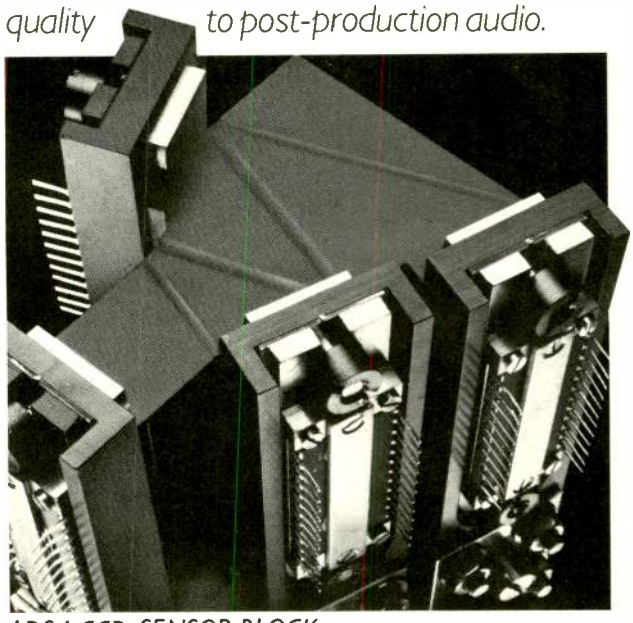


Some broadcast equipment manufacturers would have you believe that one telecine will neatly fit both film post-production and direct broadcasting.

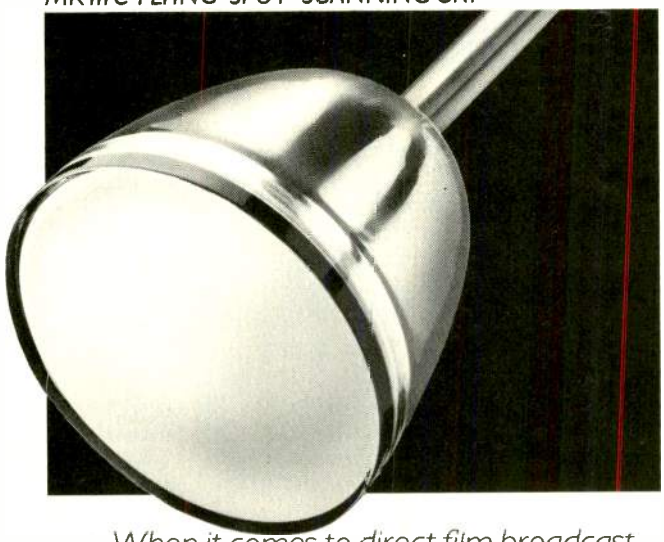
But there's one manufacturer who just doesn't agree – and that's Rank Cintel. Now, the only telecine specialist in the world has two products that clearly make the point: the Mk IIIC and the ADS 1.

The Mk IIIC is internationally recognised as the best when it comes to high-quality film transfers. Thanks to X-Y Zoom, it's the only advanced telecine capable of optical zooms and moves at full tv resolution. True still-frame reproduction is another plus made possible by flying-spot scanning technology. And as for the pictures, they are outstanding – from positive or negative stock shot for wide-screen as well as normal presentation. Of course, this impressive post-production capability – even secondary colour – can be programmed on Amigo, the simplest, most powerful telecine computer. And the FeRRIT sep. mag. sound-follower brings Rank Cintel quality to post-production audio.



ADS 1 CCD SENSOR BLOCK

MK IIIC FLYING SPOT SCANNING CRT



When it comes to direct film broadcasting, everybody can appreciate the versatility and sophistication of the Mk IIIC – but not everybody needs it. The new alternative is the ADS 1.

Designed specifically to meet the direct-broadcast needs of today's tv-station, ADS 1 offers the right performance at the right price. This is achieved by combining compact, multiplexed design with modern manufacturing techniques and the latest in solid-state technology. For the broadcaster, this approach pays off handsomely at time of initial purchase. Then it pays off with low daily running costs. Then it pays off yet again when it's time to expand. And important features like variable speed, programmable A/B roll and a unique dirt and scratch concealment system prove that these economies have not been made at the expense of performance.

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The maximum for the minimum

In designing the HK-302, Ikegami kept the frills —and the price—to a minimum while maximizing the performance. And that helps keep a moderate equipment budget from interfering with first-quality program origination.

However, staying with the basics doesn't mean sacrificing advanced technology. The HK-302's highly efficient optical system coupled to ⅔" low capacitance diode-gun Plumbicon* tubes and high transconductance FET pre-amps deliver sharp, low noise pictures (S/N 57dB) with excellent colorimetry. And the compact camera head includes a full range of operational automatics to ensure consistent signal quality.

Built-in test, maintenance and operational features are integral parts of this camera's "basics" as well. A comprehensive test pulse system lets you adjust the video with the pick-up tubes off or removed.

Complete monitoring circuitry and a broadcast quality sync generator with genlock are also standard features.

To add to the versatility of the HK-302, use the Ikegami automatic highlight compression option. It ensures highly detailed pictures even in high contrast scenes.

With the HK-302 you don't have to mortgage your station to afford prime time performance. So if you're looking for the maximum in studio production capability with a minimum of cost and maintenance, look over the Ikegami HK-302. For complete information and a demonstration, contact Ikegami.

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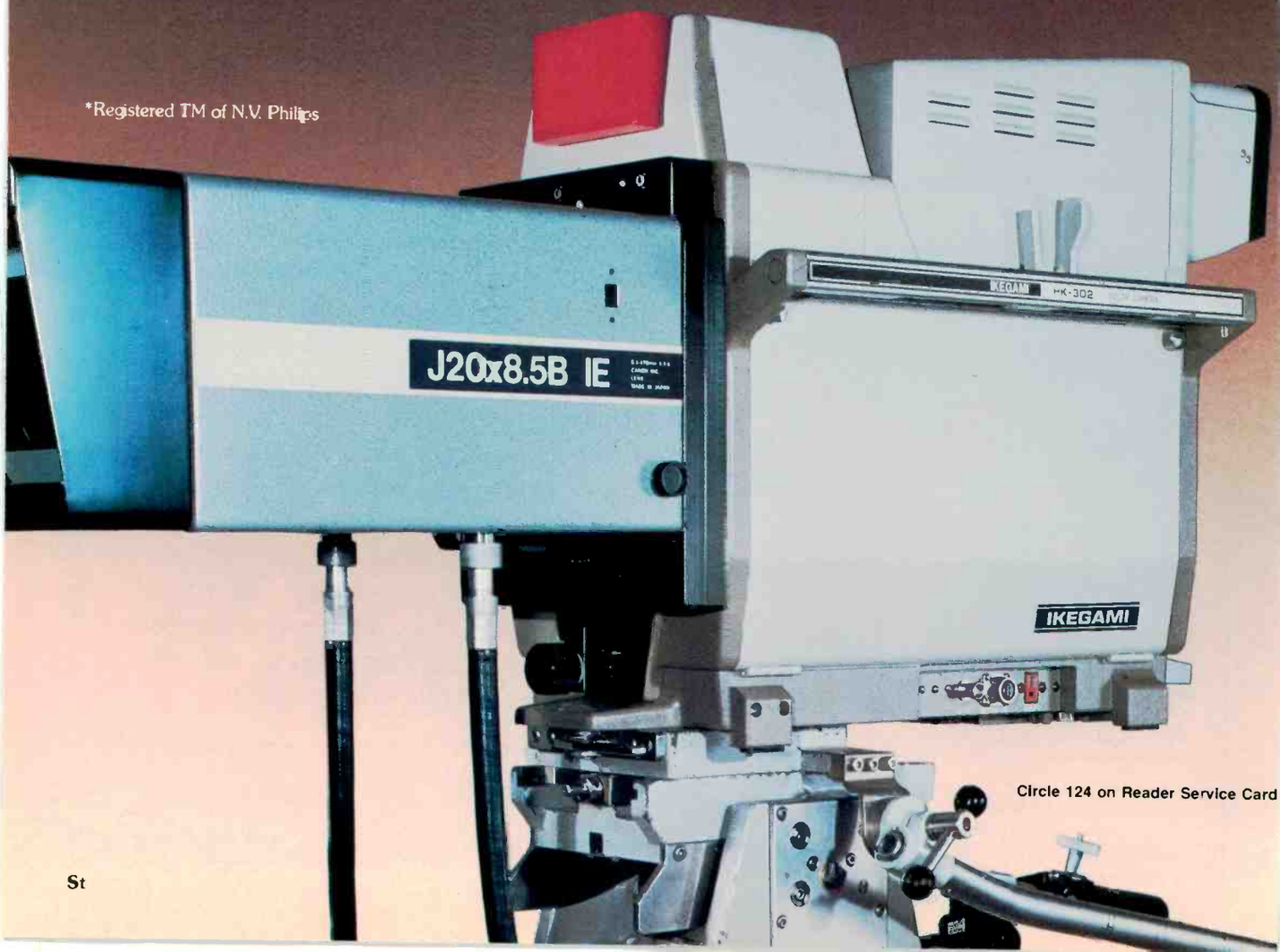

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St

ple). The MicroKey system includes both genlocking ability and adjustment of the output signal (H phase, burst phase, and proc amp controls) and includes both RGB and composite keying. Price for the PC version of MicroKey is $2500.

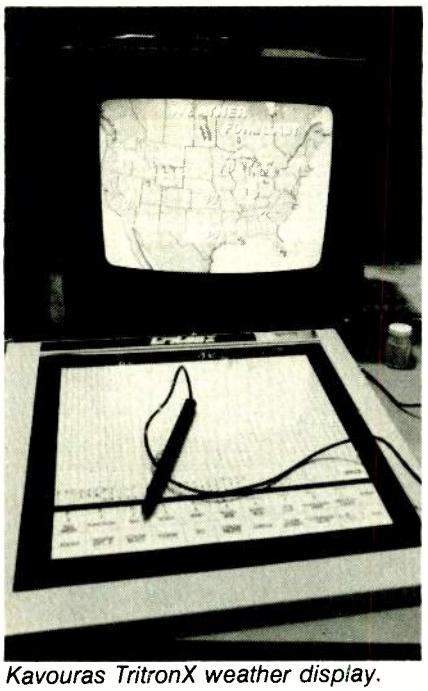
Not all graphics developments fall within these lower-cost boundaries, of course. There are still the "mega" systems such as Mirage and the FGS-4000 if you have the inclination and resources. Both systems are also continuing to undergo development. On the Mirage front, Quantel has now added the new capability to expand as well as compress the live video which forms the image. This gives the system not only the ability to expand the entire raster, but also allows it to expand just a local area when called for in an effect (a globe, for instance, compresses images at its edges but expands the area at the center).

Another new option for Mirage gives it the exciting ability to float the viewer's point of view anywhere within the 3D space surrounding the object—including a position inside the object looking out. Previously, of course, although a 3D object could be defined and rotated about an axis, the viewpoint stayed stationary in front of the obect. Now it is possible, in real time, to move inside a cylinder and examine its walls or take up a stance inside a globe and watch the world moving by overhead.

Another new Mirage feature is that it can now be configured without the rather costly 3D graphics compose station. In this way, the production facility or station which simply wants to add a set of effects patterns without necessarily modifying them or creating new ones can simply read them in from a floppy disk. The compose station can be added later if desired.

No less spectacular are the developments in the Bosch FGS-4000 3D graphics system. It already does the kind of floating viewpoint perspective now offered in Mirage. So to go one better, Bosch now offers an incredible 3D editor. This basically gives the ability to instantly convert 2D images into 3D images by "thickening" them, which provides the appropriate 3D perspective. Or the operator can type in the X,Y,Z coordinates of the 3D object directly.

Other new features of the system relate to its graphics capabilities. All sorts of exciting effects can now be added to previously created wireframe line drawings—neon glows, sparkling trails, and so forth. The FGS also now incorporates a full-fledged paint system, allowing colors to be added through a bit pad digtizer and then manipulated along with the 3D objects through the standard keyboard.



Kavouras TritronX weather display.

Productivity is the name of the game, no matter what the price tag of the system. To prove the point, MCI/Quantel released a set of figures which included the information that the BBC in London produced 1254 stills in just five days using the Paint Box, that WCVB in Boston was able to increase its graphics output after only two weeks with a Paint Box system, and that all NBC news graphics material originating out of New York is Paint Box created. Not content to rest on its laurels, Quantel has made some additions to the Paint Box repertory, including a new, 90-style typeface library, and the facility to take a cut out of either still or moving footage and paste it over live incoming video. There is also now a "tack" function which allows temporary pasting down while decisions are being made.

Weather displays

The presentation of on-air weather graphics is becoming a matter of great personal pride to stations in every size of market—one of those factors, along with the personality of the newscaster, which viewers seem to relate to (they actually remember which station has which kind of weather graphics).

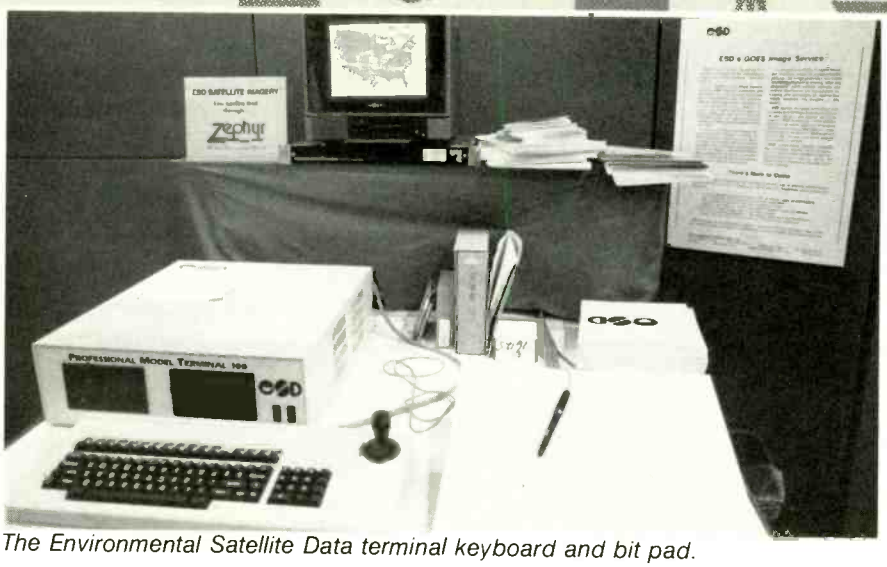
This is being fueled even more by the introduction of the government's new RRWDS live local weather radar displays. Several manufacturers are now actively promoting systems that will allow a station to access this data—especially Alden, which was first on the block. The C2000R/S allows both storage and display of the live feeds, with colorization of six levels within the display and flashing on any level to add emphasis. Naturally the system also offers access to other weather information databases such as NWS satellite photographs and weather data, which can be colorized to 16 levels.

Another way stations can increase their productivity when it comes to weather displays is to add a software package to an existing art/graphics product, enabling it to access the various weather services such as WSI and ESD. This is now possible with new software for the MCI/Quantel Paint Box. And the same is true of the Thomson-CSF Vidifont Graphics V, which has facilities for accessing both WSI and ESD. A special feature of Graphics V is that it can accept weather data on two separate memory planes, then display them together. In this way, the WSI map can be taken in on one plane, and weather data on another, and the two manipulated separately. It is also possible, through the Vidifont's off-line entry capability, to have the temperature data automatically updated from the WSI feed. The new readings are simply slotted into prearranged windows without the forecaster having to do any manual entry at all.

Dubner, Computer Graphics Labs, and Aurora all also offer weather packages for their art and graphics systems.

McInnis-Skinner has been offering its WeatherGraphics standalone weather system since 1979. This past year the company was acquired by Beston Electronics, the maker of the Newscan newsroom computer, and at NAB WeatherGraphics was positioned as a component of a total automated newsroom. (This is possible because one CPU operates all the newsroom software, and the weather system as well). Also, the company continued the development of the WeatherGraphics system as a production graphics tool, and gave the production configuration a new name, Datagraphics.

As Datagraphics, the system offers the same resolution WeatherGraphics has had for the last couple of years, 640 x 480 pixels, as well as a high-resolution, 1920 x 480 version.



The Environmental Satellite Data terminal keyboard and bit pad.

stations across the country, plotted in a high-resolution, national radar summary once an hour.

Kavouras is a one-stop weather company that provides hardware, data, and service. The company has its own data service, called Real-Time Atmospheric Monitoring (RAM), which feeds Kavouras's own hardware, the Triton X terminal (a high-resolution graphics system). Kavouras also offers a dial-up radar system, GOES satellite images, Doppler radar, and a new downlink service. So far the company has sold four downlinks to stations who do not wish to access their information by telephone.

Colorgraphics brought its latest generation of LiveLine standalone weather systems, the LiveLine IV, to NAB '84. The system, which is based around a $65,000 paint system called ArtStar, features a graphics computer and computer terminal, a monitor, graphics tablet, and telephone modem. These peripherals are used to call up Doppler radar, WSI data, dial-up RRWDS, lightning strike display (called FLASH), and graphics prepared on Colorgraphics hardware by forecasting company Accu-Weather. ArtStar is also being positioned as a production tool, and also as a component of Colorgraphics' newsroom computer NewStar.

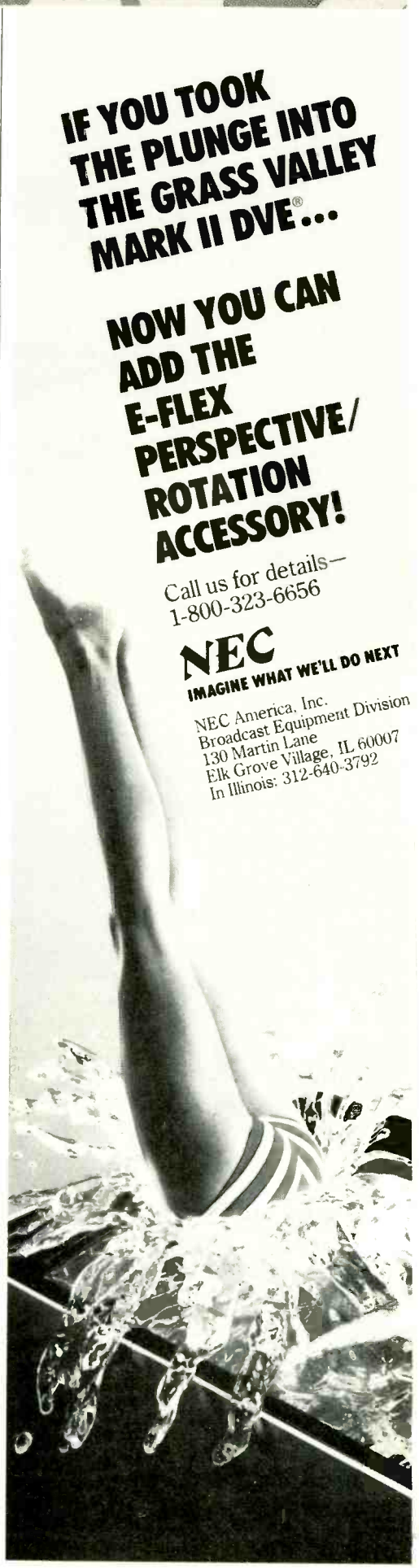
Terry Kelly, the company's president, stresses that ArtStar is, in a sense, expandable—it has "networking capabilities." A station, he says, can buy one ArtStar computer, and for $25,000 each, they can buy additional workstations. The workstation consists of all the hardware except the computer.

Excitement is also running extremely high over the new WITS (weather image terminal system) from Vectrix, priced under $10,000. Like many weather display systems, it accesses most of the weather service databases and produces full-color images based on the data it receives. But this unit does a lot more, coming as it does from its background as a computer graphics workstation. There are two main software packages: one is an interactive painting and graphics program that uses a digitizing tablet; the other, using simple BASIC programs, allows the station to create an enormous array of high-resolution images, including 3D models, frame-by-frame animation, and so forth. A character generator is included as part of the package, while a camera-based digitizer is an optional feature.

Still stores

In every area of graphics, the move is on to make systems that will be affordable to all industry segments, and still stores are no exception. NTI America, for example, has come onto the scene with an exciting new digital still store, DSS-11, priced at $10,000 for a single disk system. One of the best features is a maximum recall time of only 0.35 seconds to any of the 500 frames/1000 fields stored on each disk (maximum system size is eight disks). Extremely high image quality (50 Hz – 50 MHz ±3 dB frequency response with 56 dB S/N) is achieved with NTI's patent-pending color compensated SPF system; rather than being separated, the color signal is passed intact through a phase filter to insure faithful color reproduction.

ADDA is now proudly promoting the virtues of its ESP-II still store offering a 30 percent reduction in equipment



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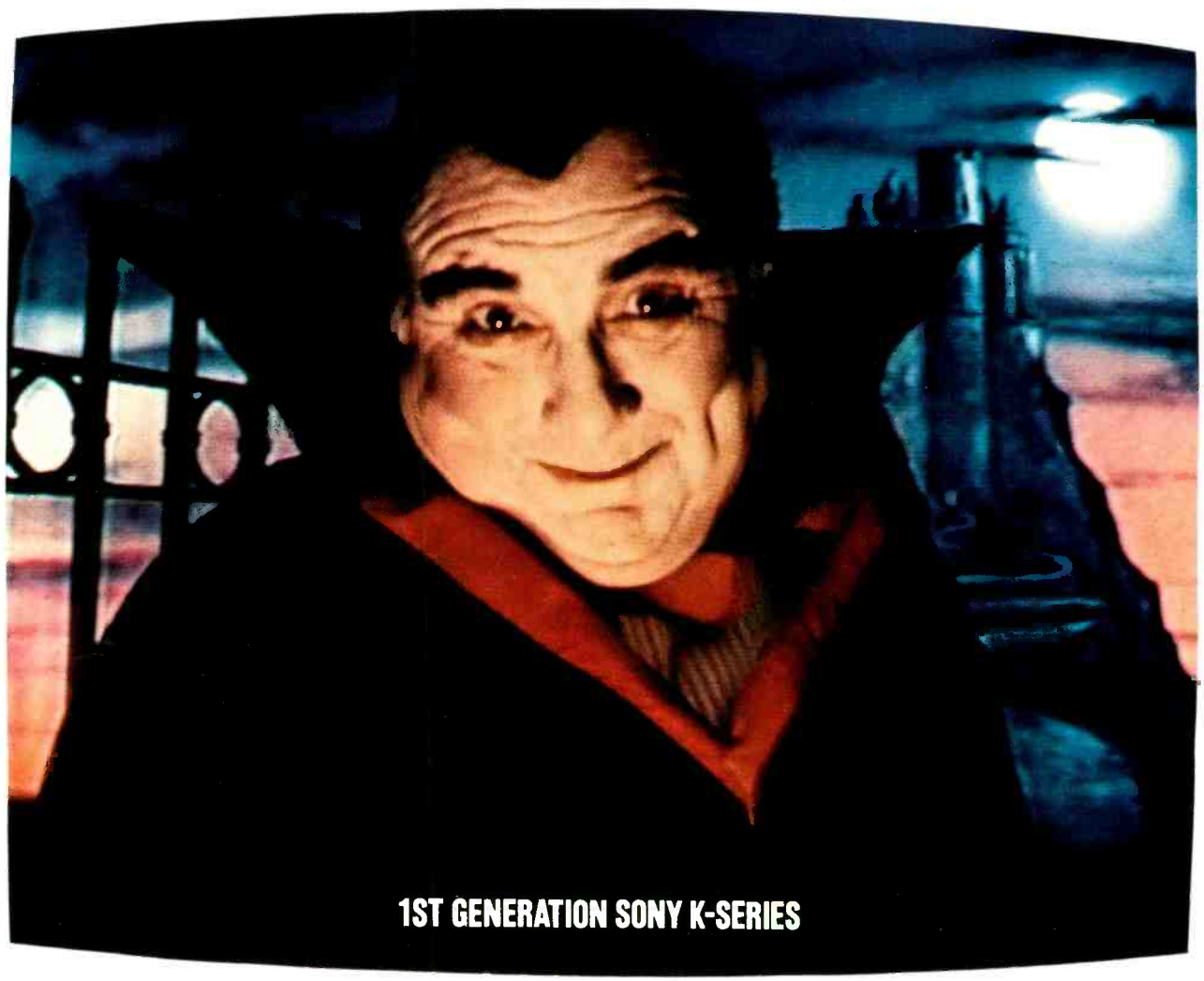

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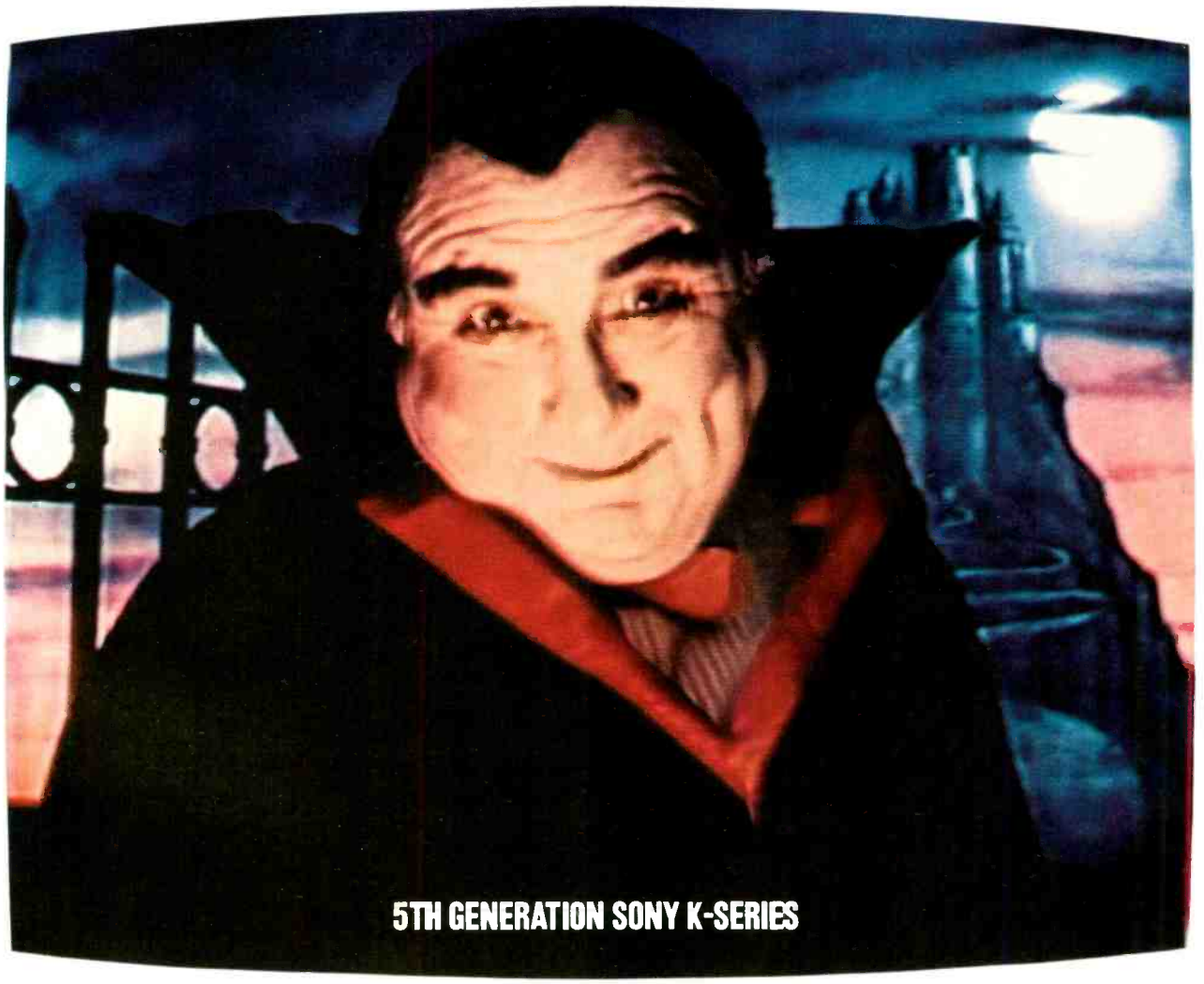

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size and a comparable decrease in cost over its ESP-C still store. It's a completely modular system, offering extensive special effects capabilities in addition to basic still field/frame storage, and the ability to manipulate and composite stored images without really having to resort to outside devices. Effects, achieved with single pushbuttons, include push ons and pull offs, dissolves, and H, V, and corner wipes.

Abekas, whose single-purpose "video slide projector" got the whole movement towards smaller still store systems underway last year, this year unveiled digital input and output ports on the system, allowing it to interface digitally with many other types of graphic equipment. The single-channel system, priced at $19,900, uses 5.25-inch Winchester disk drive technology to handle 1050 frames/2100 fields on line with a digital streaming tape drive for off-line storage.

Although many developments in this field are being designed to make systems smaller and more affordable, there is still plenty of room for the larger, distributed processing schemes. Quantel, for instance, which recently reduced at least the size of its still store electronics package, is still making progress with its Central Lending Library. The idea is that a user in the system can "borrow" an image stored in the mass memory, then work on it using a Paint Box or Mirage or other digital processor, then ship it back to the central library when completed. A new feature on the system is a "privacy" mode in which a slide can be designated as private property of the user until work on it is completed and the slide released for general use.

For the Iris II, Harris has several recent updates, including the IGS graphics compose station, designed to increase the still store's production capabilities. IGS offers variable compression and expansion from 1/10 to 2x size, variable positioning, bordering from eight pixels wide and up with full control of color, hue, and saturation, cropping, and H and V distortion. Up to nine stages of a composition can be memorized by the IGS and then replayed on command.

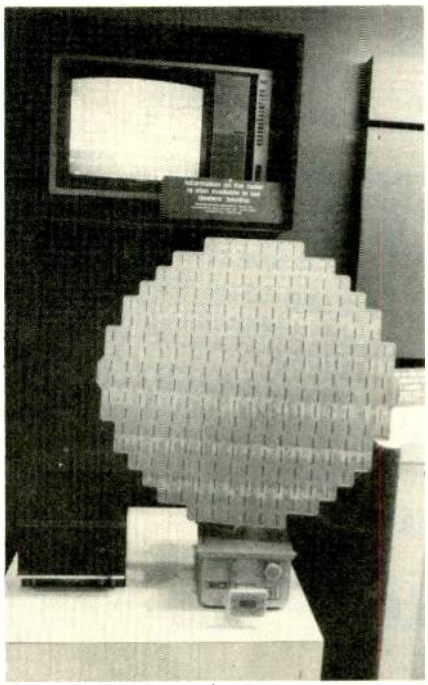
Harris also now offers a mini-control panel for Iris, designed to fit adjacent to the IGS control panel in 5.25 inches of rack space. The Mini-Controller can be operated either as a standalone unit, or several can be daisy-chained and operated through one of the Iris's six user ports.

Ampex, too, is now offering a composition station for its ESS-3 still store, where the operator can assemble portions of different images of virtually any shape or size. Image manipulation features include transparency control, H and V mirror effects, blurring, and luminance or chrominance keying. Captioning has also been improved, and the ESS-3 now uses scanned-in video fonts rather than a character generator output. All of these effects are achieved in the component digital format, insuring the highest quality.

Ampex is also introducing a new remote access station for the still store. For on-air use, it can play a preprogrammed list of stills. Or, during off-line operation, it is used to build and edit play lists.

Animation systems

One other trend in graphics is surely worthy of note: the increasing emphasis being paid to animation at all levels—even at local stations. Part of this development is being fueled by the interest in Sony's BVH-5000 single-frame animation recorder, with both Lyon Lamb and now Aurora offering interfaces to automate the recorder (in the case of Aurora, the animation control feeds computer graphics images to the Lyon Lamb controller, which records frames one at a time on the BVH). This year, Ampex, too, has joined in, offering animation-style single-frame recording for the VPR-3.



Collins doppler radar system.

Computer systems offer the advantages of precision and repeatability—the computer can memorize complex camera moves and repeat them over and over, making the system a special-effects tool. Computer systems also provide the option of recording one frame at a time, or in real time.

Interactive Motion showed its Model 3565 Motion Control System, which is essentially a $40,000 computer with a keyboard and display, control units, communications ports, motor drive systems and software. The company also features a Motion Control stage, which includes a track, camera lifter, camera mover, camera pan/tilt head, and model mover. New options featured at the show were the Model 8000 Interface Console which, according to IMC's Bill Bryan, is a "more streamlined control system," and an Operator Interface Console. This $10,000 piece of gear allows a facility to "attach Motion Control equipment to an on-line edit suite," says Bryan.

Euro Equipment showed a similar system which consists of the Magstand animation stand and the Automator Plus computer control unit. The French-produced Magstand can take on either a film or video camera, and features electronic focusing from a 1:1 ratio, production of curves with two or more points, and coloring of video logos in movement.

The Automator control unit includes a control panel that permits the manual control of six independent axes; a 12-inch monitor and a floppy disk unit for the storage and recall of programs.

Forox offers a video-only computer animation system. Components include a copy stand with a JVC KY-1900 camera connected to a ¾-inch VCR; an animation compound table; and the Model SSA800 computer controller. The camera is moved with a keypad, and x-y-z axis instructions are handled with a keyboard.

Elicon showed its $168,000 Camera Control System, a multi-axis camera motion-control system that uses a Digital PDP-11 minicomputer along with Elicon servo drives to control a boom arm configuration that moves along a track. The system does not have an animation stand, though it can be retrofitted to them. Also included in the system is a follow focus, which operates with most standard film cameras. The follow focus is designed to automatically keep motion picture optical

printers and animation stands in focus during zooms. A new option introduced at NAB is voice control.

The Warren R. Smith company had its analog animatics/photomatics system at this year's show. The system features a graphics stand for video animatics ($32,125) and, new this year, a slide positioner ($12,900). Also new this year is a tilt-mirror periscope lens.

Frank Wooley was back this year with his Motionmaster Video Animation system, a nonelectronic product that uses polarized light to create an animation-like effect similar to electronic color palette animation. According to art director Larry Whalen, this year they have "cleaned up the light." They have filtered out the polarized light so it's not picked up by video cameras.

But perhaps the most exciting development in animation still lies ahead the possibility of digital recording of the animation sequence. This at any rate is one of the promises of HENRY—a brand-new system from MCI/Quantel that is still in developmental prototype and was shown only in a hospitality suite. Quite simply, HENRY is a massive random access picture store able to digitally record frames of video (including a live sequence), then play the frames back in real time.

During playback, the sequence can be edited to change the frame rate; or images can be passed back and forth through other digital devices such as Mirage and the Paint Box to add effects.

It's obviously going to be a product with far more potential than a simple animation system, since this is exactly the kind of approach to video editing being advocated by many in the industry: store the images digitally, then play them back in sequences which can be adjusted without ever having to record anything on tape until the edit is finally completed. Quantel is not speculating about the future of the product at this time, but the editing application seems almost inevitable.

Character generators

The most significant character generator introduction at NAB '84 was not really an introduction at all: Cypher, MCI/Quantel's "ultimate caption illusion," was shown in prototype form at last year's show; this year it was on the floor as a production model.

According to company president George Grasso, the first Cypher will be delivered "about 90 days after NAB," and the price of the basic system is $102,000. This represents the most current information on Cypher. The system itself seems to be essentially unchanged from last year's product—at least in regard to its basic features (and there are quite a few powerful ones).

Cypher features "print quality characters," which is made possible by the same technology used in the Paint Box. Ninety typefaces are currently available out of a total library of 1,440. Italic characters are also available, and all characters can be manipulated in three-dimensional space. There is also no limit to the number of characters that can be present on the screen at one time; and characters can overlap each other in any manner. There are also a number of special effects offered, among them a keyframe animation effect. Hardware consists of a keyboard, a control panel with tracker-ball and wipe arm, and a floppy disk drive. The host computer is a Motorola 68000 with a Winchester disk drive.

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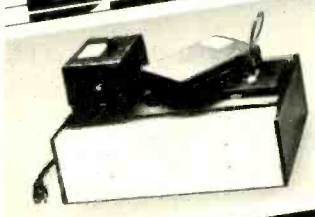

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There is also some discussion, inspired by Quanta, over what it means to call a character generator "font loadable." According to Quanta, its software-based Q8 is *face* loadable. FontFlex, as the system is dubbed, loads basic typefaces such as Times Roman. Once loaded, the basic typeface can then be manipulated, changing point size, slant for italicization, and so forth. In most other systems, of course, fonts are married to point sizes, so one needs Times Roman 12 point and Times Roman 20 point to compose with both character sets.

In a new development, Quanta will shortly begin offering a twin 5.25-inch removable disk pack for both loading fonts and storing messages. Besides improving loading speed three times over the existing eight-inch disk system, it means that hundreds of fonts and messages can be stored on a single disk pack. (Quanta at NAB announced the delivery of its seventieth Q8 system, whose basic price is $33,000).

3M entered the lower-priced CG market with its D-1000A and also added some options to its D-8800. The D-1000 features include: eight background and character colors; a built-in keyer with genlock; edge and drop shadows; four character sizes; three-speed roll and crawl; 22 characters per row; and independent edit and program channels. The new optional features on the D-8800 are software for interfacing the existing D-8800 hardware to almost any black-and-white camera (called camera compose); and a "billboard" software package, which provides for automatic presentation of prerecorded displays on the "program" channel while simultaneously allowing composition and update capabilities on the "preview" channel.

Chyron, proclaiming itself to be the manufacturer of the world's most widely used electronic graphics system, the Chyron IV, has now introduced a new version of the system with memory size doubled over existing units. Although all current programs will run with the increased memory size, there are several new features, including 3D rotation on any axis, "pinwheel" rotation on any axis, perspective creation, enhanced bordering capability, scaling and resizing, and cut and paste graphics.

At the same time, Chyron also announced that it now has a camera-based font compose option for its RGU-2—similar to the font compose available for the Chyron IV. Fonts are captured one letter at a time. Once captured, the letter can be edited to clean up the image, and the whole font manipulated to produce text of different sizes and italic slants.

Laird Telemedia had two CGs at its booth: the 3600A ($2995) with a number of new options that include a second channel and a dual disk drive; and the 7200 Communicator, which also now offers a second channel option.

Knox introduced its latest CG, the K100 Chromafont ($2990 for the basic configuration). The system features a "fluid memory" architecture, which allows for a number of sophisticated features for such a low-cost unit. Based around a Z80 microprocessor, the K100 has a resolution of 60 ns and an 8000-character memory that can be organized as 64 pages or 256 lines of characters. Two option packages are also available which will allow for such capabilites as character-by-character color control, and an interactive computer interface that will allow for the design and loading of custom fonts.

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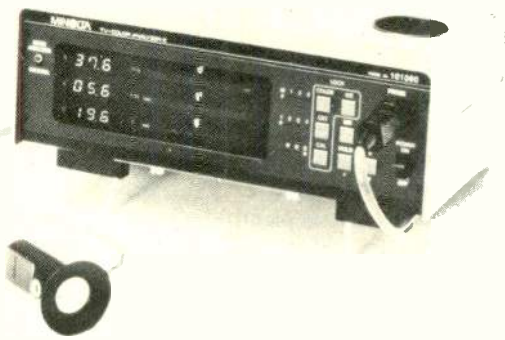

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Mycro-Tek, a first-time exhibitor at NAB, introduced a new CG to compete with the K100, the Mycro-Vision Max ($2,995). Feature highlights include: 70 nanosecond resolution; two standard fonts; and a 32,000-character memory that can be configured as 120 pages, with 32 characters per line at eight lines per page.

Wilk had its "preliminary" series 4400 CG at the show; it will be available 14–16 weeks from this writing. The system offers four fonts, 295 pages of memory, 256 colors and shades, automatic page rotation, cycling and centering, and full cursor-controlled editing features. A series 4400 can also control other similar units via telephone or cable lines; and each 4400 chassis can be programmed from one or more keyboards or Apple computers. Options include a second channel, a second disk drive, a graphics tablet, and multiple character fonts.

New TV Technology: Neither Great Threat Nor Opportunity Seen at NAB '84

DBS is not a threat. Multichannel MDS is a new ballgame more as competition to cable than TV; cable's main impact has already been rendered. LPTV is not STV but more like radio with pictures. Unless broadcasters get behind teletext it won't come about. Ten year old VCRs will have more impact than new technology on TV viewing habits and patterns. Those five sentences are a quick summary drawn from three different television management sessions held at NAB 1984.

The picture on the exhibit floor was a little different. There, teletext was a technology battle between two systems designed to win the hearts and minds of broadcasters. MDS and LPTV transmitter equipment was plentiful. On the other hand, DBS, STV, and cable were practically nonexistent. One exception was Ancom, the joint venture between Alcoa and NEC, which showed a home terminal set for DBS.

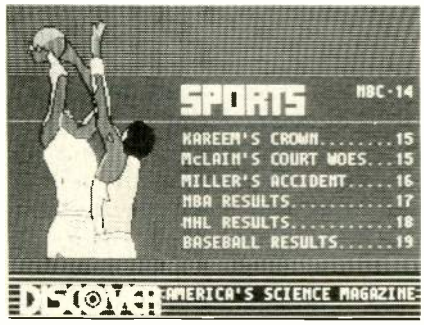
The undeniable impact of the VCR was articulated by Paul Bortz of Browne, Bortz and Coddington, past consultant to broadcasting, cable, and MDS interests, among others. Public awareness of VCR is extremely high, said Bortz, since the product has been promoted well for the last eight to 10 years. The price value point was established two years ago when recorders reached $500 or lower. The product is priced for takeoff, Bortz predicted. He likened VCR sales volumes to those experienced by color TV sets a decade earlier. Their sales curves track, he said. VCR penetration is now 12 percent; it could go to 20 percent this year and soon to 40 percent.

William Lilley III of CBS was inclined to agree and pointed out that private studies show VCRs are used half of the time to watch movies and the other half for time-shift viewing. Time shift moves bigger audiences to the strongest programs because it no longer matters that good programs are opposite each other—you view one and record the other. Recording habits among working women move daytime soaps for evening viewing.

Cable and over-the-air TV can coexist, said Tom Wheeler, former president of the NCTA, who saw cooperation rather than competition between the two services in the future. Cable homes increase total viewership despite some network erosion. UHF and indie stations gained viewers as a result of cable, he said. Cable advertising has not hurt the broadcaster, according to Ellen Gibbs, president, Communications Resources Inc., and former media security analyst. In fact, she said, TV barter advertising is larger than cable advertising.

Lilley observed that the big change in network programming as a result of cable has already occured. The cable networks, such as HBO and Showtime, have already captured the movies, the variety shows built around celebrities like Diana Ross, and some sports. This has forced the networks into made-for-TV movies and the miniseries. Bortz pointed out that much talk of competition has been misperceived. He sees four elements to the business: program production, wholesale distribution (networks or satellites), retail distribution (over-the-air broadcast, cable, MDS), and home consumption. The new technologies have really only explored the wholesale distribution and retail distribution portions. With the growing importance of VCRs, he saw good opportunity for either broadcasters or the cable nets to produce programs for VCRs.

DBS was given little hope of success—except for possibly one distributor—by Ellen Gibbs. She foresaw cable passing 65 million homes, or 78 percent of the total, shortly. Thus DBS with five channels has nothing to offer this group. The remaining 18 percent is a sufficiently small market that it is unlikely to be able to compete for programming.



NBC television teletext display.

The possibility for multichannel MDS to succeed is there, said Bortz, simply because MDS operators could beat cable TV to the urban market. Although cable franchises may have been awarded, New York City, Chicago, Washington, and Detroit are not wired. If MDS delivered first, it would cut into the penentration cable needs, thus making it unprofitable. But MDS has its risks. Single channel MDS was inexpensive to install—$100,000 for transmitter equipment, $100 for subscriber equipment. Rates of $16 turned in good profits. Multichannel MDS, in groups of four or eight channels (or more if ITFS educational channels are leased), requires a one million dollar investment in transmission and $200 per subscriber since decoders are necessary. The product must sell for $25 a month, and perhaps against cable.

It is the inability to acquire premium programming that has dashed the hope of some SMATV operators and LPTV "networks." At the session on programming low power television, John Kompas revealed that only six systems offer STV services. HBO does

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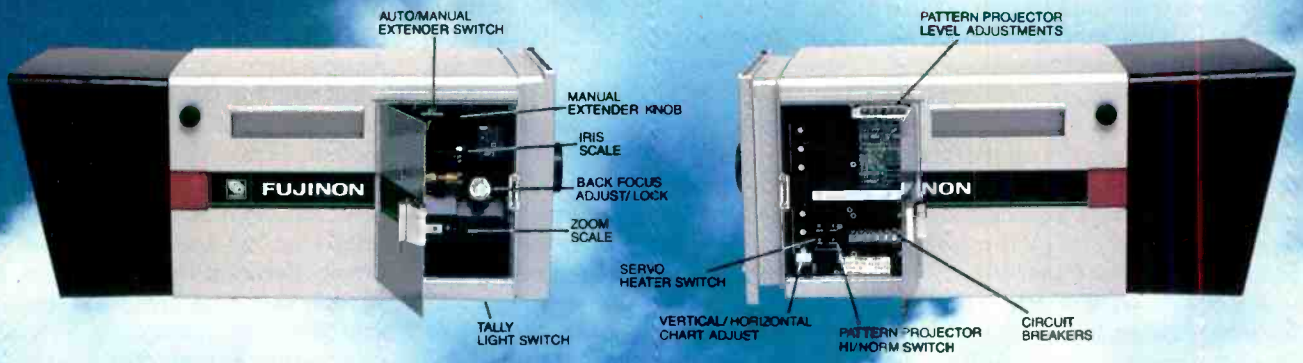

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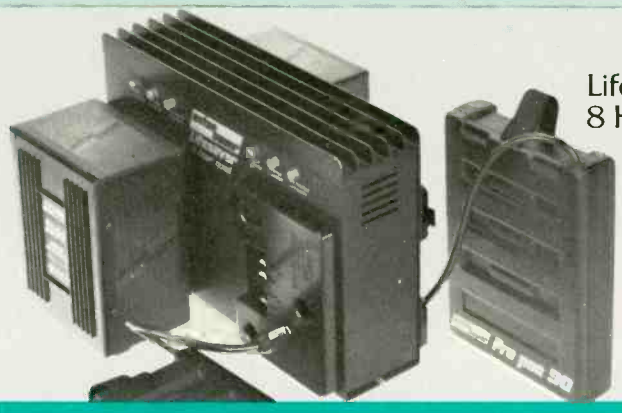
not sell its programming to LPTV, according to Ray Klinge of Satellite Programming Network. Most of the programming for LPTV is quite cheap or free. The JPD TV network runs old syndication and is not keen competition if there is other programming in the area. SPN does counter-programming; Community Television Services offers country music. LPTV stations will survive, all of the panelists agreed, not by network programming but by getting ad revenues from local community service type programming. LPTV is radio with pictures, said Frank Camora.

Nor was there talk of teletext being a big money raiser. If TV sets with inexpensive decoders finally arrive, and customers buy, sponsors will be found and there will be newspaper type ads sold. But at most, said Terry Connelly of Taft Broadcasting, profit is not visualized as being more than $100,000 to $150,000 per year. Teletext is considered worthwhile even if it merely breaks even because of its self-promotional value. Production costs are not high, said Barbara Watson of NBC. Frank Simonelli of Young and Rubicam sees teletext advertising as a helpful adjunct to regular TV advertising.

The big question to the teletext panelists is, "When?" Unfortunately, teletext supporters have been their own worst enemy in that they are pushing two different standards: the British-developed World System Teletext and the French-inspired NABTS. Most broadcasters have been reluctant to become involved until one or the other emerges as a winner. But until more teletext is broadcast, receiver manufacturers are reluctant to invest in sets with decoders. Zenith is one exception to date, but its World System Teletext-equipped sets cost about $300 more than regular sets, a price resisted by consumers. Panasonic is selling in Charlotte, NC, a $300 NABTS decoder, but that price is subsidized. The hopeful note at NAB was that World System sets would become available in early 1985 for about $50 more. A Rockwell-made chip for NABTS was announced at the session which should bring costs for this system down to the $100 range, said Jim Caruthers of Norpak.

Teletext monitors were everywhere at the Convention Center, displaying information appearing on WBTV in Charlotte, the first CBS affliate to begin a local service, and on the NBC teletext service that will be used at the New Orleans World Fair. VSA-Videographics Systems of America demonstrated a complete system, VST-100, for the NABTS standard, including the AT&T Frame Creation System, Series 500, at the Thomson-CSF booth. Members of the Charlotte news team were actually creating news inserts on the spot. Aside from the Frame Creation System, which has considerable high resolution graphics capability (the claimed NABTS edge over alphamosaic teletext), the VST-100 included a DEC 11/23 computer, a PDP 11/23, loaded with VSA software, and a VSA interface board. A VSA data bridge was shown as the means for a local station to pick up the network teletext feed. A multiplexer inserts the data into the vertical blanking interval. A Panasonic decoder and monitor completed the system. The decoder, the TU-1000X with wireless remote control, was also part of the Panasonic exhibit.



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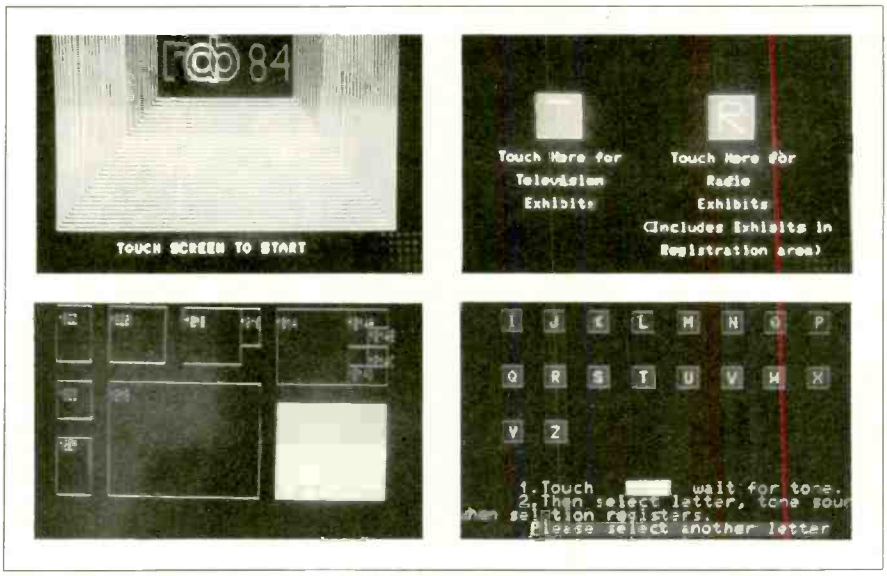
A data bridge and various pieces of vertical interval encoding and decoding equipment were on display at the EEG Enterprises exhibit. The TE 510 which can transfer NABTS data from one video signal to another costs approximately $8200. The Signatech Corp., a subsidiary of Compagne Continentale de Signalisation in France, demonstrated teletext transmission equipment including showing how a personal computer can format data.

Sony equipment for videotext, the VDX-1000 using the North American Presentation Level Protocol Syntax, was shown in a special suite at the MGM Grand.

The Ameritext exhibit, describing the World System Teletext approach, was filled with equipment from various manufacturers including Logica, VG Electronics, Jasmin Electronics, Aston Electronics, Sanyo, Zenith, and others. Ameritext promoted the cooperative effort that several companies will take at the summer Olympics to demonstrate teletext. Companies participating include KTTV Los Angeles, Harris, Keyfax, Sanyo, Taft Broadcasting, and Zenith.



Four screens from interactive information display assembled for NAB show by Lynch Exhibits.

Some new technology in the wings at NAB 1984 included 3-D TV. N-Depth 3-D developed by Craig Development Corp., Gaithersburg, MD, was demonstrated throughout the show at the Sahara Hotel. A feature of the system is that only one channel is needed to shoot scenes—a mirror offset to the left of the camera lens captures the other image. A pair of stereo images are formed one above the other on the receiver. When viewed with N-Depth glasses, an optical wedge over the right eye causes the two stacked images to be superimposed, giving the brain a three-dimensional impression.

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Specifications

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Type No.	Diameter (mm)	Overall length (max. mm)	Focusing method	Deflection method	Amplitude response (at 400 TV lines) (%)	Center limiting resolution (TV lines)	Lag at 3F (%)	Output capacitance (pF)	Application
H9387D	25	163	Magnetic	Magnetic	70	1,200	1.2	2.5	Portable and studio cameras
H9386D	18	106	Magnetic	Magnetic	60	1,000	0.9	1.8	ENG and EFP cameras

Electrostatic deflection type SATICON III

H4125	18	90	Magnetic	Electrostatic	65	1,100	0.9	2.5	ENG cameras and studio subcameras

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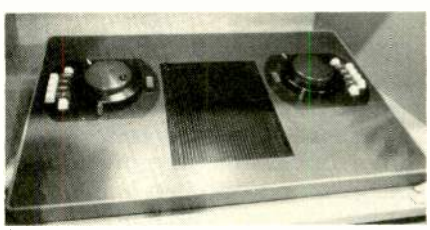
Editing Takes a Cue from Film

Film and tape technologies have been making tentative passes at each other for years, but the courtship intensified this year, with several new editing systems hinting at a possible attempt at union. Perhaps most symbolic of the merging trend was Eastman Kodak's introduction of Eastman Professional Videotape, the first foray into video imaging by the film giant. Kodak is by no means giving up on film and was promoting both its high-speed negative and low-contrast print stocks, as well as its Datakode magnetic coating for recording time code on film, which is still seeking acceptance.

It was in editing, however, that the real excitement came as editing system manufacturers explored their imaginations for creative new approaches to video editing. Two significant new systems, EditDroid and the Montage Picture Processor, created the most excitement. While both showed the influence of film editing, they differed radically from each other.

Ron Barker, the president of Montage, says he got the idea for the Picture Processor from his hobby of flying radio-controlled model helicopters. He had no trouble performing difficult, complex stunts as long as he worked instinctively; an attempt to direct the manouver with his frontal lobes, however, nearly ended in an accident. Montage is an attempt to allow the editor to work instinctively, totally ignoring numbers and even words in the process. Scenes and takes are labeled with pictures for instant graphic representation. The main console controls are a pair of



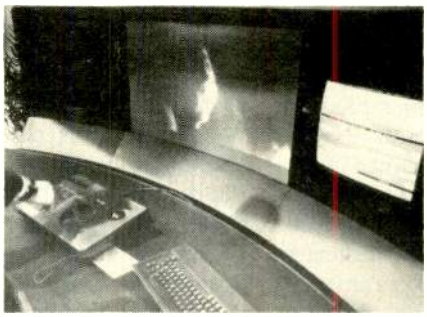
Montage Picture Processor control console.

hand-sized knobs, supplemented by a small number of buttons for picture editing and picture processing functions. At the editor's request, the system will display head and tail frames of seven short clips of video, scrolling through them on command and placing desired takes in electronic "work bins." (Unused bits go into a "discard bin," where they can be recalled if desired.) At a command, the computer will also scroll through any particular clip frame by frame. This "picture processing" and editing is clean, simple, and direct.

What makes the simplicity possible is a powerful microprocessor, the Motorola 68000, and up to 22 Z80 chips. Source material initially is recorded onto as many as 14 Beta Hi-Fi consumer transports, which serve as the sources for the console's digital images. The large number of VCRs, each holding identical material, gives the system its speed. They communicate with the console via intelligent interfaces that read and generate time code, although the user is never aware of the code. The system is capable of instantly trimming, splicing, and inserting clips in any desired order and can produce several wipes and dissolves in addition to straight cuts. It remains an off-line system, however, producing a completely clean EDL on floppy disk.

Two unusual options deserve special mention: a "storyboard printer" that turns the digital video on the 14 black and white monitors into a hard copy output, and an "electronic grease pencil" for actually writing on the frames of video. All this advanced technology does not come cheaply. A stripped-down monaural system with seven Beta transports starts at $150,000, with the fully expanded system (including stereo audio and 14 Beta Hi-Fi decks, dissolve/wipe unit, two TBCs, auto-assembly driver with eight-inch floppy, storyboard printer, and electronic grease pencil) lists for $262,000.

EditDroid, the much-touted system developed by Lucasfilms in conjunction with Convergence Corp., offers the speed and simplicity of Montage, but the comparison ends there. As its parentage implies, the system was developed to make the video editing process as much like film editing as possible. A CRT logsheet display, which can be user-configured, allows the user to enter and store almost unlimited amounts of scene and take information, including descriptions and durations. The screen also provides graphic displays of editing functions, with a cursor that changes shape, resembling a pair of scissors when cutting, for example.



Convergence EditDroid system.

The cursor is moved by means of a trackball on EditDroid's stripped-down keyboard (alphanumeric information is entered on a separate typewriter-style keyboard). A large shuttle knob, designed to recall the speed controller of a flatbed film editor, moves the video forward and reverse and contains a rocker switch for forward and reverse jog. The trackball and shuttle knob, with a couple of associated buttons, control most editing functions. Twelve additional keys control the rest, relabeling themselves with LEDs as their functions change.

While it can control all kinds of source machines, including VTRs, EditDroid is built to take advantage of what many see as the next trend in video editing, the videodisc. The unit in Convergence's NAB booth was interfaced with three Sony disc players (a standard EditDroid configuration can control up to 32 machines).

The primary advantage of discs, of course, is their rapid random access to any point in the program material. Their primary disadvantage is the difficulty of getting material mastered onto disc. It is almost universally believed, however, that disc mastering services will proliferate and that the cost per disc will drop dramatically from the rare "secret supplier" who will do a non-reproducible disc today for $300 to large-scale commercial operations that will churn out discs for less than $100. Recognizing this, editor manufacturers are losing no time in interfacing their systems to discs, following CMX's lead of 1983.

Film themes

The theme of film-style editing was reiterated by EMME, EECO's entry into the high-end editing market. The system (the name stands for EECO Multi-Machine Editing system) was

co-developed with Swiderski Electronics of Elk Grove Village, IL, whose design team included Jim Adams and other key people concerned in the development of the Bosch Mach One editor. EMME is a totaly new design that controls up to nine VTRs and ATRs plus production switcher/effects package. Particularly interesting is the choice of three different kinds of keyboard controls. The main one, called the Independent Creative Workstation, is a dedicated keyboard in which single keys are used to access all machine control functions. The second, the Integrated Creative Workstation, is an interactive design that functions through the video production switcher. It features an active EDL and control through trackball or mouse. The third kind, designed specifically for film-style editing, is the Cinemagraphic Creative Workstation. No time code numbers are displayed on the status monitor and the editor simply makes selections about in and out points based on visual and audio cues; the edit decision lister takes care of the rest. EMME sells for $35,000 to $65,000.

EECO also introduced an A/B roll version of the IVES system that controls three VCRs, plus a production switcher/effects system. Also, EECO has for the first time introduced an editing interface for half-inch recorders. The project was instigated by Panasonic, and the editing system, with Recam recorder interface, was demonstrated at the Panasonic booth.

The videodisc theme was carried through several exhibits at NAB. Ampex, for example, showed its ACE system interfaced with a videodisc system from Spectra Image of N. Hollywood, CA. The Spectra Image laser playback system has two lasers, allowing it simultaneously to read two points on the same disc and resulting in one second end-to-end search. The dual lasers also allow A/B rolls off a single disc. "It's literally real-time editing," says an Ampex spokesman, Mark Gray. "It's so fast you can't keep up with it." Ampex is working to position its ACE system as a supereditor in head-to-head competition with CMX. The company had both the touchscreen and dedicated keyboard versions of ACE on display, with new software offering four user-programmable keys (each storing up to 100 events, the last of which can be used to flag the next key) and a user-definable display of part of the EDL on the construction page. The system is also now capable of complete multiple M/E control, including the downstream keyer, on Ampex's AVC switcher.

Montage, too, is fully aware of the trend to videodiscs, and had a system in its hospitality suite using discs as sources.

Active research

CMX, of course, offers videodisc interfaces for its new systems, the 3400 and 3400+. According to company president Phil Arenson, over 100 3400 systems are in the field, with the second generation of 3400s set for delivery shortly. The touchscreen and voice recognition options, part of the 3400+ package, have also been released and are now in use. The +Touch option is $7000, while +Voice is $6000. Arenson is adamant about his company's leadership in editing systems, and few would dispute him. "We spend two million dollars a year on research and development," he states, "which

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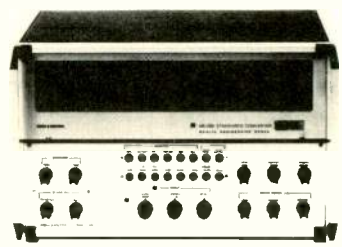

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is more than any other editing company writes in orders." All those R&D dollars have helped develop new features for the 3400, including expanded memory, multiple edit decision lists, dynamic sort modes, match cut calculation, and new GPI initializations. In addition, the company announced a new I² for 340/3400 editing systems, designed to permit control of up to four machines capable of serial interface.

The biggest excitement at the CMX booth, however, was an unnamed technological concept tucked off in one corner. This product of CMX's R&D department, while in no way a finished product, points to the possibility of what could be the simplest, most direct editing system ever. All editing functions are performed on a monitor, which displays two strips of video, about seven frames each. Audio is "visible" on the right of each strip. The operator can scroll forward and reverse, selecting in and out points on either strip by simply touching the appropriate frames. The machine then displays the splice, showing the new "strip" created by the edit. It will also review the completed edit full-screen. The system uses any video source, including, of course, discs. Where this concept will lead remains to be seen; we'll have to wait until next year to see if feedback from NAB visitors will lead CMX to introduce a new product.

The idea of showing a series of video frames like a strip of film held up to the light has obviously caught the imagination of the editing community. In addition to CMX and Montage, Asaca had a device that displays frame-by-frame video clips. Each of these units, of course, employs substantially different technology, but all display strips of frames and allow the operator to scroll through them during the editing process. The Asaca unit, the AEV-300 EditMaster multi-image viewer, displays four strips at once and interfaces to CMX and ISC editing systems. (Interfaces for Convergence and Datatron systems are expected shortly.) Based on a digital memory system, it will scroll forward or backward at variable speeds and still frame. Audio appears as a ragged right edge, allowing the editor to match an edit with a break in the audio. Sources may be

Asaca AEV 300 multi-image viewer.

VTRs or—you guessed it—videodiscs.

Perhaps recognizing the timeliness of the idea, Asaca also showed a basic, off-line, single-function edit system with lightpen control, built around the EditMaster. The system controls four source machines and is based on a personal computer (it was displayed at NAB with an Apple system). Cost of the EditMaster is $20,000, plus interface costs.

The EditMaster also put in an appearance at the Interactive Systems Co. booth, where it was interfaced to ISC's new System 51 large-scale editor. (An ISC editor was operating at the Asaca booth, too.) The 51 offers several advances over its predecessor, System

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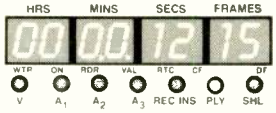

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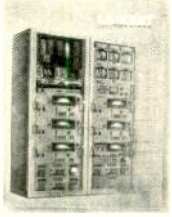

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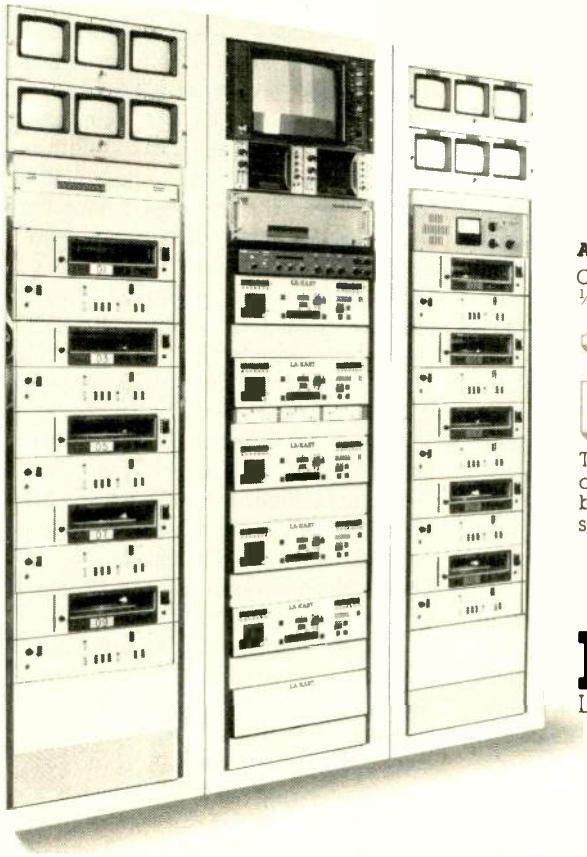

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41. For example, it has a hard disk drive with 10 Mbytes of storage, as well as 256 kbytes of memory for almost unlimited expansion capability. It is available as a rackmount system or in a standard console. A significant new software feature is the Film Package, which allows entry of film foot/frame information for either 35 or 16 mm formats with automatic offset calculation. Also new is the Remote Terminal Emulator, which allows the System 51 to control equipment having an RS-422 serial port. ISC is no newcomer to serial control; its editors have been taking direct control of Sony and Ampex VTRs through their serial ports, with no interface needed, for some time now.

Traditional systems strong

Other editing system manufacturers, while fully aware of the trend toward film-style editing, showed more traditional systems. Sony emphasized its BVE-5000 editor as the heart of a Sony-built "total system" consisting of one-inch, ½-inch, and ¾-inch VTRs, TBCs, MCI 24-track recorder and audio console, and a GVG production switcher.

United Media had a small version of its established Commander editor, the Mini-Comm, a two- or three-VTR A/B roll system for under $10,000. CMX-compatible disk output is standard for the unit, which interfaces with one-inch, ¾-inch, and ½-inch tape formats. It is expandable to a full Commander II system.

Videomedia's newest offering was the Eagle III ½- and ¾-inch A/B roll system, which boasts all the functions of the larger Z6000-E. The $30,000 system has SMPTE time code, but switcher interfaces are limited. Other additions to the Eagle line are the SM-3 triple SMPTE/EBU time code reader option ($2800) and the EA-102 nonvolatile memory option—12 years of memory for $1000. The company has now released its Version 2 software for the Z6000 series, a $1500 option that fully releases the editor's power, according to Videomedia.

Control Video, recently purchased by ADDA Corp., now offers a keyboard for its LightFinger touchscreen editor. The $2000 option is a simple dedicated keyboard that duplicates the basic screen commands with a numeric keypad, rotary shuttle knob, and a small number of keys. According to a company spokesman, the knob gives finer shuttle control than does the screen, but the user must return to the screen to complete the EDL.

California Paltex Corp., new owners of the Datatron line, showed a production version of the Edit-Star system, heir to the Tempo 76 series. Edit-Star boasts a long list of features, including a help function and three user-definable keys, each with storage for 20 events. Paltex also showed the established Vanguard system and announced that it has also acquired the IVC Editing Products Division of Cezar Industries, Ltd., including the ABR editing line.

An editor well-established in Japan but almost unknown here was introduced to U.S. broadcasters by Omicron, its exclusive U.S. distributor. Manufacturered by Japan's Elecon, the EMX-7100 controls up to four machines with A/B roll capability. It has a dedicated keyboard with remote control of playback machines and full EDL management, producing a CMX-compatible eight-inch floppy disk. It can function as an on-line or off-line system. According to Omicron, the EMX-7100 has been used for seven years in Japan, where it enjoys the largest market share.

Telecines

As expected, the telecine area—where film and video have been meeting for decades—showed few surprises at this year's NAB. The chief news was the first U.S. showing of Rank Cintel's multiplexed, on-air CCD telecine, the ADS 1 (also shown at the RCA booth as the TKS-100). Rank had some new features on its Mk IIIC post-production flying-spot telecine, including a third-generation telecine framestore, Digiscan III, and an improved vertical aperture corrector, Digivac. In addition, the company is marketing the G.T.C. synchronizer, which permits A/B rolls between two Mk IIICs.

A related product at the BTX booth was the new Cine Control System, designed to facilitate the interlock of a Mk III with a VTR. The bundled system consists of BTX's The System, a Cypher time code system, a Mk III interface, and choice of VTR interface.

Bosch enhanced its FDL-60 CCD telecine with the FRP-60 film reproduction programmer. This system, reminiscent of Rank's Amigo system, can program all of the FDL's color corrections, storing up to 800 scene settings for later recall. Storage is in the master processor's RAM, although the

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information may be transferred to floppy disk. Other features include panscan, programmable film speeds, and freeze frame. The $100,000 unit has controls B format VTRs for direct film-to-tape transfers with correction for frame rate. The other large post-production telecine, Marconi's B3410 line-array unit, was on view at the AF Associates booth in the same configuration as last year. According to a spokesman, the company has sold eight B3410s in this country.

Laird, L-W International, and Magnasync/Moviola showed their well-known telecine systems. L-W's biggest news, however, was its Athena multimedia telecines, now available in a variety of diplexing and multiplexing configurations. Magnasync/Moviola introduced a companion unit to its Videola film-to-tape transfer system, the EdgeWriter. As the name implies, this device imprints film edge numbers, footage, and frames as a window dub on the video. Control Video OEMs the EdgeWriter, which is priced in the $12,000 range.

New telecine color correctors were shown by Corporate Communications Consultants, a specialist in that field. The System XL2000 is similar to the company's previous offerings but comes with a more traditional control knob arrangement. It sells for $94,000 and is available in PAL and NTSC versions. The other new unit, System EBM, is a tape-to-tape color corrector for component video priced at $37,000.

Ikegami introduced an auto setup telecine camera system, the TKC-990, which the company says is a totally new design. A separate color corrector with optional scene-by-scene correction is available for the unit. First-time NAB exhibitor Hubcom, an outgrowth of Hubbard Communications, has entered the telecine field with HCF-One, a low-cost ($29,950) telecine camera with several unique features, demonstrated in a hospitality suite. Designed as a direct replacement for either large or small format existing cameras, its light wheel control automatically adjusts for changes in slide or film light levels. Its camera control unit can be remotely installed up to 15 m away, and it also features a waveform monitor that displays gamma characteristics using Kodak's grey scale.

A number of devices designed to simplify video-assisted film editing appeared at the show. Going at it from the film side, a Washington, DC, company, Micro Video, showed at the Laumic booth its Edit-Calc software system, which provides a film editor with an EDL complete with SMPTE time code. Information from the film edit is entered through the small Commodore computer the system runs on; the software automatically compensates for the frame rate differential. The system, including software cassette, instructions, and a Commodore 64, costs $2500.

Gray Engineering Labs introduced the FDG-241 film data generator, a microprocessor-based unit controlled by a Televideo TVI-950 CRT terminal. It encodes the video with edge, reel, scene, take, and SMPTE time code information. It should be available by the fall and will cost about $8000.

Kodak is still showing its Datakode magnetic coating for film stock. Although the company concedes the product is "moving slowly," it says that equipment utilizing Datakode is starting to appear. Coherent Communications brought its system for optically recording time code on each frame of film during production. Meanwhile, Arriflex showed its VAFE video-assisted film editing system, which utilizes a small video camera to record SMPTE-encoded video during a film shoot. The system is adaptable for use with Arri 16 and 35 mm film cameras.

Video Processing: Bits and Bytes

Much of the industry is talking these days about the slow but inevitable progress from analog to digital—and the products on view at the show this year certainly bear out the transition. But in the area of video processing, the revolution is already completely in gear. There's barely a company out there that is processing video with analog circuits any more. And as if to prove how advanced this corner of the industry is, many companies this year have leaped at the opportunity to offer component as well as composite signal processing to customers who are making the leap into small-format recording.

New in the For-A product line is the FA-410 digital TBC's ability to handle Dynamic Tracking signals from both the Sony BVU-800 and Panasonic VHS VCRs. Eight-bit sampling, component inputs, and a digitial DOC are just two of the systems's features—allowing smooth image handling during both fast and slow VCR operation, and also during freeze frame. Price is $7950.

Certainly among the most exciting new product offerings here is the Fortel Digibloc synchronizer/TBC/"mini still store," eight of which were recently installed at NBC's EJ operations center in New York City. In addition to the Fortel multi-freeze function and basic freezeframe, the unit also offers up to four fields of internal memory. The price for the basic synchronizer starts at $11,000.

Also now part of the Digibloc line is the AS-2 audio synchronizer, at $4995. The unit ofers full 16-bit A/D conversion with excellent S/N and dynamic response, and the ability to work in virtually every broadcast application.

According to Fortel president John Larkworthy, however, perhaps the most exciting new product introduction is the Color-Ex system, an extension of the Faroudja Labs Record-Ex noise reducer, handled exclusively in the U.S. by Fortel. The new technique, which works on any NTSC signal, reduces chroma noise by up to 12 dB without affecting the luminance. More significantly, the noise reduction is accomplished without field-to-field or frame-to-frame averaging, preventing the artifacts associated with DNRs. The price is only $4995.

NEC now has a new frame synchronizer on the market, the FS-18, with 4 x fsc sampling and 10-bit processing. To the basic unit, priced at $9000, can be added an optional $2800 TBC for heterodyne and direct VTRs; a $2000 four-field memory which processes the entire chrominance signal at the same time to prevent picture shifting; and a $1500 freeze function with three-line digital comb filter. To go with the new frame synchronizer is the AS-18 audio synchronizer, with two channels standard and add-on memory allowing up to four seconds delay per channel.

The same kind of approach to audio synchronizing is being taken by Tektronix, newcomer in the frame syn-

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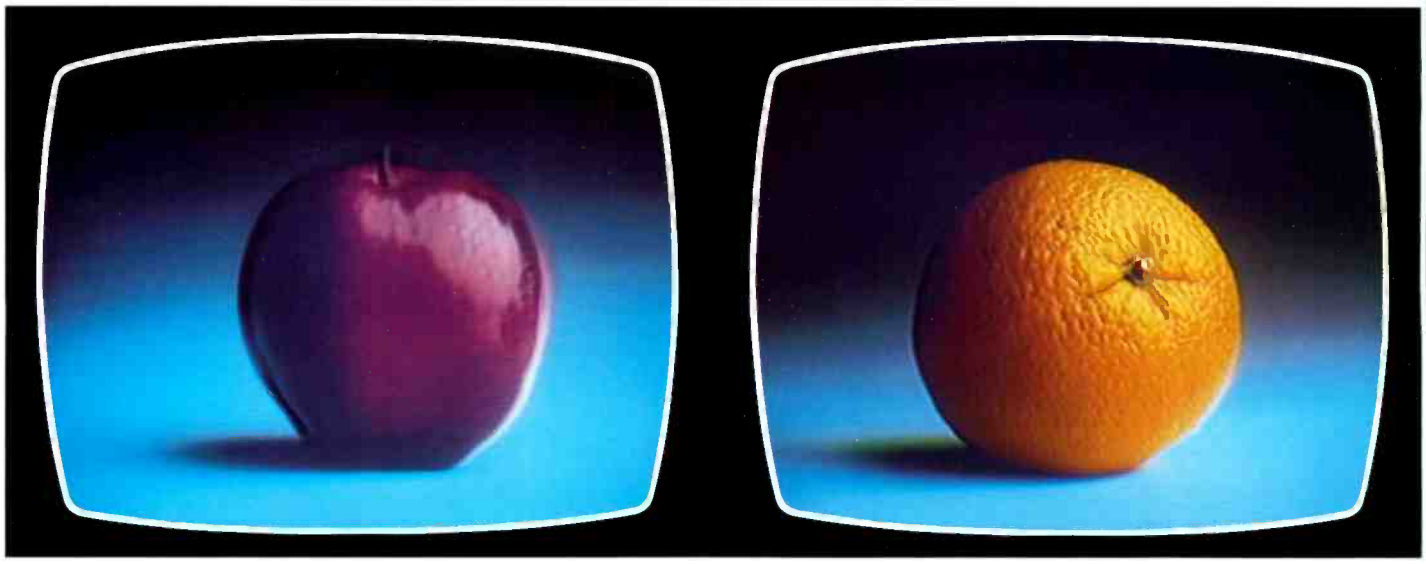


The apple (above left) was processed through a conventional TBC and shows quality loss including chroma noise, ringing, detail loss and luma/chroma timing error. The orange (above right) was processed through a Y-688[32] TEC and the result is a sharp, crisp, more life-like picture.

THE BEST 3/4" PICTURES

NO COMPARISON

The Y-688[32] Total Error Corrector™ gives you the best picture quality possible from ¾-inch VTR's. Superior picture quality that has been proven in hundreds of split-screen comparisons. Picture quality so good, FORTEL offers a cash reward to anyone who can show better pictures from a ¾-inch VTR using any other TBC, frame synchronizer, or video processor.

TOTAL ERROR CORRECTION

Comparing video from a conventional TBC to video from a Y-688[32] Total Error Corrector (TEC) is like comparing apples to oranges. A lot of companies are talking about component processing, but the fact is only the Y-688[32] TEC processes component (Y-688) video directly using the "dub" input and output of ¾-inch VTR's. The result is dramatically improved picture quality. The Y-688[32] TEC also uses advanced signal processing techniques to provide even more picture improvement by reducing luma and chroma noise, sharpening chroma transitions, and correcting luma/chroma delay. Even better pictures are possible using FORTEL's RECORD 1™ and RECORD 2™ (developed by **FAROUDJA** Laboratories) to prevent detail loss and automatically control Y-688[32] TEC image correction functions.

PROFESSIONAL POWER

The Y-688[32] TEC is the perfect complement for the new professional series ¾-inch VTR's. The exclusive DYNA-TRAC™ feature of the Y-688[32] TEC works with the Sony BVU-820™ VTR to produce the highest quality pictures from full-reverse speed to 3X forward speed, including stop action and slow motion. In fact, the Y-688[32] TEC produces better picture quality from the Sony BVU-800™ and BVU-820™ VTR's than any other TBC, including Sony's own BVT-800™ High speed shuttle provides up to 40X normal operating speed for reverse and forward search viewing.

DARE TO COMPARE

Quite simply, the Y-688[32] TEC produces better picture quality from ¾-inch VTR's than any other TBC, synchronizer, or video processor. Mail the coupon on the back page for more information. Better still, call or write FORTEL today and we'll arrange a split-screen comparison in your facility against the unit you're considering. Dare to compare! After all, you've got nothing to lose. But then, neither do we.

Quality . . . Made in USA

Y-688[32]

FEATURES

The only NTSC video corrector to use the dub (Y-688) input and output of ¾-inch VTR's. Heterodyne processing is eliminated and with it the major cause of picture quality loss.

Super-wide 32-line dual channel digital memories provide more headroom, better S/N performance, reduced luma/chroma crosstalk, and the best slow-motion and shuttle performance.

Exclusive Phase-Comp™ look-ahead chroma phase noise correction for up to 18dB of chroma noise reduction without color smearing.

Exclusive DYNA-TRAC dynamic tracking for professional series VTR's. Only the Y-688³² TEC uses high quality Y-688 "dub" signals from the Sony BVU-820 VTR for the best quality pictures from reverse to 3X forward play speed, including stop-action and slow-motion.

High speed shuttle search gives you up to 40X normal speed reverse and forward viewing.

Two 3-line adaptive comb filters separate luma and chroma information and reduce chroma phase and amplitude noise by 4.2dB. Switchable combing below 2.5MHz eliminates vertical smear. Drop out compensation is standard.

Exclusive one-year warranty on parts and labor backed by certified FORTEL service.

Even better pictures are possible using FORTEL's RECORD 1™ and RECORD 2™ (developed by **FAROUDJA** Laboratories) to prevent detail loss and automatically control Y-688³² TEC image correction functions.

SPECIFICATIONS

Digital Sampling	(Luma) (Chroma)	8 bits at 14.3MHz 8 bits at 7.2MHz
Window of Correction		32 Horizontal Lines
Signal to Noise Ratio	(Combs Off) (Combs Off)	57dB Encoded Mode 60dB Dub Mode
Differential Phase (Residual Error)		Dub In/Dub Out (Y-688) 0.5° Encoded In/Encoded Out 1.5°
Differential Gain (Residual Error)		Dub In/Dub Out (Y-688) 0.5% Encoded In/Encoded Out 1.5%
Bandwidth		5.0 MHz (–3dB)
K Factor (2T)	(Y-688 Mode) (Encoded Mode)	1.5% 3%
Residual Error	(Luma)	±20nsec
White Clip		110 IRE Nominal (Internally Adjustable)
Power		87-130VAC or 200-260VAC 50 or 60 Hz, 235W
Ambient Temperature		10°C to 40°C (50°F to 104°F)
Ambient Humidity		10% to 90%
Weight		18.2kg (40 lbs.)
Dimensions		48.3cm (19″)W 8.9cm (3.5″)H 60.3cm (23.75″)D 54.6cm (21.5″)D into rack

Specifications subject to change without notice

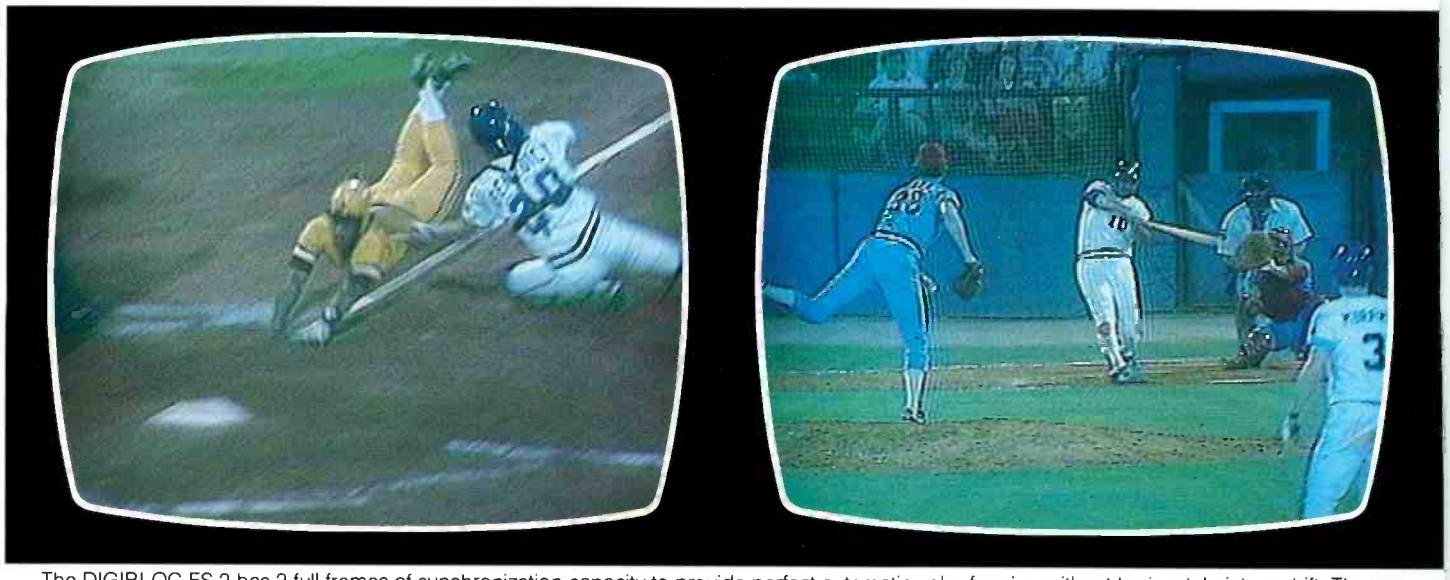
™Y-688³² Total Error Corrector, DYNA-TRAC, and Phase Comp are trademarks of FORTEL Incorporated

™BVU-820, BVU-800, and BVT-800 are trademarks of Sony Corporation

™RECORD 1 and RECORD 2 are trademarks of FAROUDJA Laboratories and are licensed to FORTEL by Faroudja Laboratories

FORTEL®

video courtesy of WTBS (Turner Broadcast System) and the Atlanta Braves



The DIGIBLOC FS-2 has 2 full frames of synchronization capacity to provide perfect automatic color framing without horizontal picture shift. The unrivaled power and performance of the FS-2 gives you perfect synchronization, direct and heterodyne time base correction, and when used with the DIGIBLOC RES-1 Remote Engineering Station, exclusive multi-freeze for up to 4-fields of still-store capacity (shown above).

THE ONLY SYNCHRONIZER, TBC, MINI STILL—STORE

NO COMPARISON

Only FORTEL offers a four-field synchronizer, an infinite window TBC, and a mini still-store all in one with quality and reliability backed by FORTEL's exclusive one-year warranty on parts and labor. The DIGIBLOC Series™ of digital video and audio synchronizers . . . The digital building block system for the 80's.

VIDEO SYNCHRONIZATION

At the heart of the DIGIBLOC Series are the FS-1™ and FS-2 Frame Synchronizers™ Using the power of the latest microprocessor and RAM technology, the FS-1 and FS-2 set new standards for performance and cost effectiveness.

The FS-1 and FS-2 use state-of-the-art 64K dynamic RAM's to provide four times the memory in the same space, and with lower power consumption per bit than the 16K Ram's used in most synchronizers. Both also feature 14.3MHz digital sampling and optional 8 or 9 bit quantizing.

TBC & AUDIO SYNCHRONIZATION

The FS-1 and FS-2 are more, however, than just advanced video synchronizers; they are the core of a powerful integrated digital video/audio system. Both the FS-1 and FS-2 can be equipped with TBC options for use with direct or heterodyne VTR's, and both can be used with the DIGIBLOC AS-1 Audio Synchronizer™ for automatic compensation of audio-to-video path delay, or with the AS-2 Audio Synchronizer™ for normal path compensation.

MINI STILL — STORE

Of course, the FS-2 has 2 full frames of synchronization capacity for perfect automatic color framing without horizontal picture shift. In addition to perfect synchronization, the FS-2 can provide direct and heterodyne time base correction, and when used with the DIGIBLOC RES-1 Remote Engineering Station™ exclusive multi-freeze for up to 4-fields of still-store capacity. Use the multi-freeze to capture "slides" of video for later use in captioning, to freeze action sequences, and to store and show weather pattern shifts.

DIGIBLOC Series of video and audio synchronizers, Mail the coupon on the back for more information, or call FORTEL today for a demonstration of the DIGIBLOC Series.

Quality . . . Made in USA

DIGIBLOC Series

FEATURES

Features standard with the FS-1 and FS-2 Frame Synchronizers include:

Dual Microprocessor memory function controls.

14.3MHz digital sampling rate with 8 bit quantizing.

User Programmable hot switching to meet individual requirements.

The FS-2 includes all of the above standard features plus:

2 frame synchronization for perfect automatic color framing without horizontal picture shift.

Multi-freeze for up to 4 fields of still-store capacity when used with DIGIBLOC RES-1 Remote Engineering Station.

Optional features of the FS-1 and FS-2 include:

Direct time base correction.

Heterodyne time base correction and 3.58 feedback operation with automatic switching between heterodyne and direct synchronizing.

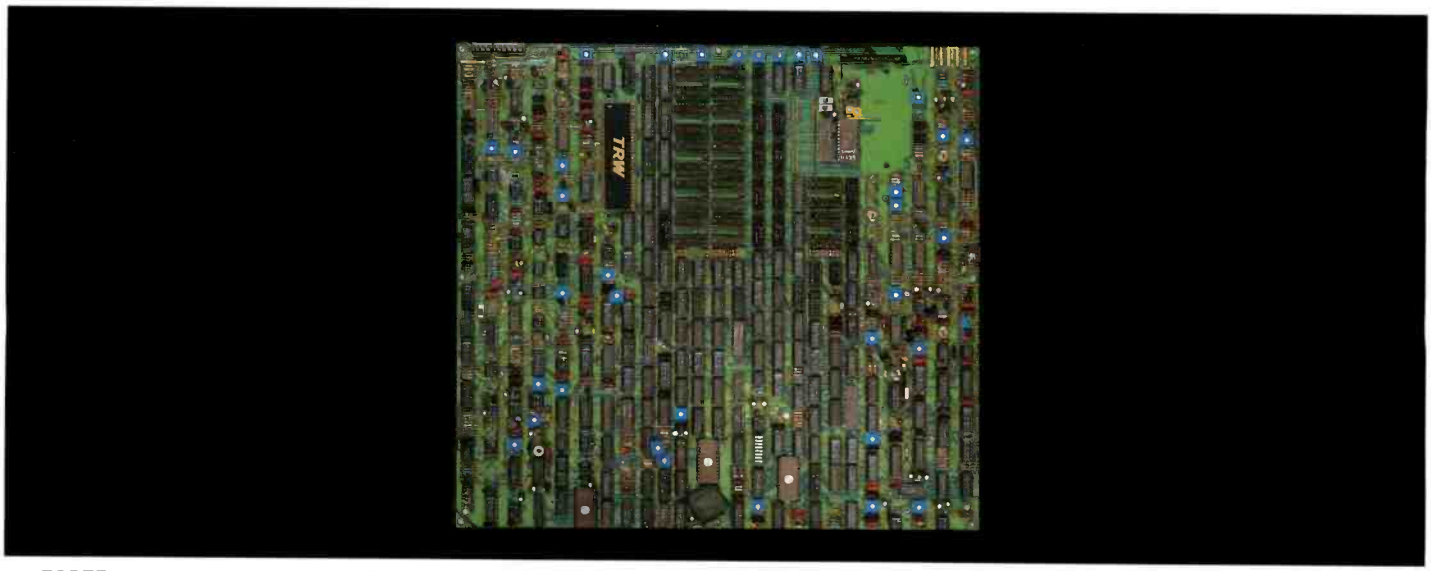
9 bit quantizing.

Specifications subject to change without notice.

™DIGIBLOC Series, FS-1 Frame Synchronizer, FS-2 Frame Synchronizer, AS-1 Audio Synchronizer, AS-2 Audio Synchronizer, RES-1 Remote Engineering Station, are trademarks of FORTEL Incorporated.

SPECIFICATIONS

Digital Sampling Rate		14.3MHz	
Quantizing Bits		8 or 9	
Window of Correction		Infinite Window	
Bandwidth	(Direct)	5MHz	(–3dB)
	(Heterodyne)	2.5MHz	(–3dB)
Signal-to-Noise Ratio	(8 bit)	58dB	
	(9 bit)	60dB	
Differential Phase	(8 bit)	2°	
	(9 bit)	1°	
Differential Gain	(8 bit)	2%	
	(9 bit)	2%	
K Factor (2T)	(Direct)	1%	
	(Heterodyne)	3%	
Residual Error	(Monochrome)	±20nsec	
	(Heterodyne)	±20nsec	
	(Direct)	±2nsec	
Tilt	(Line Rate)	1%	
	(Field Rate)	1%	



FORTEL's exclusive UNITEC single P.C. board construction (above) provides light-weight (less than 15 lbs.), low power consumption (less than 100 watts), and rugged-durability in a single rack unit (1¾-inch high); and all at a price that is thousands of dollars less than other manufacturer's TBC's. Exclusive "personality" program cards provide easy interchangeable use with any major brand of Type "C" 1-inch VTR or ¾" U-Matic.

THE TBC THAT SKIPPED A GENERATION

NO COMPARISON

FORTEL introduces the most significant advancement in the history of time base correction. The TBC32 Time Base Corrector™ — a TBC so advanced, so powerful that it surpasses every current TBC in performance, price, size, weight, and power consumption. A TBC that redefines the term "state-of-the-art," and has been described as having, "...skipped a generation in the development cycle."

POWERFUL PERFORMANCE

Strong Statements for TBC32 performance, but consider the following:

- The TBC32 corrects time base error from all major manufacturer's 1-inch VTR's, including those made by Ampex, Hitachi, RCA, and Sony.
- The TBC32 corrects time base error from ¾-inch and ½-inch VTR's with SC feedback, and with the TBC32 this is a standard feature, not a costly add-on.
- The TBC32 has a super-wide 32-line digital correction window to correct even the most severe time base errors, and provides dynamic tracking without expensive memory options.
- Exclusive DYNA-TRAC™ dynamic tracking from 2X reverse to 4X forward speed, including slow-motion and stop-action.

UNITEC SINGLE P.C.B. CONSTRUCTION

The most amazing part of the TBC32 is that all of this performance is packed into a single rack unit (1¾-inch high). FORTEL's exclusive UNITEC™ single P.C. board construction and new exclusive chassis design provides both light-weight and rugged-durability. These features, plus total power consumption of less than 100 watts, makes the TBC32 your ideal choice for the most demanding field and van uses, as well as studio applications.

THE RIGHT PRICE

Like all FORTEL products, the TBC32 is backed by FORTEL's exclusive one-year warranty for parts and labor. Best of all, the TBC32 is priced thousands of dollars less than other manufacturer's TBC's.

TBC32 ... The most significant advancement in the history of TBC's by the company famous for TBC's. Mail the coupon on the back page for more information, or call FORTEL today for a demonstration of the TBC32 There is NO COMPARISON.

Quality ... Made in USA

TBC 32

FEATURES

The TBC32 corrects time base error from all major manufacturer's 1-inch VTR's, including those made by Ampex, Hitachi, RCA, and Sony.

The TBC32 corrects time base error from ¾-inch and ½-inch VTR's as a standard feature, not a costly add-on.

The TBC32 has a super-wide 32-line digital correction window to correct even the most severe time base errors, and provides dynamic tracking without expensive memory options.

Exclusive DYNA-TRAC dynamic tracking from 2X reverse to 4X forward speed, including slow-motion and stop-action.

Shuttle mode viewing from 45X reverse to 45X forward play speed.

Phase Comp II™ velocity compensation, and unparalleled DOC based on line averaging.

Optional 8 or 9 bit digitizing at 14.3MHz sampling rate gives you S/N Ratio, K Factor, and differential phase and gain specifications that meet or exceed every 1-inch Type "C" TBC on the market.

Exclusive UNITEC single P.C. board construction provides light-weight (less than 15 lbs.), low power consumption (less than 100 watts), and rugged-durability in a single rack unit (1¾-inch high).

Exclusive one-year warranty on parts and labor backed by certified FORTEL service.

Specifications subject to change without notice.

™TBC32 Time Base Corrector, DYNA-TRAC, and Phase Comp II are trademarks of FORTEL Incorporated.

SPECIFICATIONS

Digital Sampling		8 or 9 bits at 14.3MHz
Window of Correction		32 Horizontal Lines
Signal to Noise Ratio	(8 bit) (9 bit)	58dB 61dB
Differential Phase	(8 bit) (9 bit)	2° 1°
Differential Gain	(8 bit) (9 bit)	2% 2% (Analog processing yields less than 0.5% DG; quantizing DG limited to 2% with currently available A/D Converters)
Bandwidth		4.5MHz ± 0.25dB
K Factor (2T)		less than 1%
Residual Jitter	(color) (mono) (sync)	± 2nsec ± 10nsec ± 1nsec less than 5nsec SCH phase change due to temperature
Tilt	(Line Rate) (Field Rate)	1% 1%
Power		87 - 130 VAC or 200 - 260 VAC, 50 or 60Hz, 65W
Ambient Temperature		10°C to 40°C (50°F to 104°F)
Ambient Humidity		10% to 90%
Weight		6.8kg (15 lbs.)
Dimensions		48.3cm (19″)W 4.5cm (1.75″)H 58.4cm (23″)D 54.6cm (21.5″)D into rack

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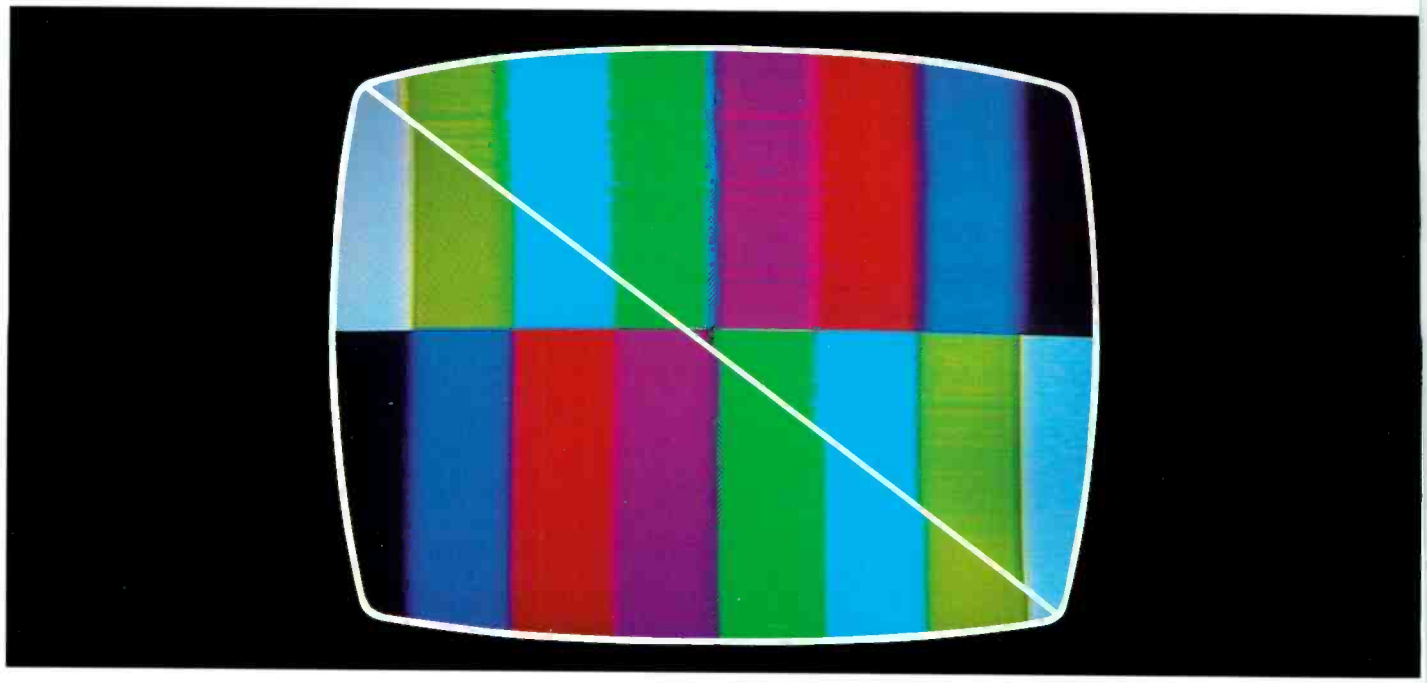

The above split-screen comparison shows the difference COLOR EX makes. The right side shows quality loss including chroma noise, chroma ringing, and Y/C delay. The left side shows the same video playback processed through COLOR EX. The result is significant picture improvement and restored rich, vibrant color content without the color smear and motion artifacts associated with digital noise reducers.

A DIFFERENCE YOU CAN SEE

NO COMPARISON

COLOR EX Chroma Noise Reducer™ . . . The better alternative to higher priced digital noise reducers (DNR's). COLOR EX uses a unique processing technique, developed by **FAROUDJA** Laboratories, to reduce chroma noise and improve the color content without affecting the luminance (luma) portion of the video signal. This exclusive processing technique reduces chroma noise without frame-to-frame or field-to-field averaging. The result is a crisp, clean video picture without the motion artifacts associated with DNR's.

CHROMA NOISE REDUCTION AND MORE

COLOR EX works with any NTSC composite video signal, time base corrected or not, to reduce chroma noise and restore rich, vibrant color to your video picture. In addition, COLOR EX corrects problems inherent in different video sources. COLOR EX virtually eliminates quad banding from 2-inch VTR's, and removes annoying moiré and other interference patterns from satellite and microwave transmission paths. COLOR EX gives more complete and comprehensive improvement of chroma deficiencies from color-under VTR's (½-inch and ¾-inch) than DNR's costing thousands of dollars more. In addition to chroma noise reduction, COLOR EX reduces chroma ringing by up to 50%, improves chroma risetimes for sharper, crisper color transitions, and corrects Y/C delay for improved luma/chroma registration.

POWERFUL PERFORMANCE — SIMPLE OPERATION

While COLOR EX gives you powerful performance, operation is simple requiring only a video loop-through (video in/video out). Front panel controls are power (on/off), program (bypass/operate), input source selection, and Y/C delay control. Simply connect COLOR EX to the video source, turn it on, select the appropriate input source, and COLOR EX does the rest. Up to ± 100 nanoseconds of Y/C delay is automatically corrected, additional manual control can be used to correct more severe delay.

COLOR EX is your alternative to digital noise reducers. Think about it: better performance at a lower price. Mail the coupon on the back page for more information. Better still, call FORTEL today for a demonstration of COLOR EX in your facility and see the difference for yourself.

Quality . . . Made in USA

COLOR EX

FEATURES

COLOR EX features include:

- Chroma noise reduction up to 12dB in the Heterodyne (Het) mode and up to 6dB in the Direct (Dir) mode.
- Up to 50% reduction in chroma ringing.
- Chroma risetime improvement for sharper, crisper color transitions.
- Automatic Y/C delay correction of ± 100 nsec.
- Manual Y/C delay correction of up to 280 nsec.
- Exclusive one-year warranty on parts and labor backed by certified FORTEL service.

Use COLOR EX with any NTSC composite video signal, time base corrected or uncorrected:

- To virtually eliminate quad banding from 2-inch VTR's.
- To reduce moiré and noise from 1-inch VTR's.
- With ¾-inch and ½-inch color-under VTR's to reduce chroma noise, improve chroma risetimes, and reduce ringing and Y/C delay.
- To remove moiré noise and other interference patterns from satellite and microwave transmission paths.

Specifications subject to change without notice.

™COLOR EX is a trademark of FOROUDJA Laboratories and is licensed to FORTEL by Faroudja Laboratories.

SPECIFICATIONS

Signal-to-Noise Ratio		65dB
Differential Phase	(Direct) (Heterodyne)	1.5° 2.0°
Differential Gain	(Direct) (Heterodyne)	1.5% 2.0%
Bandwidth	(Full) (Narrow)	4.2MHz ± 1.5dB 2MHz ± 1.5dB 2.7MHz ± 6dB over 28dB @ 3.58MHz
K Factor	(Direct) (Heterodyne)	1.5% 2.5%
Tilt	(Direct) (Heterodyne)	1.5% 1.5%
Chroma Noise Reduction	(Direct) (Heterodyne only)	6dB 12dB
Chroma Ringing Reduction	(Heterodyne only)	50%
Chroma Risetime Reduction with 1us input risetime	(Heterodyne)	500ns
Chroma/Luma Delay Correction	(Automatic) (Manual)	± 100ns 280ns
Power		117VACS, 60Hz, 40W
Ambient Temperature		5° to 45°C
Ambient Humidity		10% to 90%
Weight		5.0kg (11 lbs.)
Dimensions		48.3cm (19″)W 4.4cm (1.75″)H 55.9cm (22″)D

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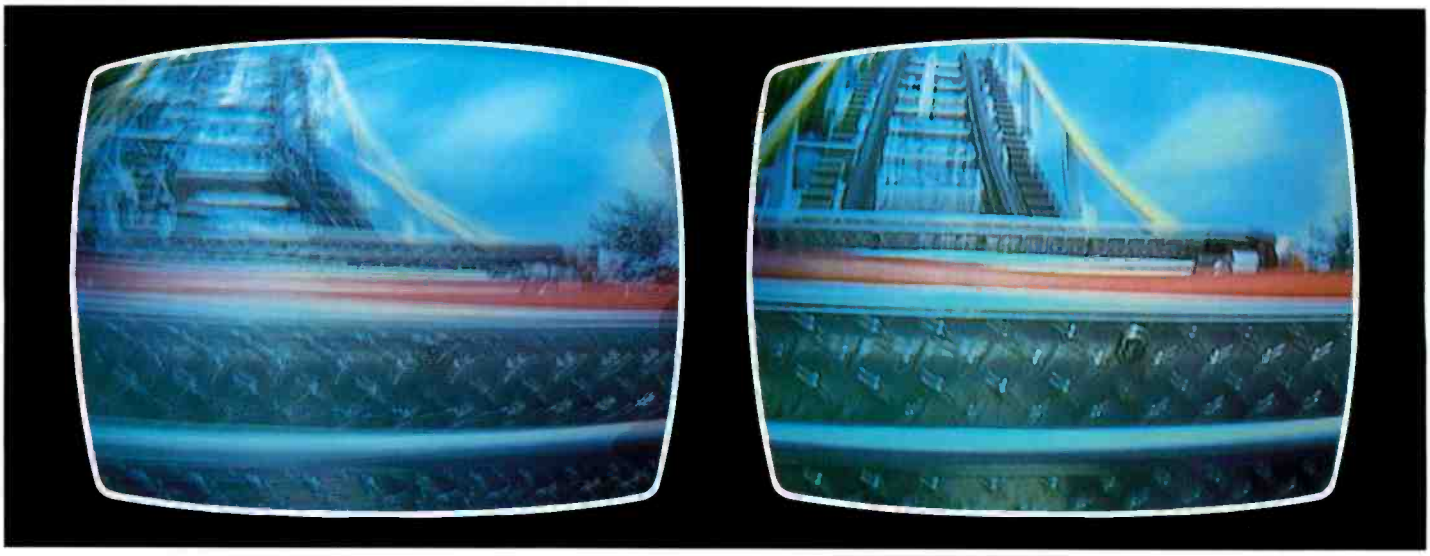

The C-YIQ32 Time Base Corrector unlocks the full power of Type "M" ½-inch VTR's. Only the C-YIQ32 time base corrects pure YIQ component signals for better picture quality than conventional TBC's. The super-wide 32 line correction window corrects more severe time base error from shoulder-mounted Type "M" VTR's than smaller window TBC's. The above pictures show video shot on a roller-coaster without (top-left) and with (top-right) C-YIQ32 time base correction.

PURE COMPONENT POWER

NO COMPARISON

The C-YIQ32 Time Base Corrector™; the only TBC specifically designed to time base correct pure, undistorted YIQ component signals. The C-YIQ32 is yet another example of FORTEL's leadership in component signal processing, and the only TBC that uses YIQ component signals directly from Type "M" format, high speed ½-inch VTR's. In fact, using any other TBC limits the picture performance of a Type "M" VTR.

YIQ COMPONENT PROCESSING

The key to the Type "M" ½-inch format is YIQ component processing. YIQ processing eliminates picture quality loss due to heterodyne processing or composite NTSC encoding and decoding. Using the C-YIQ32 for time base correction retains the full-bandwidth picture quality of pure baseband YIQ component video signals.

TOTAL TIME BASE CORRECTOR

Field trials have shown that a 32 line window of correction is necessary to correct the large gyroscopic errors produced by the high speed, shoulder mounted Type "M" VTR's. The C-YIQ32 has two 32 line digital memories for separate time base correction of the luma (Y) and chroma (I,Q) components of the color video signal. Not only does the 32 line memory assure the power to correct severe time base error, but correcting the luma and chroma separately improves picture quality by reducing luma/chroma crosstalk. In addition, the TBC control input from a ½-inch Type "M" VTR to the C-YIQ32 gives picture viewing in the search (jog) mode.

PICTURE POWER

The C-YIQ32 gives you performance flexibility far beyond the Type "M" format. The C-YIQ32 can be used to time base correct video from ½-inch VHS and ¾-inch U-Matic VTR's with 3.58 feedback for full-bandwidth operation. The C-YIQ32 provides a 2 wire Y-688 "dub" output for dubbing to ¾-inch U-Matic VTR's. Tapes dubbed from ½-inch Type "M" to ¾-inch tape using the Y-688 "dub" output of the C-YIQ32 gives ¾-inch picture quality rivaling that of a live camera.

Mail the coupon on the back page for more information, or call FORTEL today for a demonstration of pure component power.

Quality ... Made in USA

C-YIQ32

FEATURES

The C-YIQ32 time base corrects full bandwidth, pure baseband YIQ component signals for the best picture quality from ½-inch Type "M" VTR's.

The C-YIQ32 has two 32 line digital memories for separate time base correction of the luma (Y) and chroma (I,Q) components of the color video signal. Not only does the 32 line memory assure the power to correct severe time base error, but correcting the luma and chroma separately improves picture quality by reducing luma/chroma crosstalk.

The C-YIQ32 uses the TBC control input from ½-inch Type "M" VTR's to permit viewing in the search (jog) mode.

The C-YIQ32 can be used to time base correct ½-inch VHS and ¾-inch U-Matic video with 3.58 Subcarrier Feedback for full bandwidth operation.

The C-YIQ32 provides a 2-wire Y-688 "dub" output for dubbing to ¾-inch U-Matic VTR's. Using Y-688 signals for dubbing produces picture quality that rivals a live camera feed.

Exclusive one-year warranty on parts and labor backed by certified FORTEL service.

Specifications subject to change without notice

™C-YIQ32 Time Base Corrector is a trademark of FORTEL Incorporated.

SPECIFICATIONS

Digital Sampling	Y Channel -	14.32MHz
	I Channel -	3.58MHz
	Q Channel -	3.58MHz
Window of Correction	32 Horizontal Lines	
Signal to Noise Ratio	Better than 57dB (p-p signal to RMS noise, per channel at defined p-p input Y and chrominance levels)	
Differential Phase	Encoded In/Encoded Out	1.50
	YIQ In/YIQ Out	0.50
Differential Gain	Encoded In/Encoded Out	1.5%
	YIQ In/YIQ Out	0.5%
Residual Jitter	±7.5 Nanoseconds (Stable Input)	
Bandwidth	(–3dB)	
	Luminance	4.5MHz
	I Channel	1.5MHz
	Q Channel	1.5MHz
	Subcarrrier (3.58 Feedback)	4.5MHz
K Factor (2T)	YIQ	1%
	Subcarrier (3.58 Feedback)	1.5%
Power	87 - 130VAC 50 or 60HZ	
Ambient Temperature	10°C to 40°C (50°F to 104°F)	
Ambient Humidity	10% to 90%	
Weight	18.2kg (40 lbs.)	
Dimensions	48.3cm	(19″)W
	8.9cm	(3.5″)H
	60.3cm	(23.75″)D
	54.6cm	(21.5″)D into rack

FORTEL®

$5,495

HIGHEST PERFORMANCE, LOWEST PRICE

NO COMPARISON

The CCDHP Time Base Corrector™ is the world's highest performance heterodyne Time Base Corrector, at the world's lowest price.

COMPONENT PROCESSING

A lot of companies are talking about component processing, but the fact is FORTEL perfected component processing in conjunction with CCD (Charge Coupled Device) technology over 8 years ago. The CCDHP uses many of the same circuits patented in our original CCD time base corrector, including Y, R-Y, and B-Y component baseband processing.

INNOVATION IMPROVED

While it has taken other companies 8 years to discover the power of component processing, FORTEL has used that time to perfect and improve its original innovations. The CCDHP incorporates all our knowledge and experience in TBC design including digitally controlled CCD memories and a Y/C separator, developed by **FAROUDJA** Laboratories, for better component separation. The result is picture quality unequaled by higher priced TBC's. In addition, noise reduction and horizontal enhancement control are standard features — not costly options.

PROVEN PERFORMANCE WORLDWIDE

Over 3000 CCD Type time base correctors, are in use worldwide in NTSC and PAL formats. The legendary performance and durability of CCD time base corrector has given it the nickname, "The Workhorse." That same rugged-durability and proven performance is built into every CCDHP, performance and durability so good that each CCDHP is covered by a one-year warranty for parts and labor. The CCDHP is a full-function TBC that meets all FCC requirements; use it to correct time base errors to RS170A specifications, do A-B rolls, and even special effects.

Proven performance, rugged-durability, and the world's lowest price ... Is it any wonder the CCDHP is the world's most popular TBC? Mail the coupon on the back page for more information, or call FORTEL today for a demonstration of the CCDHP.

Quality ... Made in USA

CCDHP

FEATURES

The world's highest performance, lowest priced, heterodyne TBC features:

- Full function performance that meets all FCC requirements and corrects time base error to RS170A specifications.
- Y, R-Y and B-Y baseband component processing for improved specifications and picture quality.
- Y/C separator, developed by **FAROUDJA** Laboratories, for superior component separation
- Patented digitally controlled CCD (Charge Coupled Device) memories.
- Corrects wrong field edits automatically.
- Full proc amp control.
- Noise reduction and horizontal enhancement control.
- Available in NTSC and PAL models.
- Exclusive one-year warranty on parts and labor backed by certified FORTEL service.

Specifications subject to change without notice.

™CCDHP Time Base Corrector is a trademark of FORTEL Incorporated.

SPECIFICATIONS

Window of Correction		2 Horizontal Lines
Signal to Noise Ratio		60dB (NTSC), 58dB (PAL)
Differential Phase		0.5°
Differential Gain		1.5%
Bandwidth		2.8MHZ (NTSC), 3.2MHZ (PAL) at −3dB
K Factor (2T)		2%
Residual Error	(Luma) (Chroma)	± 25nsec ± 2° relative to burst
White Clip		95 IRE to 130 IRE (Internally adjustable)
Tilt (60HZ)		1%
Lock Up Time	(V Lock) (Line Lock)	33msec 3sec
Power		105-130VAC or 200-240VAC 50 or 60HZ, 100W
Ambient Temperature		50°C to 45°C (41°F to 113°F)
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Fortel Color-Ex chroma noise reducer.

chronizer field last year with the introduction of the 110-S 10-bit synchronizer. This year the product line has been expanded with the 118-AS, designed to compensate for the delay between processed video and unprocessed audio.

Excitement continues to mount over the Digital Video Systems DPS-103 component digital TBC—a totally digital product, including a digital sync separator. The 103, which uses only a single clock and component processing, maintains lock from 40x reverse to 40x forward and color through 10x. Priced at $8950, the system offers a 16-line window, velcomp, self diagnostics, and RS-170A output.

A brand-new digitial TBC was also unveiled by Hotronic. The AE61, priced at $6000, is a full-function unit occupying only 1.75 inches of rack space. It uses 4 x fsc sampling with eight-bit resolution and has a constant H phase for matched frame editing. Other features include full proc amp controls, adjustable H and V blanking, and both heterodyne and direct operation.

Transimage International has the perfect solution where a TBC must be shared among several VTRs—the brand-new TS-102 time-sharer. Video and audio from up to four VTRs are plugged into the rear panel connectors, parameters are set for each source, and the operator then simply presses a front panel switch to select the VTR's signal that will be corrected and fed through the system. Based on plug-in modules, the system makes provision for extensive control of the audio signal as well.

Don't forget about already existing products such as the Harris 690 digital frame synchronizer/TBC. The 9-bit/4 x fsc system has an extremely high 59 dB S/N and full 4.2 MHz bandwidth. One of its main features is a carefully designed cooling system, allowing it to operate well in tight spaces.

There were also a number of other significant developments in the video processing area. Among the more important...

MCI/Quantel's 1750 digital framestore/synchronizer, housed in a single rack unit....ADDA's VW Series digital TBC/frame synchronizer, and the AC-20A dual-channel TBC/synchronizer....Harris's HVS 632C component frame synchronizer with digital noise reduction, compress/positioner, and digital keyer, plus the HVS 690 frame synchronizer/TBC....James Gruner & Assoc./Cel Ltd.'s TBC/frame synchronizer with infinite window and color corrector with proc amp. It also has some digital effects including pixelization, posterization, and forced-color imaging. It is a seven-bit component device designed for all ¾- and ½-inch systems....Leitch's new framestore synchronizer and the VPA 331 video processing amplifier....Nova Systems' Model 500 compact, low-cost digital TBC with eight-bit, 4 x fsc sampling, featuring only 50 W power consumption in one rack unit....Apert-Herzog's H2 TBC synchronizer and A2 full frame synchronizer....Thomson-CSF's new Mark IV Series of image enhancers with 255 dB S/N, combed H and crispening, and automatic sensing to prevent over-enhancing....J. Osawa/Protron's FS-1000 frame synchronizer to convert RGB computer output to NTSC.

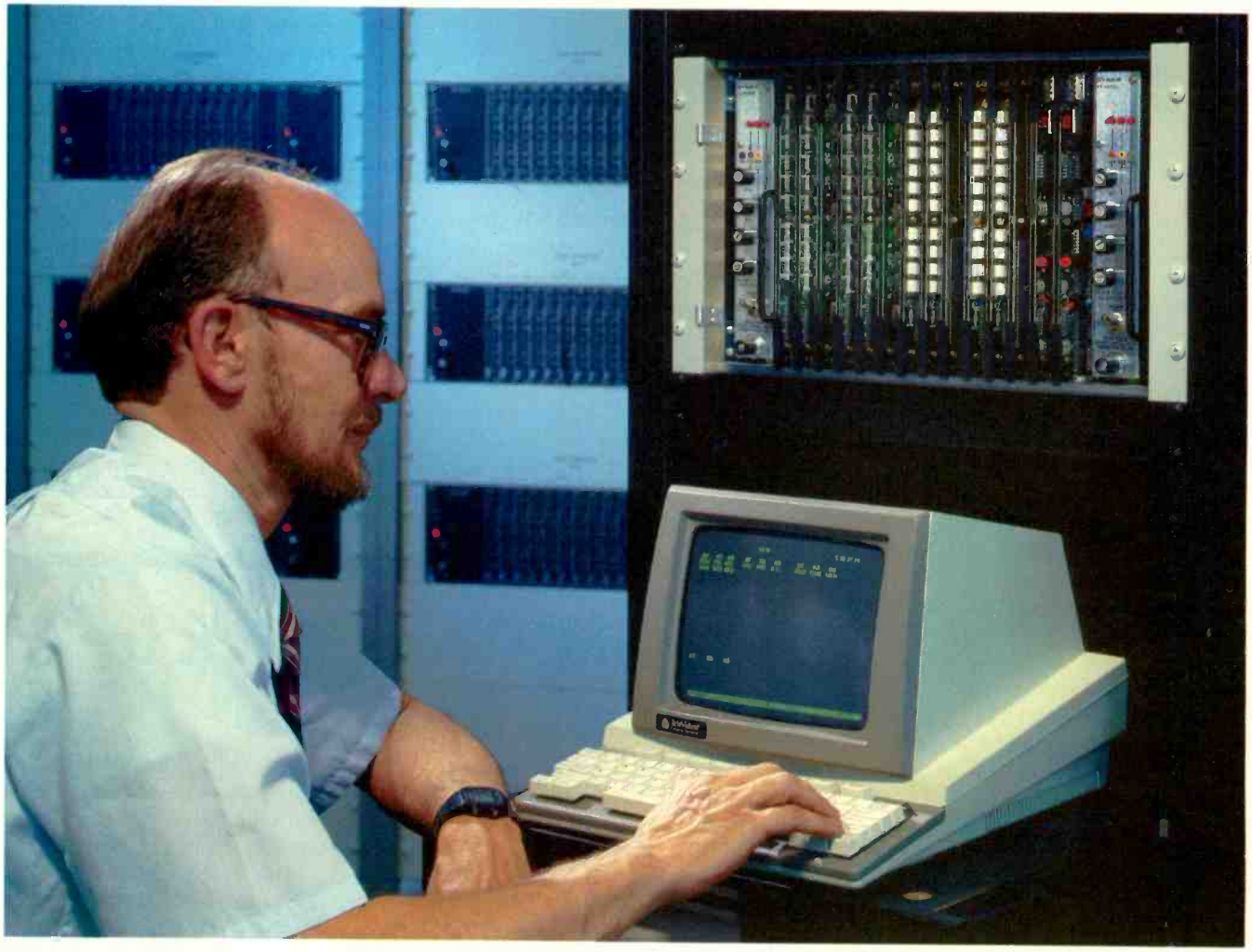
Special Effects Back in the Black Box

"The networks, top market stations, and major production houses have already invested in big-ticket digital effects systems," observes Tom Lyon, ADDA's senior project engineer. "Our research tells us that the majority of broadcasters in small and medium markets...(also) want the programming flexibility of digital effects, but the system must fit their tighter budget restrictions."

ADDA, of course, has been taking advantage of its development work with lower-cost TBC/frame synchronizers for some time, the results of which are now found in the VIP-C effects processor. A major part of the excitement surrounding this system are its control panels—including both a "basic" model for news applications with pushbutton control to achieve effects, and a panel offering more advanced production capabilities such as a three-axis joystick, and programming of up to 224 events.

But ADDA is not the only company involved in this kind of development. For although many manufacturers jumped on the bandwagon early to supply "mega" effects systems that could be interfaced with other pieces of digital equipment to form the core of the "electronic graphics studio of tomorrow," today's needs at the typical broadcast station are a lot more down to earth. And although many dream of the day when a plant will be totally interfaced so that video never leaves the digital domain until the last moment before it is transmitted, more and more broadcasters find themselves far more able to afford individual pieces of digital equipment that will get the job done all by themselves, without the need for extensive interface.

Leading the way with this kind of product is Abekas, which last year unveiled the now-popular VSP "slide projector"—a simple, "black box" approach to still stores which uses a 5.25- inch internal Winchester disk to hold 1050 frames on line—just enough for most production tasks. This year, Abekas has wowed the industry with a similar approach to digital effects—the A52, priced at only $55,500 for a single channel system with a second channel optional. This is no low-budget effects package, and includes compression along any axis, infnite expansion, repositioning, posterization, mosaics, flips, tumbles, freeze and multifreeze, etc., etc. Equally important is the attention paid to image quality. Sampling is at 14.3 MHz, with digital decoding down to the 4:2:2 international digital standard. This approach to processing shows both in the smoothness of movements and the smooth edges of the effects themselves, both the result of advanced digital anti-aliasing techniques.



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Perhaps the most exciting feature of all on the A52, however, is the brilliant approach to the control panel. Designed for both on-air and post-production applications, it features a small display screen built ino the panel itself which shows the types of transitions available immediately above the single keys necessary to achieve them. Loaded from E^2PROMs, the effects can either be used as supplied by the factory, or else user programmed following a simple, prompted program, directly from the control panel.

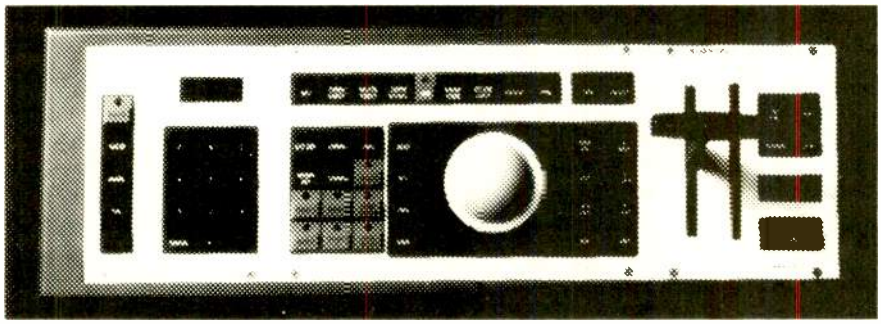
A unique approach is taken to off-line storage, using both a streaming tape drive and also a Datakey—an E^2PROM in the shape of an ordinary lock key that stores a single effect. Once the key is inserted, the effect is loaded into one of the memory registers.

This tendency towards lower-cost yet high image quality systems is nowhere better exemplified than in Encore, MCI/Quantel's brand-new digital effects processor. The cunning British have found a way to exceed even their own DPE effects system—which will now be replaced by Encore.

Essentially, each Encore box consists of both a full 13.5 MHz/4:2:2 digitizer and image manipulator, but with the addition of a built-in combiner. One of the combiner's inputs is from its own manipulator. But the other is set up to automatically receive input from another Encore. Thus, while the single Encore is a relatively straightforward black box, it can also be combined with up to seven other Encores or Mirages to form an enormously powerful multichannel effects system using a status display monitor to track the effect.

The effects themselves incorporate just about everything that is now possible with digital effects, including unlimited expansion and compression with Quantel's characteristic image quality maintained until just before invisibility itself. Three-dimensional perspective is an integral part of this system with the exciting addition of shading to the perspective, further enhancing the illusion of depth by having the portions of the image further away from the viewer and the perspective view made to appear slightly dimmer. In addition to all the standard effects—rotation, re-positioning, pulls and pushes, and so forth, Encore also accepts an input key.

As predicted, Harris has entered the digital effects arena, using Toshiba Japan as its manufacturing source for a brand-new effects system. The HDE comes in three versions: HDE-100 is the basic model, with variable compression and positioning, programmable multi-pix freeze, H and V inversion, mirroring, and so forth. HDE-150 adds variable expansion, programmable trajectory, mosaic effects, flips and tumbles, sequencing of up to 150 events per effect, and a removable bubble memory for off-line storage. The HDE-200 adds automatic input switching, decay, and prewiring for the second channel option.



Floating viewpoint control panel for Quantel Mirage.

Digital Services Corp. (DSC) has also been busy with new, low-cost digital effects packages. The Illusion system is its latest offering—a full-frame effects system offering a barrel roll effect, posterization, flips and tumbles, bordering, chroma key manipulation, and other effects, priced "substantially under $50,000." The price also includes DSC's Optical Perspectve 3D perspective rendering program. Illusion can be used as a two-channel device with the second channel either another Illusion, or another digital effects processor, or DSC's FlexiKey digital efects system, which provides image repositioning, split images, matrix wipes, H and V squeezes, flips, tumbles, rotation, and compression/expansion, now offers a Key Klean-Up mode that eliminates ragged edges from poor key sources.

This movement back towards simpler, more affordable systems is seen even in companies which also manufacture the larger effects devices. One is Ampex, seeking to secure its position in the broadcast business with a broadcast version of ADO. Rather than creating the same effects from scratch each time a show such as news is run, the TD simply loads up to 20 effects from a pre-formatted disk. Cost of this ADO version is $86,700.

Another exciting new ADO development is Digimatte—a $9500 hardware option that adds the equivalent of a half-channel of extra processing power. It takes the input key source and the input key fill from a device such as Newsmatte or Ultimatte, then manipulates the two signals together using ADO's joystick. Rather than manipulating the whole raster, it is therefore possible to move only a single object and have the background remain static. (Other new effects on the ADO system are software updates including posterization, solarization, luminance inversion, and more.)

New from Central Dynamics is a digital video processor interface designed to work in conjunction with its Series 80 switcher. It automatically controls and sequences up to 49 effects "moves" that have been rehearsed and stored in an effects sytem such as NEC's E-FLEX (shown operating at NAB). It is thus possible to simultaneously use video processing and digital effects together to achieve transitions such as wiping off a picture as it is being squeezed.

Central Dynamics now also offers Flexiwipe, which automatically creates new wipe patterns for the Series 80 switcher from a logo or picture image input by a camera. It uses a soft key processing scheme that integrates the captured image into a switcher's pattern selector so it can be selectively repositioned as a wipe effect.

There's also a brand-new effects system on the market from Chroma Digital Systems (CDS)—the Chromafex 766, priced at only $14,750. The neat little package incorporates an infinite window TBC and framestore, and performs a wide set of effects including compression, repositioning, and inversion, together with push-on/slide-off transitions. Deliveries are slated to begin in June, although the product shown in a Las Vegas hospitality suite still required additional engineering work on its color circuitry.

One of the most cost-effective sys-

tems around continues to be the NEC E-Flex, which starts at $68,000 for a basic, single-channel system. There is a new E-Flex combiner/chromakey unit, priced at $22,500. It combines the video outputs and key signals of two separate E-Flex processors and enables the editor to treat complex effects as a single source. The same packages are, of course, available as an option for the Grass Valley Group's Mark II DVE.

Grass Valley, by the way, introduced a significant new production switcher, the Model 100, which represents the company's first entry into the "cost-conscious" end of the market. The 100, which lists for $10,000, is aimed at small-market broadcasters and high-end professional video users looking for top quality and low price. The multilevel mix/effects system allows the user to mix or wipe between backgrounds, mix or wip to or from a key or preset pattern, mix or wipe backgrounds behind a key, and change backgrounds while simultaneously adding or deleting a key. Included in the M/E system are eight looping video inputs, 10 wipe patterns with rate-controlled positioner, a variety of wipe transitions, and other effects possibilities.

Graham-Patten had an interesting development: a halo generator, which has the ability to change the position of a key or border and move it to produce a halo effect. It's not a product yet, and the company was displaying it to see if there is any interest.

The latest trend in effects is, of course, for manufacturers of framestores and TBCs to harness their digital power, reprogram them, then put them to work to create digital effects transitions. The latest in this group is Fortel, which is offering effects for its new TBC^2. The heterodyne/direct TBC has a 30-line correction window, dynamic tracking, shuttle mode viewing, velcomp, and DOC. In the effects department it offers 32 digital effects (16 patterns with reversals) at 10 transition speeds. Automatic control includes half-stop on effect transitions, or manual effects control for greater creative control. The BC itself is priced at $14,995 ($9000 for a heterodyne-only version), and feeds full-bandwidth video to the effects processor over a single coax cable.

Control panel for new Abekas efx processor.

Microtime continues to expand on its T^{2}E-120 A/B roll effects system—now with the addition of the S-230D TBC/frame synchronizer. The new unit's frame synchronzing capability (it can also be used as a standalone signal processor) allows a wider variety of inputs than the T-120D TBC only, and also adds freeze-frame capability to the effects inventory. The S-230D can be used on either or both channels of the two-channel effects processor. Also new to the Microtime system is a mosaic effect in two sizes with a fixed transition rate. The effect is currently programmed into the "dissolve" function of the effects control box, but future development will add a separate button for mosaics, along with a toggle switch to control forward and backward transitions.

Newsroom Computers Await Big News

It seems inevitable: newsroom computers are bound to become integral and essential to broadcast operations. Sooner or later this will be a major product category, although to date there are probably less than 50 actually on line. But with the '84 Presidential primaries just around the corner, and with the increased versatility and simplicity of the systems themselves, this could be the year newsroom computers rise to prominence.

Some of the most important sales announced at NAB '84 were directly related to the elections, in fact. NBC News in New York, which has had a Quanta Corp. Quantanews system in its studios for evaluation for several months, recently signed an agreement to purchase the system. Currently, Quantanews is being used by NBC for wire search and story filing, and that is probably how it will be used during election coverage.

Quanta feels that this agreement is only the beginning. It is possible that NBC will purchase systems for all its owned and operated stations, and also its remote bureaus.

The Quantanews system is unique because of the way it safeguards itself in case of main computer failure—always a major concern among all manufacturers and computer users. The system incorporates removable disk storage packs in each terminal. This means that each reporter can store his story on a shelf as backup in case the main computer goes down.

Another major feature of the system and one that seems to be a trend among system makers is software (in this case ARCNET) that ties local terminals together using coaxial cable with an extremely fast two-megabyte bit rate. Prices for a Quantanews system start at $12,000.

Basys is also doing business with NBC News because of the upcoming political conventions. NBC is renting four computers to support 60 or more terminals and other devices for its coverage of the Democratic and GOP National Conventions. The total package will be portable enough to move from Dallas to San Francisco quickly. Basys also announced recent sales to BBC Radio and the MacNeil-Lehrer Newshour.

All of the systems Basys sells are run on Onyx computers or IBM PCs. The largest system it has put together was a 130-terminal configuration for RAI (the Italian broadcasting system), and the smallest was a single terminal for a radio station.

All the systems perform such functions as inputting wire copy and telexes, routing copy, word processing, formatting TV scripts, ordering stories, script printout, and running word count of stories. Basys also generates its own teleprompter signal and feeds caption generators. Basys system prices are $10,000 per terminal, and about $200,000 for a standard full-blown system.

At Colorgraphics, makers of the NewStar system, company president Terry Kelly says he is close to "a major network deal on a news system." In other developments, the CBS Radio Network in New York purchased a NewStar, and KSL in Salt Lake City bought two—one for radio and one for TV. Colorgraphics will also be providing CBS Radio with terminals and

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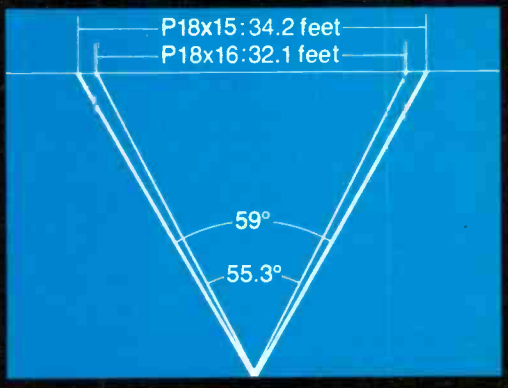

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printers for its Convention coverage. Kelly says that 16 NewStar systems are now up and running.

Kelly also points to two new features of NewStar: an archive system and an optional electronic prompter. The archive system features on-line storage on two 160-megabyte disks, global search, and unlimited backup storage on 25 megabyte removable DiscPaks.

The other major development at Colorgraphics is MiniStar, a new computer system with 36 to 160 megabytes of on-line storage. It will handle all daily news production needs including multiple wire intake, assignments, script production, program timing, and assignment/script archiving. MiniStar is expandable from one to seven terminals. The system can be lease purchased for a starting price of $600 per month.

Telesource was at the show with its new BUZ Series 2000. Company president Bob Early calls the system a "local area network." Workstations each run by a Motorola 68000 microprocessor and based around an IBM Care linked by one coaxial cable. Up to 250 terminals can be put on the system.

According to Early, this concept "makes the electronic newsroom practical. You can move stories in and out of a show in and out of a teleprompter in milliseconds, not seconds." Early says that the BUZ system will be participating in election coverage this year, but he had no specific deals to announce.

An IBM PC-based system was also at the heart of a venture between two newsroom computer companies, Beston/ McInnis-Skinner and Data Communications Corp. DCC will be marketing a Beston-developed system which, like the Telesource system, uses a Motorola 68000 as its CPU. Essentially, the computer that DCC was marketing last year has been dropped and replaced by Beston's Newscan computer. The name of the product, BIAS, remains the same, however.

DCC has also repositioned BIAS as just one component of a more far-reaching automation system called Buyline. Now, according to DCC's Jamie McMahan, "BIAS can be part of a big picture, Buyline, or it can be a standalone."

DCC announced several BIAS sales at the show: WUHQ in Battle Creek, MI; KPDK in Portland; KDVR in Denver; and KTXL in Sacramento.

This past year, Beston acquired

Quanta's Quantanews system.

McInnis-Skinner. The merger did not significantly affect the company's computer, Newscan, but it did reposition the product as a part of an automated newsroom and production operation. Beston's Paul Straughn explains: "The merger made possible the ability to bring CGs into the newsroom function, so you're having things happen keyed by words in a script. A word comes up in a certain place, and it automatically puts your supers on from your CGs." Newscan can also be used to automatically bring up graphics.

Another new feature of Newscan is an election package called Votescan.

Jefferson Pilot Data Systems showed its new Electronic News Processing systema computer positioned for "smaller-market stations." ENP is also based around an IBM PC, and plans to offer networking capabilities so the system can expand.

Jefferson also showed a multi-terminal ENP system. Features include dual processors and automatic backup disk storage.

Getting Control of Your Plant: Machine Control Reaches Maturity

Not all that many years ago, machine control and the associated field of technical automation were the "hot" topics of interest being discussed whenever and wherever broadcasters happened to gather. Despite the prediction of some, however, this industry has not eliminated the jobs of the engineering departments; it almost seems as if there are more people in the business now than ever before, and that is due, in large part, to the appearance of rational and feature-packed machine control systems in the broadcast plant.

If one had to describe the ideal machine control system, it would be a standalone machine, capable of directing and placing on air a multitude of devices from widely dispersed areas. Telecines, audio loops, quad machines, commercial carousels; all of these would be tied into the system, and would be switched as the daily schedule, prepared and downloaded from the traffic system, called for. At the end of the day, the operations system would upload the log of events back to the traffic department for billing and reconciliation. A closed-loop process, if you will. What progress was made, then, at NAB?

AF Associates introduced the Protel computer system at the show. It was designed, in England, as a complete television automation system for use in every area of the station. It gets its power from a modular design, allowing for as much or as little as the station needs to be installed initially, and it can be expanded to operate all necessary station equipment as needs increase. It is based on a closed-loop data transfer scheme (often called a "ring"), with a loop controller and executive processor to control and direct information to the on-line devices.

Each major section of the operation, such as discrete machine control, master control switching, and database management is handled through a dedicated Comspeed Terminal which segregates the data and handshaking for each section. These terminals then control individual machines during the operation, operating on the information through supervisory interfaces to the customer equipment. This scheme of operation is more efficient than a "bucket brigade" installation; the failure of one piece of equipment or processor does not mean the failure of the entire system, and thus the machine sitting next to the one that is down doesn't even know there is a failure.

This problem of machine accountability has to be taken into consideration

very early in the design process; it is all well and good for an automation or switcher system to call for the machine to go online, but what happens if the machine isn't ready or there is a fault?

Vital, with its recently introduced SANDI machine control system, attempts to address this concern head on. The heart of any good machine control interface has to include the ability to collect data and route command and control (C2) signals, and must provide some type of feedback to the operator(s). Vital has taken this one step further and has designed the SANDI to include a bar-code reading device so that the individual tapes can be coded with a label of the pertinent data (title, run time, date), and the device can read that information into the system to allow the main computer to know where and when that particular source will be used—in conjunction with the daily schedule which is downloaded from the traffic computer. SANDI also makes ongoing checks of the status of each "logged in" device, and is programmed to alert the operator if that device should, for any reason, show a fault that would not allow it to go on air.

The big bugaboo in designing a machine control system is the question of "where do I run those bundles?" since most computer systems seem to grow by the bushel. RS-232 standards call for 24 conductors, but most sytems use only four to eight. And so it is easy to see that for a medium-sized shop of 20–30 drops, there is a lot of money tied up in copper—not to mention the space needed to accomodate the bundles themselves. RS-232 also limits the speed of transmission due to the wire size and length constraints.

To help solve these problems, Vital has gone to the updated RS-422 standard, which allows for a four-wire transmission standard at twice the current fastest speed (38,400 bits per second for RS-422 versus 19,200 for RS-232). This feature alone means that the system can transfer data about four times as fast as would normally be expected, thus increasing the throughput and allowing the system to more closely maintain a watch over the operations.

So far, most of this discussion has focused on the aspects of direct machine control; some thought might be given at this juncture as to where the switching itself comes into play.

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can start all the machines in the world, but if you still depend on an operator to make the crosspoint (either by patching, pushing a button, or opening a fader), timing errors and the possibility of mistakes are still present, to a large degree. Automation and machine control, being linked together in more of an "assist" position than ever before, also have entered the realm of switching as a complement to the start/stop routines inherent in the standalone machine control systems. Considering that, for the most part, switchers (either crosspoint or mixing) are computer controlled to a large extent already, such a combination makes perfect sense from a cost-effectiveness perspective.

The Grass Valley Group has taken this approach, integrating an ADDA still store interface to its switcher line, along with upgrading and improving the products. The microprocessor-based 200 series of control switchers has been designed to allow the TV station to buy just as much switcher as its needs (and money) allow. As in most things in the processor-controlled realm, the more you want to spend, the more you get; the base unit includes machine control and preroll protocol, and you work up from there to a full-blown automated switcher/machine control system that also works with the traffic system to develop the daily schedule, and create the log of events based on that input.

So far, most of the machine control systems we have discussed have, in computerese, a bus architecture. This means that there is a common data pathway running among the individual machine interface cards; they are addressed, or make a request to be addressed, based on the operational requirements.

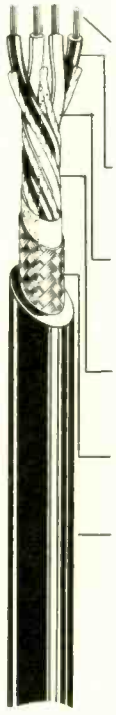
A company that one would not associate with broadcasting, per se, has entered the machine control arena: Grumman Aerospace Corp. It has introduced Starcom, a modular design, computer assisted machine control system. What makes this system different is that it is based on a "star" network for data distribution; that is, there is a central controller in the system, and the machine control devices (machine panels, studio panels, and studio interfaces) are all connected to an input/output port on the master. The big plus for a star network is that a request for status on any given studio device is not dependent on the number of devices in the network. In other types of bus architecture, as the number of devices increase, the time lag between request and data increases at an arithmetic rate; there is some lag in a star, but after the initial configuration, adding nodes on to the network does not significantly slow down the system. This means that the rate of throughput (data transfered from point to point in the system, and then appropriate action) is not dependent on the size, only on the number of processors.

Bosch also had some new equipment at the show to be justifiably proud of: the MCS-2000 master control switcher. One of the nice features of this unit is that the individual control buttons have alphanumeric readouts associated with them. This allows the operator to understand at a glance which sources are associated with a particular crosspoint. These assignments can be changed dynamically as the day continues. The switcher also includes serial communications capabilities for interfacing to a computer system.

Utah Scientific, long a leader in the development of computer-assisted broadcast systems, had on hand a comprehensive display of its line of master

The Protel station automation system from AFA.

The difference is what you don't hear



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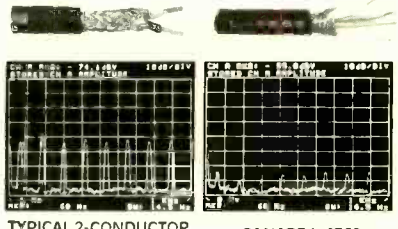

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control switching/machine control equipment. One of the hallmarks of this equipment, besides the industry standards of modular design, is that it was designed as a system, each piece complementing the other.

There have also been some developments in signal distribution. One of the most significant was the Central Dynamics SDS-2, introduced last year but now in full production. The unit on display at NAB is 32 x 32 in four levels—one video and three audio. Its features include eight salvo groups, three breakaway groups, alphanumerics, security locks, matrix status, real time clock, and battery backup memory. One sign of the times is a display, on a six line by 40 character vacuum fluorescent monitor, of the routing switcher assignments.

Looking towards the future, there is the strong possibility that TV plants will soon have to handle wider bandwidth, HDTV signals. Looking towards this possibility, Leitch Video introduced the HDS-481 high definition video switcher. The switching bus features very low crosstalk, excellent frequency response, and low noise—as would be expected of a high definition switcher—and is configured in an 8 x 1 matrix with power supply.

The Aesthetics of Production

Television aesthetics: once, there was no such thing. "Up full and flat" was the early director's cry; flat, stark lighting constituted TV's look.

The look has changed, to say the least. Thanks to the ever-increasing light sensitivity of cameras, a subtler, more dramatic, more filmic look is attainable. And there are cameras for any situation now—they can go anywhere and perform the most contorted movements without a hitch.

Lighting, power, and support equipment has had to grow and change with these developments—and it has. In fact, advances in these areas have often made this progress possible.

Batteries provide freedom for camera crews, and a number of companies at NAB '84 had some new ones on hand. Anton/Bauer, responding to the lighter weight and lower current requirements of many new video cameras, introduced the compact, 2.2 Ah Trim Pac nicad batteries. The Trim Pacs are available in two voltages: 13.2 and 14.4.

Cinema Products introduced three new 24 V nicad batteries—the RDS series—available as 4, 6, or 8 Ah units.

Compu-Prompt monitor-based teleprompter.

The company also showed a quick-charger for the batteries. Prices start at $600 for the batteries; the charger sells for $1200.

PEP featured at the show its 14.4-volt, 4 Ah battery, and its XLSO battery with snap-on mount, along with two fast chargers: the V90 and the XL. And Cine 60 highlighted its new battery belt series, and its OC series camera batteries.

A number of other chargers were introduced at the show. Alexander had its Sequential Smart Charger ($545), which will charge up to six batteries, in sequence, automatically, as well as its Three-Unit Fast Charger ($545). Christie showed an updated version of its Reflex-20 burping charger, which will give full recharge in under 20 minutes. Perrott also introduced a new charger, the 8204 nicad Minicharger. The company also showed its new Cellmate Battery Discharger ($265). The Cellmate controls the discharge of nicad and silver-zinc battery packs, therefore prolonging their life.

The lighting world received a number of new products at NAB '84. Lighting systems were plentiful, and there were a number of new ballasts as well. Anton/Bauer introduced its portable Ultralight system. The lights cost $195 for a single unit, and $330 for a dual configuration. Arriflex showed a new series of portable lights, the Arrilite 650, 1000, and 2000. Colortran introduced the Color Arc and Color Beam Followspots, which range from 700 to 3000 watts. The company also demonstrated two new control consoles, the System Two and System Five.

Bogen announced its new M-100 portable video light. The 100 W unit can be powered by a 12 V source. Strand Century introduced a solid-state ballast, the 6901, which has a power output of either 575 or 1200 watts. In-

The crowded O'Connor Engineering booth.

troduced along with it were two ParLite floodlights—a 575 W and 1200 W. The entire configuration is called the Dual Wattage Parlite System, because the ballast will power either light.

Two ballasts for the ILC 12 kW HMI were introduced in prototype form by CineMills. According to Jon Paul of CineMills, the units are much lighter and more compact than traditional ballasts. The vertical unit measures 14 by 14 by 18 inches and weighs 150 pounds. The horizontal ballast measures seven by 18 by 24 inches and weighs 104 pounds. Paul, who plans to rent them primarily, hopes to have about 30 to 100 units in New York and Los Angeles by the fall to get industry feedback. CineMills also introduced a new, all-aluminum, 6 kW HMI light.

Cinema Products introduced a new 200 W uni-focus handheld light. It is being offered with a dc power supply and a 24 V, eight amp hour battery, and also as part of a package that includes a four-leaf barndoor, gel frame, 3 m cable, ballast, 24 V battery, charger, and case, priced at $5500. Cinema Products also announced the availability of a new 6000 W RDS/HMI Fresnel spotlight. Both the luminaire and the ballast

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used to power it are priced at approximately $15,000.

DeSisti introduced a number of new lights including: 200 W and 2500 W CID open-face focusing spots; 1000 W and 2000 W quartz-halogen studio softlights; 200 W and 1200 W Caravaggio par lights; and a 30 V electronic ballast for the 200 W CID and HMI par units, compatible with existing 30 V battery belts.

Cool Light highlighted its Starpak portable lighting "studio" in a case ($995). The case's contents include: two Mini-Cool lights, a stand adapter, a collapsible light stand, six flood lamps, lenses, filters, mounts, and cords.

GE introduced its new Watt-Miser Quartzline stage/studio lamp. GE says the lamp represents a significant gain in lamp efficiency.

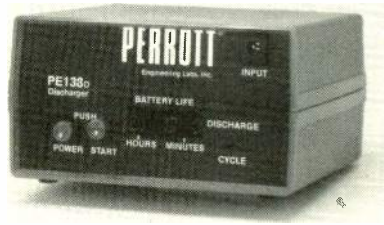
ILC Technology introduced a new metal halide gas discharge lamp, Daymax and Daymax-32. The lamp has been developed for motion picture set lighting, or any other application requiring faithful color rendition, efficiency, and precise control.

New lighting support equipment, in the form of gobos and frame-ups, could be seen at Lowel's booth. Lowel's new, small frame accepts a variety of control materials including: a black mat to shadow subjects, backgrounds, or camera lenses; and a transluscent mat to diffuse and soften light.

Several dimming systems were introduced at the show. Comprehensive's contribution was a remote-control unit. The system consists of two major elements: the IR-1000 dimmer receiver, which can control a light or lights up to 1000 watts; and an IRT remote dimmer transmitter, which is capable of controlling up to four IR-1000 dimmer channels. The units have an operating range up to 25 feet. IRTs sell for $69; an IR-1000 is $189. A kit with one IRT, two IR-1000s, and a carrying case is $457.

Kliegl showed its K96 SCR multiplexed digital dimming system. The company also featured two lighting consoles: the 12-channel Entertainer; and the top-of-the-line Command Performance, with 20 submasters, x-y time faders, library storage, and portable remote.

Union Connector's digital dimming system was new for NAB. It consists of a handheld controller (Digi-1) used in conjunction with as many as 256 separate 2400 W dimmers. A Digi-1 is plugged into any ac outlet in a building, and dimmers are addressed with a coded signal sent via the power line.



Perrott's Cellmate battery discharger.

Prompters made a strong showing this year—particularly computerized systems. Compu = Prompt, which has been in business less than a year, showed its system, which consists of an operator's console and, if you wish, a master-slave configuration. Compu = Prompt features instant text editing, color coding in six combinations, computer-generated prompter copy, and the capability to send or receive copy by phone. The CP-1000 console costs $5950; the master-slave system sells for $9950.

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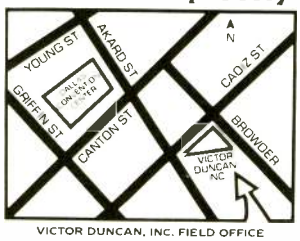

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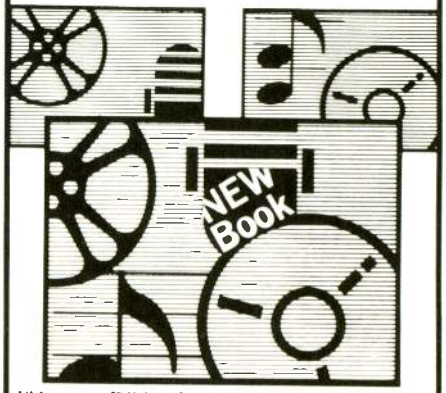

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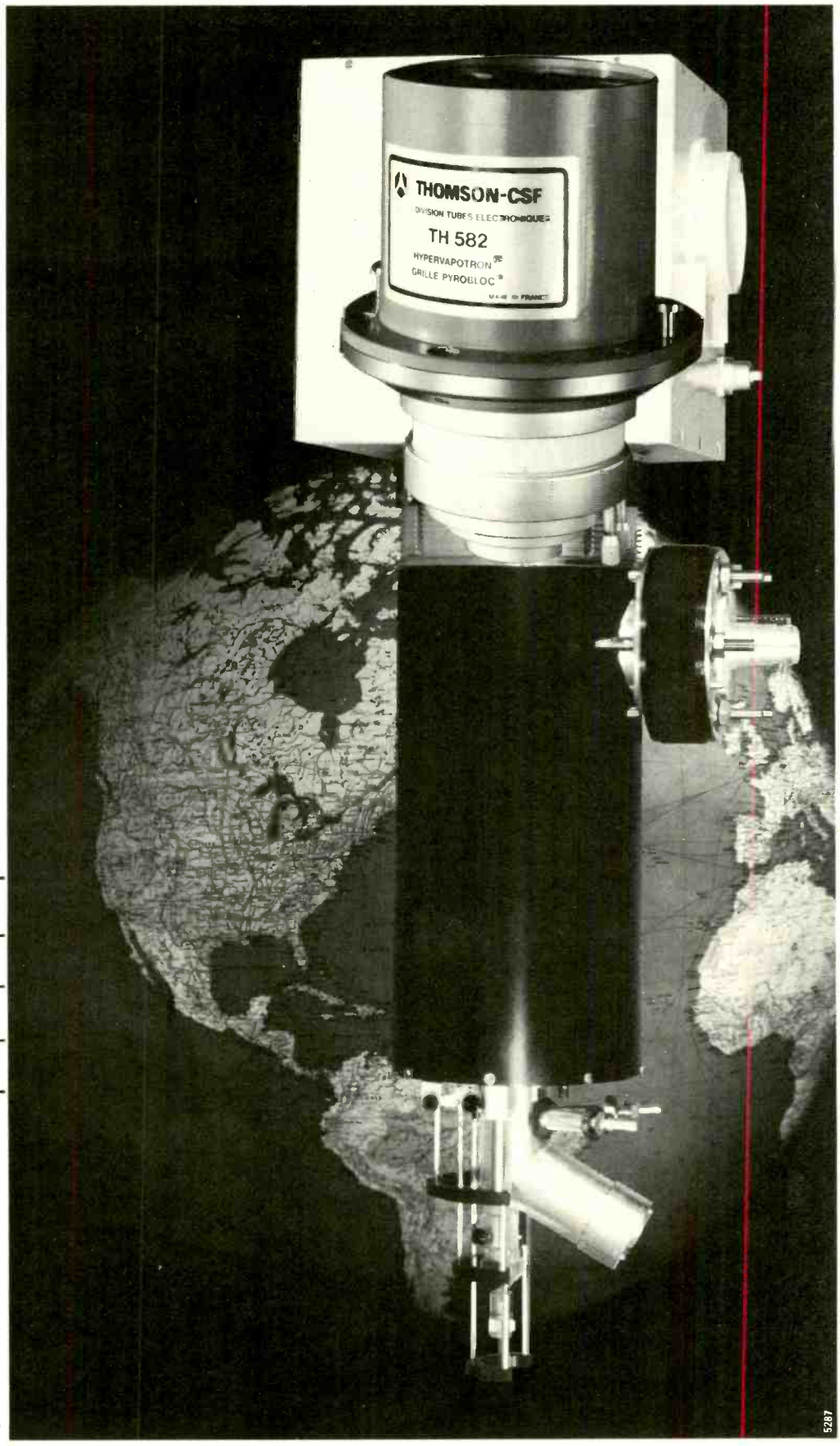

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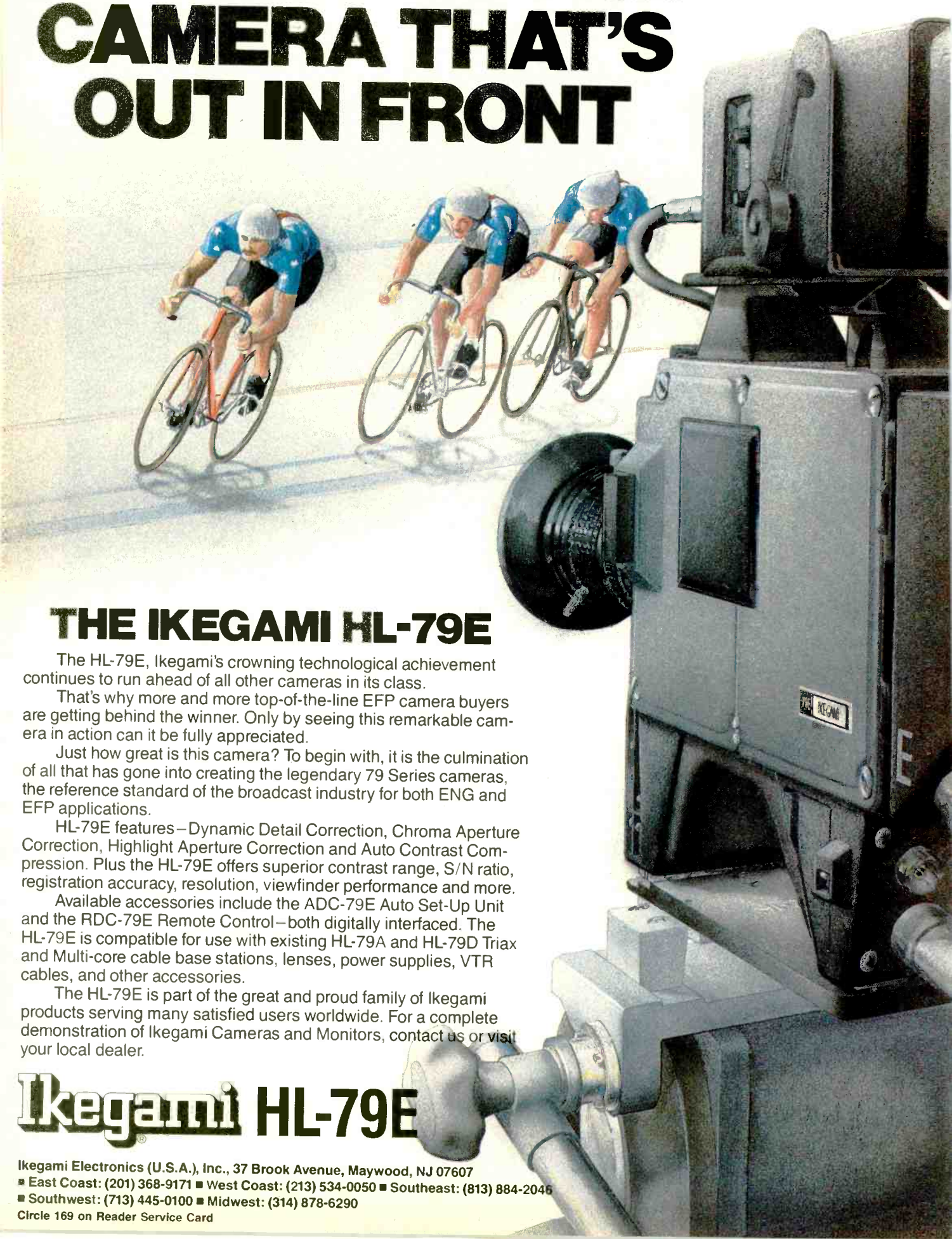

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Telescript introduced a new computer prompting system based around a number of personal computers such as the Commodore 64 and IBM PC. Suggested list price for the Commodore system is under $900. A system with the IBM and compatibles is under $4900.

Q-TV went electronic this year with its new VPS-500 ComputerPrompter. Q-TV offers a basic package, for $4750, that includes a console transport, a Vidicon camera with lens, a 14-inch prompter monitor, and a remote hand control.

The VPS-500 is not fast enough to be used in a computerized newsroom, but the Autocue 2000 is. The system—available as just a keyboard, or as a keyboard and a microcomputer—is a live transmission prompter that can be interfaced directly with the host newsroom computer. It can accept a download of up to 200 individual stories from the host computer; it can accept last-minute host computer editing on any story except the story already on-air; and it can accept any number of story running order changes before or during transmission.

New from Listec is the A-2100 Electronic Scriptwriter, a kind of word processor for use with a prompter. A Scriptwriter package with keyboard, disk drive, and operator's plug-in remote-control panel sells for $6500.

In camera and microwave support, there was an influx of new technology in what was once a relatively nuts-and-bolts product category: pan-and-tilt heads. Cinema Products demonstrated its new Mini-Worrall cable/gear head, along with Mini-Mote—a remote-controlled pan-and-tilt head.

Total Spectrum Manufacturing showed several support products, including the HS-100P servo-controlled pan/tilt system. The control head will accept all ENG-style cameras and lenses. Its new VS-200M is a motorized pan/tilt system capable of providing remote-control positioning of any ENG-style camera. Matthews also introduced a remote-controlled pan-and-tilt head, the Cam-Remote.

Vinten introduced the MicroSwift 200 digital remote camera-control system. The microprocessor-based system allows the setting and storage and subsequent replay of up to 99 shots for a single camera. Davis and Sanford introduced a new fluid video head, which accommodates cameras up to 25 pounds. Sachtler also showed a new fluid head, the Video 14 System. The company also introduced a prototype tripod called the Hot Pod.

Karl Heitz showed some new equipment including: fluid heads for five cameras up to 50 pounds; levelling balls; a mini microphone fishpole; and a mono-tripod. New from O'Connor is the Model 53 tripod dolly. The 53 is a tripod with casters that provide smooth rolling shots. Another innovative product is the stand-up sit-down dolly from Keylite Production Services.

Support gear

Bags and cases had, as usual, a strong presence at the show. Kangaroo Video Products, the company that brings you Cordura nylon bags, introduced several new ones this year, among them: the Super-Tough, a top-loading, aluminum-reinforced camera case; the Chip-Tote bag for the TRS-80 portable computer; and a case for the Nagra recorder.

New from William Bal are Silverline cases, available in three sizes. Viking Cases' new offering this year is a lightweight case called CarryLite. Calzone highlighted its G-spec custom cases—a line originally designed and built for government and military applications.

Anvil Cases had several new cases at the show: a Shockmount Rack case with an interconnecting shelf; a Hinged EIA Rackmount case; a Production Component Drawer; a Roll-in Ramp; and Tape-Reel, Disk Pack, and Cartridge cases.

Rebo Truck Breaks the Space Barrier

As expected, the NAB convention was a showcase for teleproduction and audio trucks of all descriptions, from plush semis to practical vans. (Many of the trailers, including those shown by Centro, Midwest, and Shook, were described in last month's report on mobile production.) One truck that received little advance publicity, however, generated special excitement at the show for its innovative and elegant design. Rebo Associates' White Truck may not have been the largest truck in the Convention Center. Other trucks may have had bigger switchers, more sophisticated graphics, or giant audio boards. But none was planned and built with more attention to detail.

According to Barry Rebo, the truck was designed to fit the particular needs of an urban area—in this case, New York City. The truck itself is a 20-foot Iveco diesel job, just six inches longer than a Ford Maxivan but with a tighter turning ratio, Rebo says. Inside, the first impression is of space, an unusual feeling inside even a large teleproduction truck. The production area ceiling is high enough for all but the tallest producers to stand comfortably, and a crew of five, seated in the rear, has plenty of legroom. (Total crew capacity is eight.) The production switcher position, a bench stretching the width of the truck, is even raised to allow a clear view of the monitors on the rear wall.

How is this possible in a 20-foot truck that, when fully equipped, carries six cameras and five one-inch and half-inch VTRs, to say nothing of switching, distribution, and monitoring gear? As with any truck this size, every inch of space is utilized, but Rebo and his associate Barry Minnerly designed the truck so that almost everything folds up against the wall or stows under a seat for travel. All shelves and VTR racks—even the switcher table—fold away or push in somewhere. The front passenger seat has a table for a small sound mixer, and the switcher bench (which conceals the camera storage area) flips over to face front for travel. In addition, three lightweight cube racks on the rear wall slide out, allowing the user to carry engineering and switching electronics and monitors anywhere needed. The attention to detail is evident even in the choice of generator, a 5.5 kW Honda unit noted for its quiet operation.

ABP Systems-designed truck for Rebo and Assoc.

ABP Systems, Inc., of Freeport, NY, built the truck for Rebo. An extra attraction to those who visited the booth was an original proprietary fiberoptic camera control system, designed by Barry Minnerly and demonstrated in a feed from the Panasonic booth to the White Truck, a distance of 1500 feet (system capability is 4 km). The system works with the truck's Ikegami HL-79s and Panasonic Recams and is passive to the Anton/Bauer Micro Control camera system, allowing other cameras to be added on.

Optimod /op'-tə-mod/

Op-ti-mod *n* [>Early Orbanian; deriv. of *optimum modulation*]

1. A broadcast audio processor built by Orban Associates to the highest standards of quality and reliability, incorporating patented circuitry to achieve a cleaner, brighter, louder airsound.

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RADIO AND AUDIO DEVELOPMENTS

Radio broadcasters attending this year's NAB show had no reason to feel left back in the shadow of television. The general technological turmoil, especially intense this year, touched the radio hall in equal measure to the TV side, and radio sessions focused on the many new money-making opportunities now available to radio.

Those new opportunities—including SCAs, cellular radio, and even visual services transmitted over the radio band—attracted plenty of attention, in both exhibit hall and meeeting room. Technical papers from several transmission experts laid to rest any remaining fears about SCA-induced degradation of the broadcast signal. Meanwhile, McMartin turned heads with its "Radio You Can See" exhibit, using color TV monitors to demonstrate teletext, fax, and slow-scan TV pictures transmitted over FM SCA. A related development from Cybernetic Data Systems, "Silent Radio," is an electronic billboarding service transmitted over FM SCA or television verticle blanking interval and displayed as moving type on LED screens.

A more standard use of SCAs—paging—was featured by Motorola and Reach, Inc. Another exciting idea was an interactive plan from JBL, the CallCount system for measuring audience reaction by telephone. The system handles a huge number of calls quickly and with a voice response, tabulating answers by computer. Blaupunkt's ARI traffic service, delivered by FM SCA, is another opportunity with profit appeal for broadcasters.

AM SCA attracted interest as well, with equipment on hand from the likes of Altran, which also submitted a paper showing SCA use will not interfere with AM stereo transmissions. Cellular radio also looks like a promising money generator for radio stations, according to panelists at the management session.

As if this were not enough, the momentum appears to be building on AM stereo, which is recovering from its sluggish start. Aiding interest is the new multi-system receiver from Sony, which promises to free broadcasters from nontechnical concerns in choosing a stereo transmission system.

The current interest in SCAs and stereo, however, has not dampened excitement in traditional radio transmission technology. Just the opposite—spurred by the quality concerns of broadcasters moving to stereo and exploiting their SCAs, manufacturers showed significant advances in transmitter quality. Both Wilkinson and CSI, for example, showed FM transmitters designed especially for optimized operation with SCAs. Other FM transmitter news focused primarily on new, higher efficiency solid state designs, with overseas manufacturers such as Pye, Thomson-CSF, and NEC making incursions into the U.S.

Another area where new technology is pushing radio to a higher level is digital audio. The digital audio disc is beginning to come into its own as a radio programming tool, and its impact is being felt throughout the radio plant. This affected not only the increased amount of digital production equipment on display, but also the analog tape recorders and audio consoles, which must keep up with the pressure from digital recording to stay competitive. The large number of high-spec, low-pricetag audio consoles at NAB '84 was a good indication that the industry, while cost-conscious, is in no mind to sacrifice quality. The other noticeable trend in radio consoles is their increasing versatility and modularity, with production boards taking on air responsibilities and vice versa. The sheer number and variety of boards at this show would seem sure to guarantee any and all broadcasters the board of their dreams.

Radio broadcasters, therefore, appear fully justified in returning from NAB full of hope for their industry. With so many new opportunities, and the equipment to take advantage of them, radio need be second to none.

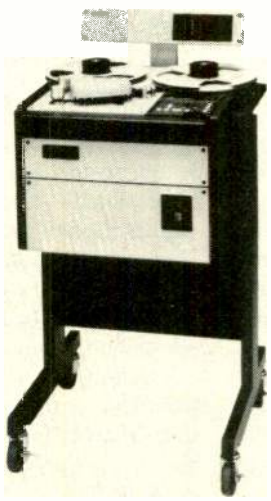
Preparing for Digital Audio

Talking about digital audio with American radio broadcasters these days is a little like talking about the Japanese coutryside to a resident of the sprawling Tokyo megalopolis (where many of the ideas on digital audio are originating these days): everyone knows the countryside is a better place to live, but few can afford the time or capital to get there.

Nonetheless, digital audio is undergoing rapid development—on several fronts simultaneously. The most recent set of events has been the trench warfare, somewhat unusual in the rather staid world of broadcast equipment manufacturing, between proponents of the DASH stationary head format (a joint agreement signed at last year's New York AES between Sony, Studer, and Matsushita/Panasonic) and the digital sampling and recording techniques advocated by 3M and Mitsubishi (represented in the U.S. by Digital Entertainment Corp.).

The battle has come down to a fierce tug-of-war between the manufacturing groups, each claiming superiority for its system. The net result may indeed be a slackening of overall interest in digital recording by American broadcasters, afraid of getting caught on the losing side should any of the groups capitulate.

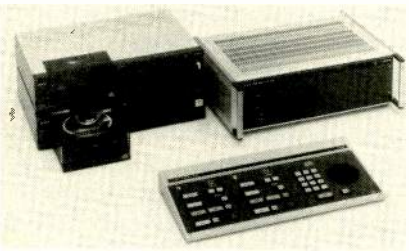
In terms of product development here, one of the most significant was Sony's PCM-3102 two-track DASH recorder, the first quarter-inch two-track digital deck on the market. Obviously eyeing broadcasters and producers more used to working in the two-track



Sony two-track DASH machine.

rather than multitrack format, the deck also makes razor blade editing possible by recording an analog track for reference.

Also involved in the digital recording battle is JVC's digital audio mastering system, which records the digital audio signals on a VHS recorder using a bi-parity recording format with new, advanced error correction circuits. In addition to the VCR, the system consists of the VP-900 audio processor (16-bit, two-channel PCM), and the AE-900V editor. It is the ability to edit the audio masters with the same ease that videotape is edited which gives the system a unique advantage.



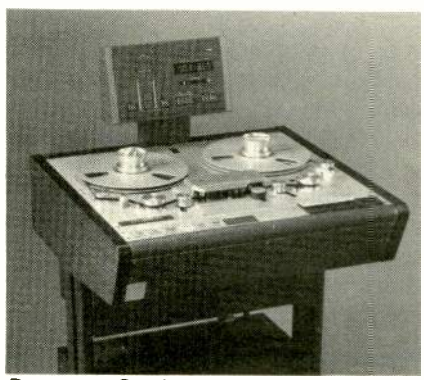
Philips LHH 0502 professional CD system.

(Both Sony and Matsushita, it might be noted, are also working fast and furiously on formats for digital cassette recorders for the home market. Seen at one of Sony's Japanese plants recently were two prototypes: a stationary head digital cassette recorder using cassettes virtually the same size as today's standard audio cassettes; and a new, rotating head format, based on some of the same technology as Beta VCRs, but using a miniature videocassette. Both of these machines are being submitted to the EIAJ, which is expected to make a decision soon on which cassette format will become the standard for home recorders. And although Masahiko Morizono, Sony's deputy director and head of its R&D efforts, prides himself on maintaining two separate research programs—one for consumer products, the other for professional—it is probable that the digital home recording standard will have an impact on the broadcast industry in years to come.)

Meanwhile, another spillover from consumer developments, the compact disc, is most definitely invading the broadcast environment. Stations in virtually every sized market are finding themselves able to play material off compact discs and replace existing cart decks. This is particularly true in light of the introduction of several professional CD players with associated disc programmers which allow the DJ or engineer to remotely control two decks with checkerboarded selections.

Technics, for example, introduced the SL-P50 in a hospitality suite. Even though this product comes out of the consumer audio division of Matsushita, it is a fully professional CD player, designed especially for radio station applications. Extensive electronic indexing is provided, listing the cuts, play time, start and stop locations, and so forth, and there is a special display for actual time remaining once the track has been cued. Like all CD players, the signal quality is extremely high: 90 dB S/N, with a dynamic range of more than 96 dB and total harmonic distortion less than 0.01 percent.

Sony showed its CDP-3000 player and CDS-3000 controller for the first time. The player is a modular version of the CDP-5000 introduced earlier, claimed to be the first professional CD player on the market. It features a newly designed disc drive mechanism controlled by special servo LSIs. Two 3000s can be mounted side-by-side in a standard 19-inch rack, then interfaced with the CDS-3000 for automatic or manual operation.



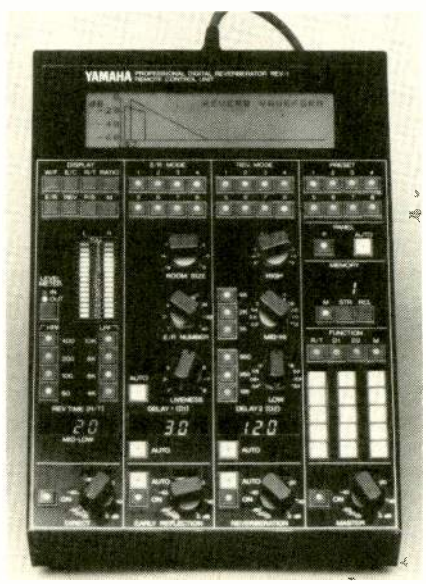
Prototype Studer two-track DASH ATR.

The other big force in CD players, Philips, also has a brand-new professional model on hand. The company's LHH 0502 consists of two CD drives interfaced through a CD controller with identical keypad controls for each drive. With this system, access to track number, time (from the beginning of the track), and time remaining (on the rest of the track plus the next pause) are available to the engineer or DJ with an accuracy of 13.3 milliseconds—the kind of acuracy only possible with this kind of digitial system. Designed especially for radio stations, the professional player has three modes which can be set either manually or through the controller: standby, ready, and on-air. Startup from standby is virtually instantaneous.

The other area of intense digital audio development comes in production—both special effects and mixing. Neve's digital audio console is discussed elsewhere in this report. But Sony, too, has introduced a brand-new digital mixer, primarily designed for field work, mobile vans, and so forth. The desk-top, modular system has eight digitial inputs such as digitally recorded masters for CD discs—and mixes them into three separate digital audio outputs: a two-channel main output, a two-channel sub output, and an an eight-channel direct output.

Sony professional CD system.

In digital audio processing developments, one of the leaders this past year has been Lexicon. Brand-new in the product line is a digital audio synchronizer, especially configured for multichannel TV sound applications. The delay ranges from 341 to 2048 ms, and the unit features an exciting approach to synchronizer hysteresis, plus a well-designed input control module. Also new is the Model 1200C time compression/expansion processor. New this year is an RS-422 interface, enabling the unit to be hooked up directly to a VTR such as the BVH-2000.

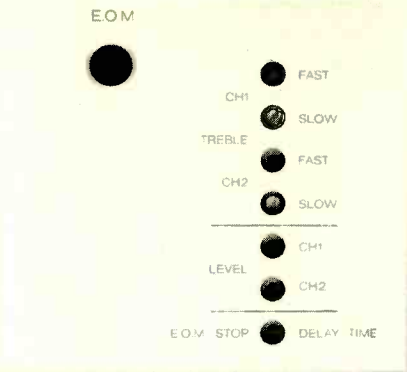


Yamaha REV 1 digital reverb.

The Revox Automation Advantage

The new Revox PR99 Playback Only presents a ten point program for more cost-effective broadcast automation.

1. Compatible with Existing Systems–The PR99 Playback Only is fully compatible with practically every existing broadcast automation system. In many cases it can be swapped for existing decks in a matter of minutes.



2. Front Panel Controls–Immediate access to repro levels, EOM stop delay time, and treble EQ for both speeds. Mode switch selects track 1, track 2, mono, or stereo; a calibrate/uncalibrate button switches from front panel adjustable output to standard reference level.

3. EOM Stop Delay–Adjustable from 0 to 24 seconds. Front panel indicator illuminates when 25 Hz signal present.

4. Switchable Sensor Circuit–The 25 Hz sensor circuit may be switched out of the signal path to allow extended bass response.

5. Easy Maintenance–Modular plug-in circuit boards make servicing a breeze. Most parts subject to wear are easily accessible and quickly replaceable.

6. Lightweight and Compact–Weight is a mere 40 pounds. Front panel dimensions are 19" x 15¾"; depth is 8". Rack mount flange is standard.

7. All Formats–Choose mono or 2-track stereo; 3.75/7.5 or 7.5/15 ips speed combinations.

8. One Plug Does All–A single Cannon multipin connector carries all the audio, status, and remote signals. These signals may also be accessed through parallel XLR and DIN connectors.

9. Studer Revox Quality–A fully professional machine in every respect, the PR99 Replay Only features die-cast aluminum alloy chassis and head-block, servo-controlled capstan motor, contactless full logic switching, and a Studer-made play head. Careful German craftsmanship shows in meticulous attention to every detail.

10. Attractive Pricing–Best of all, the new PR99 Playback Only actually costs less than last year's best-selling reproducer. So before you order an automation system or replace your present decks, call or write for more details. You'll find that the Revox Automation Advantage was well worth the wait.

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With this interface, because of its more rapid data transfer speed, there is no lag between machine speed changes and the processor's pitch changes.

Yamaha also came out with two new systems. The REV 1 is a digital reverberation unit based on proprietary LSIs and new software to create up to 40 early reflections and up to 99 seconds of subsequent reverberation for sonic manipulation to match artificially any kind of listening environment. Also new is the YDD 2600 digital delay unit with variable channel configurations and a wide range of programmable delay time settings.

Multichannel Audio Developments

The FCC's acceptance of the industry-recommended BTSC multichannel audio for television system will have several immediate ramifications. Broadcasters can now dust off some of the programming that has already been mastered in stereo in anticipation of stereo broadcasting. And as early as next month we may hear the first FCC-approved stereo and bilingual broadcasts, from the Summer Olympics in Los Angeles (though at the moment this appears doubtful—there aren't enough stereo receivers in American homes to make the venture financially worthwhile for ABC). Meanwhile, KSL in Salt Lake City is due to begin stereo broadcasts any minute now.

But even if every broadcaster in the country suddenly decided to begin broadcasting multichannel sound immediately, there would be one small hitch: though the theory of stereo audio for television has been worked out, the practicality of completely retailoring the audio chain at broadcast facilities, involving everything from mics and consoles on up, has still got to be addressed.

Fortunately for those broadcasters willing to be the first on their block to get into stereo, there are several forward-looking manufacturers who already have systems ready to go.

One of the most impotant new pieces of equipment that will be required is the stereo generator, which puts a pilot tone on the composite audio signal. At the moment, both McMartin and Modulation Sciences are selling stereo generators. The two companies also sell SAP (separate audio program) generators, which are needed to produce the third audio channel (most will use it for bilingual translations) which will be transmitted along with the stereo signal.

The audio must also be encoded with dbx noise reduction because, according to dbx's VP of engineering Les Tyler,

Doug Dickey demonstrates SSL board for a crowd of interested NAB attendees. Console features full VCA-controlled automation.

"the stereo signal is poor enough so that a noise reduction system is necessary." The companding compresses the spectral dynamic range at the transmission point, and expands it again with the decoder during reception.

Another variable in multichannel transmission is RF bandwidth, according to Gregory Best of Harris. In order to reduce crosstalk and provide optimum stereo separation, wide RF bandwidth is important. With this in mind, Harris is now including wideband audio stages in its TV transmitter aural exciters.

Transmission is obviously a critical aspect of the multichannel picture, but, according to Douglas Dickey of Solid State Logic, it is probably the simplest aspect to get right: "If a broadcaster buys the proper gear, he's ready for transmission. But there are other considerations for which there are no hard and fast rules—namely, routing through the plant, monitoring, and production/post-production. These things present trickier problems," according to Dickey. "I have yet to come across anyone who has a comprehensive grasp of the solutions."

In routing, both Dickey and Best say that station people will have to take more care in routing stereo audio around the plant. In monitoring, there is the obvious need for two speakers instead of one in an area, says Dickey, "where audio is critically monitored.

"In most television facilities, audio still finds itself tucked into the odd spaces that were left after video, lighting, and the machine rooms were accommodated. Many of these spaces are not suitable f r stereo monitoring, exhibiting problems ranging from poor stereo imaging, unacceptable frequency response due to room geometry and equipment placement—in fact, a whole multitude of sins."

What to do? Dickey does not suggest that broadcasters rebuild their control rooms—not generally speaking, anyway. "In many cases," he says, "nearfield monitoring will sufficiently minimize the negative contributions of the room itself. Coupled with judicious equalization and some minor acoustic improvements, you can probably come up with a workable solution.

"The point is not perfection," he concludes. "The point is that your listening areas must provide a reference standard which will result in excellent stereo quality at the receiver."

Besides transmission, routing, and monitoring, there are also important decisions to be made about producing and post-producing stereo audio, and a number of manufacturers came to NAB

Ramsa WR-8616 post-production board.

ADM teleproduction console.

this year with boards they feel are well suited to multichannel.

ADM, for example, showed its new 9000 series, a microprocessor-based console with a third channel (presumably for SAP) built in. The company also demonstrated its BCS 2443 stereo teleproduction board. The console, which is manual rather than micro-based, has some of the same features as the 9000 series: mic and line preselection, stereo mixing buses, and full stereo submasters and masters.

Mark III-8 ½" 8 Channel Recorder

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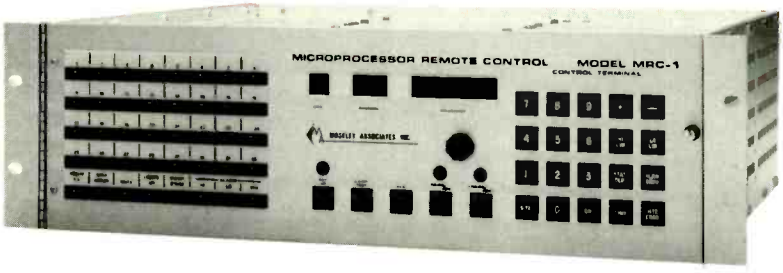

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  - 32 STATUS CHANNELS
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System setup is the key to the MRC-1's flexibility. Each remote site has up to 32 telemetry and 32 status channel capability. Command line outputs may be specified to function as the raise or lower output of any telemetry channel. A telemetry channel may be keyboard calibrated for linear, indirect power or direct power scaling. Upper and lower telemetry limits may be set and the channel may be muted when desired. Status inputs can be set to latch, or to invert before being displayed on a set of 32 LED's.

Where great display capabilities are needed, the CRT option can show all 64 status and telemetry inputs simultaneously, and duplicate the command functions of the Control Terminal. The Automatic Logger option records status and telemetry data at user-specified intervals. Instant control of 10 preselected functions is simple with the Multiple Direct Command option. Optional Moseley Memory protects against extended shutdowns by electronically preserving setup data for up to 10 years.

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Neither board offers multitrack recording—a feature the company feels is not especially desired for teleproduction.

Ward-Beck introduced two new microprocessor-based stereo consoles, the LS2442, and the LS3642. The consoles, which are totally modular, provide true stereo mixing. Mono mic/line input modules and stereo line input modules are assigned to four stereo submasters with sub assignment to two stereo masters and two independent mono masters. Also, the microprocessor master controller provides user-programmable signal routing, individual and group channel control, channel assignment and overload status monitoring, flexible muting, and interactive machine control. There is also an optional edit interface, which will communicate with computerized editing equipment, accessing channel direct outputs, and providing a variety of ramp, V, and crossfade functions. Console delivery positions are available in the fourth quarter of 1984.

Neve featured its 51 series, a line the company has been selling to the international market, but is just now selling in the U.S. According to Anthony Langley of Neve, an "uncomplicated" console is desirable in stereo production, and that is what he stresses about the 51 series. The boards, which are sold as four-bus units for $40,000 or eight-bus for $80,000, can be broken up and made smaller or can be added on to—a design concept with TV in mind. The 51 series also offers stereo or mono inputs, outputs, and submasters.

McCurdy highlighted its 8700 ($40,000–$50,000) and 8900 ($65,000–$75,000) series consoles. Both boards feature stereo inputs and stereo outputs, and also provide for mono sources such as mics, tape machines, or telephone inputs. This is especially useful in TV production, where much of the audio comes from outside (frequently mono) sources. Both consoles can also group a stereo section and a mono section into a stereo output. The 8900 can also do eight-track work.

Harrison featured TV-4 at the show. The console has been designed for a medium-sized facility, and was conceived with a number of uses in mind: on-air production, remote production, studio production, sweetening, post-production, and fixed-installation line sound. TV-4 is available in a variety of configurations of up to 52 mono mic/line or stereo line inputs. The console

also provides facilities for multitrack production (via the stereo audio submasters), but this will not complicate the board's basic operations, which do not require the use of multitrack recorders.

TV-4 is modular in construction and is available in three signal flow configurations, with each configuration available in a variety of sizes and physical presentations. The simplest configuration has two direct stereo assignments from each input module—main program one and main program two. No group modules are required, only one master module. The most complex configuration does not have direct output assignments. Instead, it has eight indirect group assignments. Eight stereo group modules, one for each stereo group assignment, are required for this console.

Studer was at the show with a range of consoles. But the interest, according to Fred Layn, centered on the 900 series, which now has several new modules and options. New features include a universal stereo input module, which offers stereo EQ, stereo high-level inputs, and an internal transformerless M/S microphone matrix circuit for stereo mics. Several high-level-only stereo modules are also available.

Ramsa highlighted a post-production console, the WR-8616. According to Gene Juall, "post-production is the prime activity of video producers working in audio, because sound is often recorded elsewhere and must be mixed down and sweetened." The WR-8616 can take the output of stereo pre-recorded material, cart machines, turntables, compact discs, and VTRs. Multitrack recordings, up to 16 tracks, can also be input into the board. The WR-8616 will also serve as a multitrack recording console.

In addition, Juall says the board has been designed with broadcasters' particular preferences in mind. There are VU meters on the outputs because, says Juall, broadcasters prefer them. And Ramsa put LED meters on the inputs "because recording people like that."

At $150,000 for a typical installation for live television, and $180,000 for a computer-controlled model for post-production, Solid State Logic's SL 6000E Stereo Video System is the Cadillac of teleproduction consoles.

The 6000 has three stereo mix buses. With this triple stereo arrangement, it is possible to get a stereo mix of one program and a mono mix of another, just by pushing three buttons, thus creating a stereo mix and a mono SAP mix "in little more time than it currently takes to create one program."

Also built into the console is a four-band parametric equalizer and a compressor-limiter and expander noise gate on every channel. The console also offers five-machine control. An option to the system is an events controller which offers control of not only five ATRs or VTRs, but also up to 16 cart machines.

Dickey says there are also provisions to edit on-air, and to escape from a sequence and re-enter at another point if, for example, "the talent gets their shirt caught in their fly and you have to go to someone else."

Audio Takes Hold in the Post-Production Environment

The days when audio played second fiddle to video in the television studio are rapidly drawing to a close. With the impending advent of multichannel sound, those who think of sound as secondary are being hustled toward extinction. Therefore, it came as no surprise that the NAB show was the scene of major advances in audio production and post-production, including new automation systems, new audio/video synchronizers, and new production equipment designed to fit into a complete studio system.

Neve 5116 with Necam automation.

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peripheral equipment to a degree equal to or greater than that of its video equivalent, the editing system. Advances in console automation have not only made the boards themselves more powerful, but have increased their control over a variety of audio and even video equipment.

These machine control functions are among the most significant advances in audio console automation, and the two top names in console automation, Neve and Solid State Logic, both incorporate machine control into their boards. Both companies announced advances in console automation at NAB, while at least two other companies prepared to

Quad Eight/Westrex Westar console.

move into the high-end automation field.

SSL's major announcement in the automation area was a new synchronizer controller for its SL 6000 E stereo video console system. The synchronizer controller extends the power of the board's Primary Studio Computer, a separately housed device that controls the automation functions, storing mix and time code information on floppy disk. The computer keeps all mix data frame-accurate during editing and has an alphanumeric keyboard that allows location information to be entered as names, numbers, time code, or feet/frames.

The synchronizer controller, which currently interfaces with the Adams-Smith 2600 Series and Audio Kinetics Q.Lock 3.10 synchronizers through their RS-232 ports, expands the machine control functions of the computer by allowing the engineer to command a lockup of up to five peripheral machines, operating them as a single unit. Machines (which may include ATRs, VTRs, or film chains) can be added to or deleted from the lockup at any time.

The controller's compact display has enable/select and deselect/stop buttons for each of the five machines under control, and also lists available machines, indicating which is the selected master. With an optional master transport selector, the engineer can designate any one of three machines as master directly from the console's keyboard, therefore taking advantage of the system's autolocation and list management programs. In addition, the offsets between various machines can be marked and modified simply and entered either as time code or as feet/frames. Floppy disk storage allows simple recreation of multimachine setups.

Another new option from SSL is a programmable equalizer, mounted on the console itself, that provides two channels of three-band parametric EQ, each with programmable stereo panning. Once again, a floppy disk memorizes all settings and control movements for later recall and update. The unit also has a programmable pan pot for each channel, with visual display of the actual control value of every variable element. According to SSL's Doug Dickey, up to four channels of programmable EQ are possible, as the large amount of electronics required currently limits the number of channels. The company plans to work on increasing the number of channels, however.

Neve, also a pioneer in console automation with its Necam system (in the field for nearly eight years, according to the company), announced its latest generation automation system, Necam 96, at NAB. The industry will not actually see the system, however, until the Association of Professional Recording Studios (APRS) show in London this month. Neve's Barry Roche says, "The new system has such sophisticated data handling that the computer automatically looks after everything, with no buttons to press."

Automation-ready LS2442 board from WBS.

Perhaps the most obvious difference between the Neve and SSL automation systems is that Neve employs servo controls to physically move the faders during automated sequences, while SSL's VCA controllers repeat the sequence electronically with no visible movement in the console. Servos eliminate any signal quality loss that may occur when the audio passes through the additional amplifier, although SSL's Dickey points out that the quality of VCAs has risen to the point that degradation is minimal or nonexistent. He adds that VCAs track more quickly and accurately than servos, which may take two or three frames to reach the desired position. Neve's Roche, on the other hand, says the moving faders give a

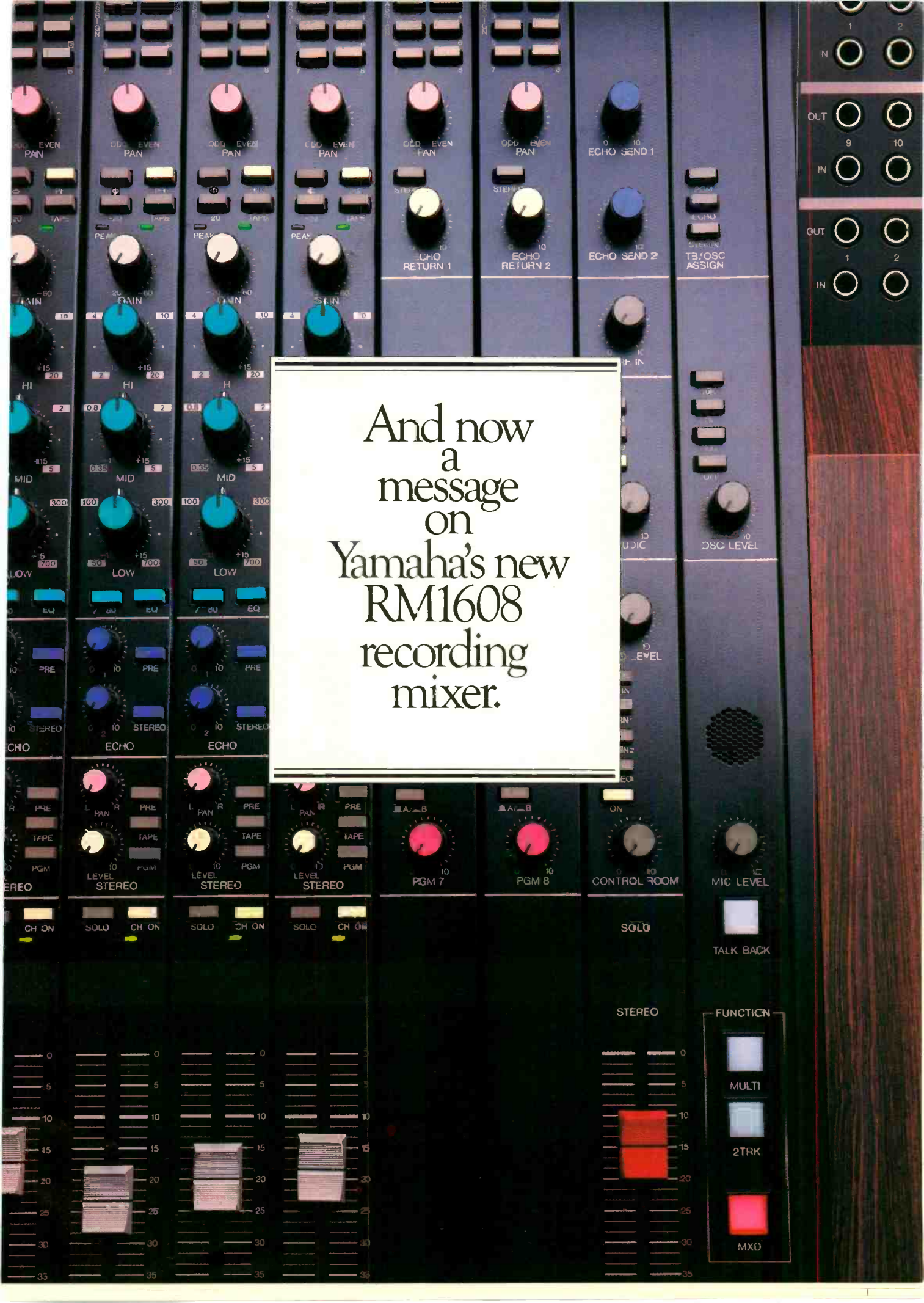
Autogram Microgram with automation.

more "instinctive" feel to the system, visually cuing the engineer throughout the mix. The new Necam, he says, incorporates an improved version of Neve's motorized faders for a lighter touch.

Machine control advances are also part of the new system, which will now control track switching on an ATR, useful for overdubbing. A new color monitor display lists such information as studio name, mix name and number, and word labels for mix elements. It also keeps a record of the position and timing of all mutes, with changes entered through a keyboard.

In addition to dynamic information such as fader movements, both the Neve and SSL systems store static fader positions for future recall. Necam 96, for example, will store a series of such "snapshots" and crossfade between them, which can eliminate the need to check time code numbers during live work and post-production. The comparable system from SSL is called Total Recall; it allows engineers to pick up where they left off with 0.25 dB accuracy.

Few other console manufacturers have looked seriously at automation. One exception is Quad Eight/Westrex, which hopes to show its new automation system this fall at AES or SMPTE. The company's new Westar console, which did make it to NAB, is ready to accept automated panning, fading, and EQ functions. The company's Joe Urbanovitch says the automation system will retrofit consoles now in the field. It will run off a personal computer with a 10 Mbyte hard disk and will subsitute intelligent digital faders with 256-step linear encoders for analog faders. (The microprocessor-controlled faders are fully functional even without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PGM 7
PGM 8
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ously. The basic eight-channel model costs $8550 including spare parts and three-year warranty, and a "fully loaded" 22-channel board is less than $22,000.

An important new board from Harrison is the AIR-7, the company's first console designed specifically for radio broadcasters. Based on Harrison's proprietary balanced, differential electronic signal function blocks, the console offers excellent signal performance and high RF immunity. It is available in a wide variety of configurations and features studio-quality conductive plastic VCA faders, VCA circuits for level control and muting, silent Hall-effect main logic switches, and center-detented stereo pan and stereo balance controls. Harrison had several other new consoles, including the PRO-7 for broadcast, live sound, motion picture, and TV production, and the Raven and MR-4 recording and sound reinforcement boards.

Harris's latest radio console is the Medalist-12 dual stereo audio board. This is the 12-channel version of the 10-channel Medalist shown last year. It is designed for both on-air and production applications and features five dedicated meters for program, audition, and mono/sum. Counters or clocks may be added if desired. All circuits provide at least 25 dB of headroom, and the console incorporates dbx VCAs, Penny & Giles attenuators, and Schadow switches. The Medalist-12 is priced in the $7750 range, depending on configuration. Harris also showed its Micro Mac modular audio console with digital control, on the market for about three years.

Quantum Audio (at the Gotham booth) brought new on-air modules for its Series 22 board. The modules, which may be retrofitted to consoles already in the field, incorporate ideas and feedback from radio engineers the company talked to last year. While eight, 14-, and 24-input frames are standard for these consoles, the company had a 28-input semi-custom job in the booth. A basic eight-input board sells for around $7200, 14 inputs for $10,000, and 20 in the $13,000 range.

The established Citation, Signature II, and Monogram II audio consoles were once again featured by LPB, which emphasized the boards' reliability. The company is now offering Penny & Giles conductive plastic rotary faders as an option.

The newest entry from Allen & Heath Brennel was the MBI Series 24A console, available for the past three years in Europe and the U.K. This completely modular board is available with two to 24 inputs. All input modules employ ducking facilities, allowing any channel to be assigned to control another channel for level control of source machines or incoming telephone calls; the feature is switch-selectable. The board also has new dual-movement meters for stereo L-R image adjustments. The average price for a system with three mic inputs, four stereo line inputs, one multisource stereo line input module, telephone input module, and all necessary control modules is approximately $30,000.

Allen & Heath also showed a prototype of the MBI Model 12, a two-piece unit that can function as a news or on-air mixer. The top section is essentially a nine-channel news mixer, with an optional fader pack that turns it into a small console. Complete, it is expected to sell for $9800. Interest was high in the company's System 8 console; shown was the smallest version, 12 inputs, which sells for $4400. The company also featured its Syncon Series B,

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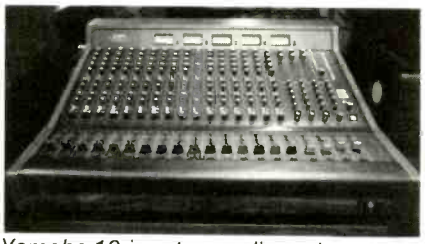


Yamaha 16-input recording mixer.

a true multitrack board available with from eight to 44 inputs at a price range of $9800 to $40,000.

Trident Audio Developments had a new console entry, the t.i.l., which looks like an "in-line" board but avoids potentially confusing status changes. This is possible because any or all of the eight auxiliary sends can be routed to either the input or monitor section of the console. In addition, the entire EQ section can be routed into the corresponding monitor section, and routing can be split for selective monitoring of either just the high and low or the two swept midsections. The standard mainframe accomodates 36 inputs, with eight auxiliary sends, six echo returns, a 360-way patch bay, separate mic and line inputs, and four-band equalization.

Studer introduced a variety of new options for its 900 Series consoles, including input and auxiliary modules, a choice of EQ sections, a full line of stereo inputs including a universal stereo input, input selector options, and new insert/patch points.

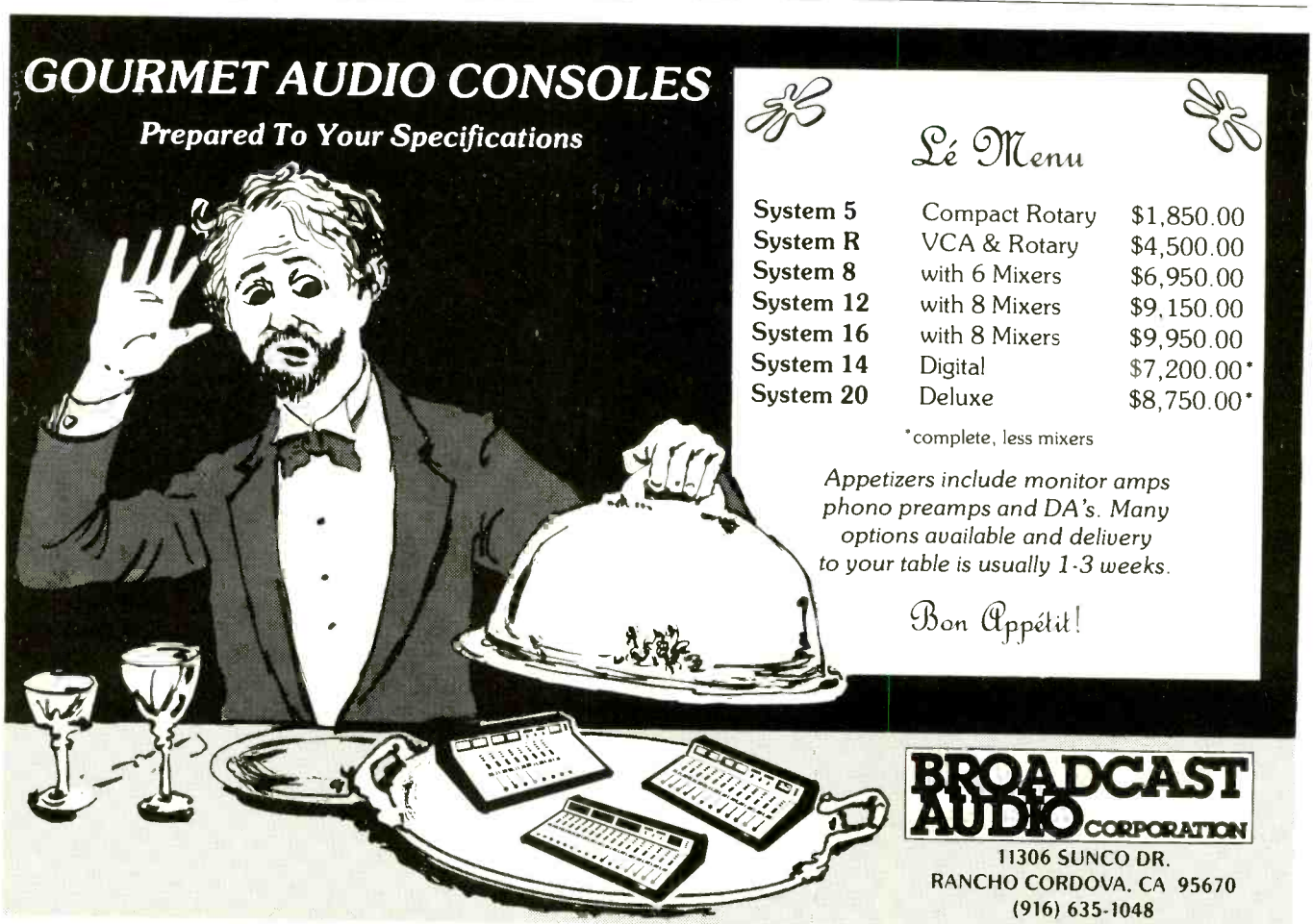
A new console "built to meet the aural performance requirements of digital audio technology" was the Logitek Perfectionist, which handles up to 32 selectable inputs on eight rotary or slide mixing channels. The company evidently has confidence in its product since it demonstrated the board with digital disc source material and high-quality headphones. The board boasts high specs and has silent electronic switching that allows program and audition channels to be fed separately or simultaneously. A bus swap push-button allows one-button control of multiple sources, and a prewired remote connection panel is equipped with telephone-style punch blocks and can be positioned to suit the user.

TASCAM added to its console line with a new production mixing board in a 20 x 8 configuration—versatile enough to work in radio or television.

Broadcast Audio emphasized its ability to quickly and economically customize any of its consoles to user specifications, with monitor amps, phono preamps, and DAs as desired and a variety of optional accessory modules. The consoles, ranging from the System 5 compact rotary-fader model to the System 20, are adaptable for on-air and production needs.

Amek brought its line of audio consoles designed for production. Introduced were the M 2500TV, a large-scale television board shown in a 56 x 48 configuration, and the Matchless, an audio production board shown in its 26 x 24 version. The M-2500TV is available in 24 bus, 24 or 48 monitor, 24- to 56-input versions with VCA automation. The company also featured its BCO-1 portable ENG/field mixer.

Featured at the JBL/UREI booth were two new series of small on-air boards, the 1650 and 1680, in a total of six models. Users have a choice of five-mixer or eight-mixer units and Penny & Giles, Shallco, or conductive plastic attenuators. Both series boast −24 dBm output into 600 ohm loads, allowing dynamic program material to be hand-



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previously brought out a UHF frequency synthesis system.)

Miniaturization of frequency synthesis components has been a key factor in WRR-210 and WRR-220 (diversity) receivers. To minimize interference, a computer analysis was done to select the most compatible groups of transuse of frequency synthesized transmitters for their power consumption, large size (to accommodate larger batteries), distortion, spurious outputs (in some

Swintek RF intercom system.

700 Series cabled system. There are nine new add-ons in all including a belt pack BH710BP and a two way speaker station WL742. And did general sales manager John Kenyon actually say HME was ready to give RTS a run in high-end cabled systems? (He did.)

As for making a run at the high-end wired systems, McCurdy introduced the Digitally Controlled Intercom (DCI), a microprocessor-controlled system with either programmable keyboard entry or dedicated firmware. The user can tailor the intercom for all transmit/receive locations, call functions and tallyback. In addition, according to McCurdy, the audio quality is good enough to allow monitoring of the program audio signal over the intercom system.

Clear-Com was clearly not sitting on its oars, nor were ROH, Swintek, R-Columbia, and Farrtronics. Clear-Com was featuring the CP-300 portable, remote station. Configured to work with both Clear-Com and RTS type systems, the CP-300 allows for two channels on a single microphone cable.

ROH had its flexible Series 300 which can be set up in several combinations in eight-, 16-, 24-, or 32-channel systems. Farrtronics showed its Model 525 intercom stations and the Model 175 intercom stations.

Among the wireless systems at the show, Swintek introduced the Mark 200D, a full duplex headset system. It includes Swintek's db-S processor for optimum S/N. Price is $1995.

New at the R-Columbia booth was the ultra-light, hands-free headphone/mic, Model UL-85/M that goes with the Series 6058 electronic telephones manufactured with pulse or tone dialing in single or switchable two-line configurations. This system is designed for ENG use.

Also emphasizing field production, Motorola C&E showed its line of IFB gear as well as new cellular mobile phones and headset amplifiers. Motorola also had the R-2200 communications service monitor for field servicing radio communications.

New Opportunities for Broadcasters: Radio That You Can See, Silent Radio

Recent FCC rules authorizing new services such as cellular radio plus more and unrestricted use of subcarriers have turned on innovators and entrepreneurs beyond expectation. So it was not surprising to find at the 1984 NAB Convention and Exhibition not only "Radio That You Can See," but also "Silent Radio," both new services possible under current FM SCA rules.

Still other technology-related opportunities being presented to broadcasters include benefiting from the availability of digital compact discs and converting to AM stereo. Both of these topics are covered in separate articles in this issue. Yet another is CallCount, a development that ushers in interactive broadcasting. The use of AM subcarriers for utility load regulation was discussed extensively at NAB as was TV stereo and second audio programs, all new opportunities. The latter two, related to TV, are covered elsewhere in this isssue.

"Radio That You Can See" was a slogan used by McMartin Industries to implant the idea that FM subcarriers can be used to transmit teletext pictures, facsimile, or slow-scan TV. McMartin can transmit five independent subcarriers in the authorized baseband spectrum from 53 to 100 kHz using its new Super S FM/SCA generator, the BFM-S-500. At the McMartin exhibit one setup showed all five carrying music or audio. More dramatic was the setup showing data transmission, including teletext picture transmission (with outstanding graphics), standard data presented in visual form, and slow-scan TV. All of these presentations were on color TV sets.

McMartin Communi-Quik display.

The examples shown were all possibilities that will be included in what McMartin has announced as the national subcarrier Comuni-Quik network (See *BM/E*, May 1984, p. 64) being structured by the company. A regular stream of broadcasters visited the McMartin booth to learn more and find out how they might participate. Some of them were among the several hundred who had earlier expressed interest in the imaginative plan. All got assurances from Ray McMartin that plans to create the network were proceeding. Broadcasters who become part of Comuni-Quik will get one channel for their exclusive use in return for permitting their transmitters to broadcast four other subcarriers. These four other channels will be programmed by Comuni-Quik. Broadcasters will get a royalty on the other channels based on their gross. Although broadcasters are expected to pay for the necessary SCA equipment, some barter arrangements trading equipment for SCA leases are contemplated. McMartin feels about 230 stations will blanket the country.

The McMartin Super S generator system was the only one at the NAB show ready to handle five subcarriers. It uses a spectrum-efficient AM single sideband technique. Subcarrier channel frequency assignments and receiver carrier reinsertion are locked to one-half multiples of the 19 kHz stereo pilot tone. The carriers become 57, 66.5, 76,

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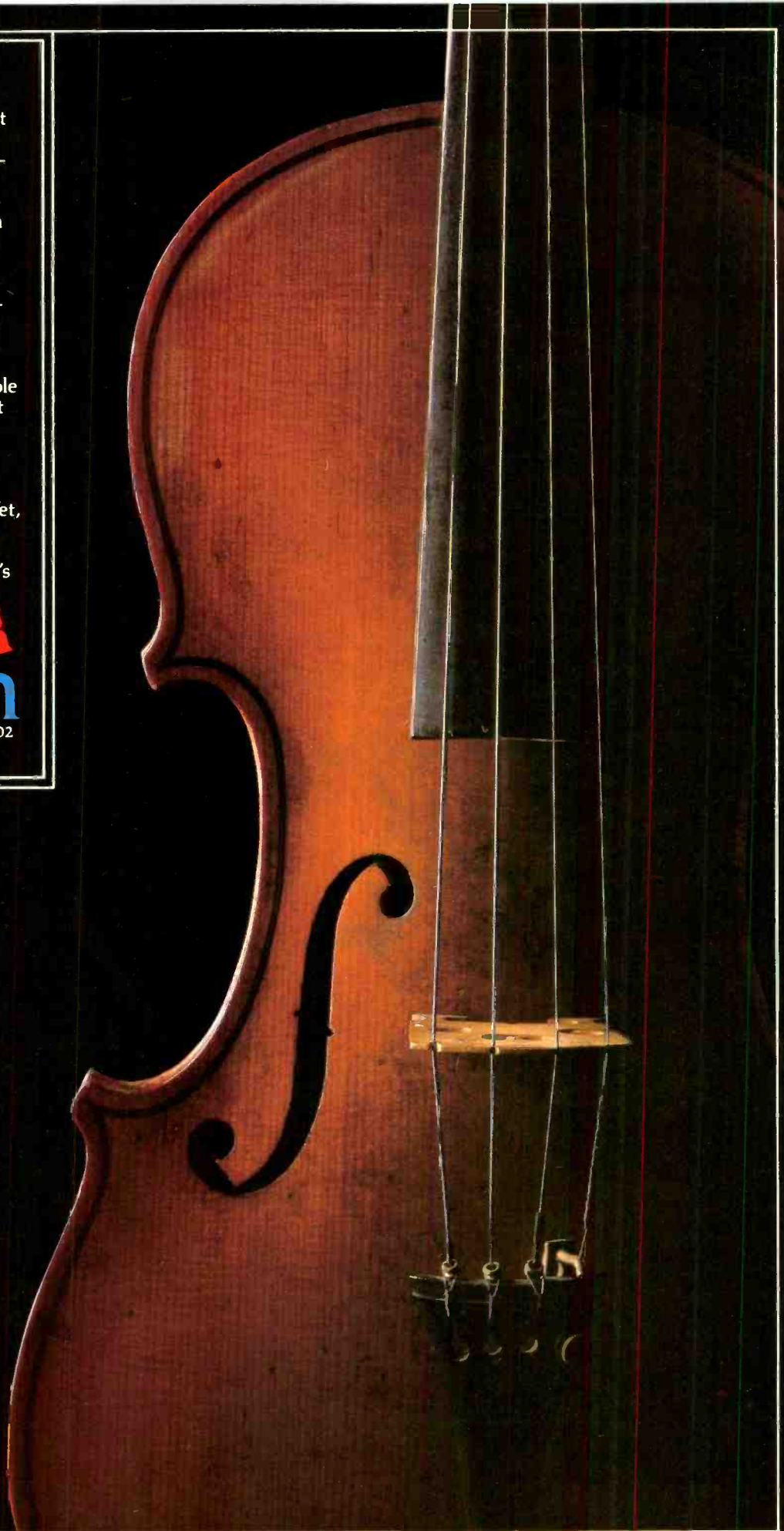

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85.5, and 95 kHz. The Super S is simply installed between the stereo generator and the FM exciter. Other related McMartin equipment on display included Super S tuners, TR-S-500, and stereo generators. The company is also poised to move into TV stereo, showing several generators including a TV/SAP (second audio program) unit for this purpose.

To assist it in the data transmission business, McMartin has retained a consulting firm, Broadcast Technologies Group, Inc., part of Broadway Video. Data schemes under development include possibilities of transmitting at the rate of 9600 bps, or 48,000 bps if all five carriers are used.

"Silent Radio" is a new medium best described as electronic billboarding made possible by transmitting digital signals either over FM SCAs or TV vertical blanking intervals. The new medium exhibited at NAB by Cybernetic Data Products has been used to transmit fresh content to thousands of individually addressed billboards over a wide area. Now Cybernetics has created Silent Radio to display sports news in bars, or news headlines, weather, or advertising messages in a variety of public places. The information is displayed as a moving message (one or two lines) on bright red LED screens. The encrypted digital data is inserted at a station on an FM subcarrier (or unused TV line) and received on a special tuner where the data is stripped out and fed to the display.

Cybernetics supplies a complete editorial service based on major wire or local news inputs. Cybernetics has been transmitting to 11,000 locations in Los Angeles using the TV station KCET. Another several thousand will be added for the Olympics. Its signal to the Las Vegas Convention Center came via SCA using the Univeristy of Nevada's local FM station. In the top 25 markets, Cybernetics says it is looking to lease an unused carrier; in the smaller markets it instead plans to go into a partnership with a local broadcast station to offer the service.

Subcarrier degradation?

Broadcasters harboring the notion that the use of subcarriers automatically lessens the modulation of the main channel and therefore degrades normal stereo, were in for a pleasant surprise at this year's NAB. It was reiterated in many ways at the convention that 110 percent modulation of subcarriers authorized by the FCC March 29 (Docket 82-536) makes it possible to avoid weakening FM loudness.

The documentation was described in a paper read by Harrison Klein of Group W, Westinghouse. It is a physical law that main channel modulation must be reduced (backed off) when subcarriers are introduced. The 110 percent modulation rule has decreased by half the former requirement for backoff. Thus, said Klein, "main channel modulation will be reduced less than a half decibel when one 10 percent subcarrier is added." He said this should be the necessary incentive to get stations to take advantage of their subcarrier capability. Test data shown by Klein revealed that the necessary protection ratios against unwanted interference were maintained when comparing stereo plus two subcarriers at 110 percent modulation against stereo alone at 100 percent modulation. (No tests were performed with five subcarriers.) Klein said even short-spaced stations could maintain their RF signal levels without fear of interference.

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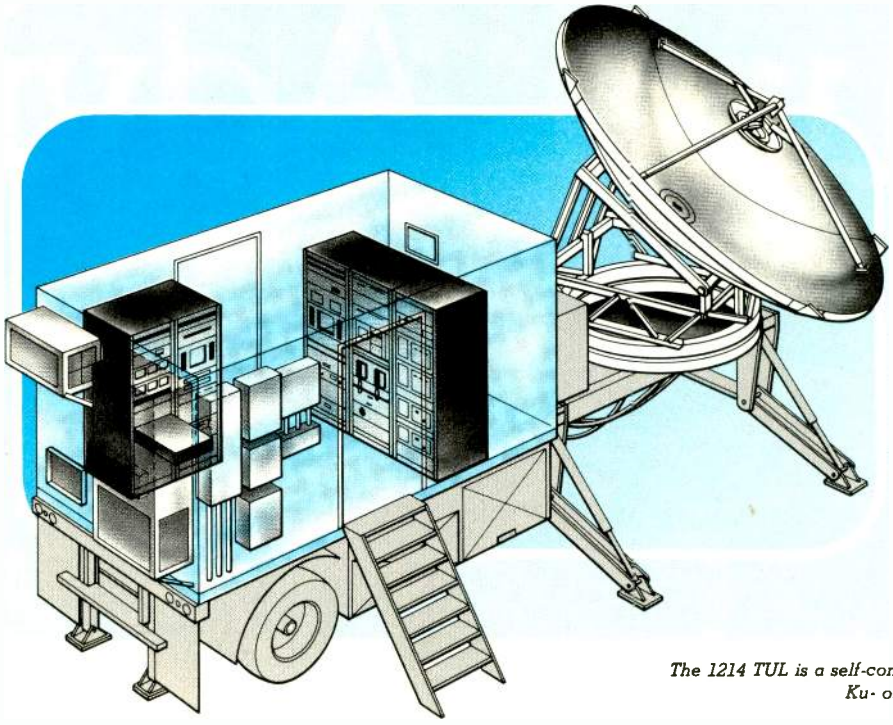

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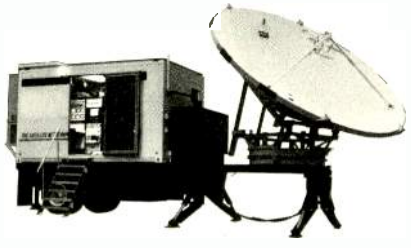

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tion be paid to the bandwidth and linearity of every link in the chain. In analyzing some of the subsystems at a technical session, John Lyles of Broadcast Electronics said corrections for bandwidth and distortion limitations should be made at every stage, and he described those limitations that might be encountered in the SCA generator, the stereo generator, the FM exciter, composite STLs, and transmitter RF stages.

Among some warnings: SCA audio should be bandlimited to 4.3 kHz to minimize crosstalk; too much bandpass filtering can cause unwanted intermodulation products in the demod; stereo generators must have good 38 kHz subcarrier suppression (with modulation supplied) and lowpass filters must have good group delay characteristics to avoid overshoot or ringing; FM exciters must be very linear; STLs must have a flat bandwidth through 53 kHz (since many FM exciters and STLs can't meet this requirement—or even a more stringent one in the case of multiband SCA—the stereo generator should be able to compensate for deficiencies); in RF amplifier stages, solid state broadband circuits are better than tuned networks, but the latter may be necessary as output bandpass filters in dense RF environments to avoid intermodulation products from being generated in power amplifier modules. All broadcasters with old equipment should study Lyle's paper closely.

In considering data transmission via FM subcarrier, Eric Small of Modulation Sciences told engineers that frequency response, distortion, and S/N ratios were not as valuable as speed and accuracy in describing equipment and systems. He said a properly tested system has an error rate (expressed as number of errors in so many bits passed) attached to it. Errors like one in 10 to the fifth power (telephone specs) or one in 10 to the seventh power are typical. Small advised engineers to beware of equipment described as having error rates so low as to be insignificant. While outdoor antennas may permit a system to claim an error rate of one in 10 to the seventh power, this may drop to one in 10 to the fifth or worse when indoor whip antennas are used. Small said indoor antennas are unacceptable in high rise office buildings in densely populated urban areas. He also warned that consumer type FM antennas vary too widely in VSWR to be predictably safe; the only answer is the Scala FM log periodic.

Small said that the Modulation Sciences Data-Sidekick transmits at a 4800 bps rate (using frequency-shift keying to produce zeros and ones) but that other modulation schemes are faster. Any data channel can be subdivided into number of separate messages at lower rates. Error correction coding is usually incorporated in the software of the message. Small observed that data on subcarriers is a new technology with vast potential for the entrepreneur.

Among some of the very simple data transmission schemes now in operation are paging services—permissible as an SCA use. Two on exhibit and described in papers at NAB were those offered by Reach and Motorola.

Tests run by Motorola reveal paging is not practical in urban areas particularly when the transmitter is 12 miles or further from the heart of the city. The problem is penetrating a building with a sufficiently powerful signal. Most Class A stations will have a very limited range. To reliably receive a signal on a pager (whose internal antenna is rated about 20–30 dB poorer than an auto dipole) located on the first floor of a high rise building, the transmitter should be no further away than about six miles. While it might be assumed translators could fill in poor signal areas, this would call for another frequency and pagers come equipped with only one. Land mobile systems can add transmitters on the same frequency. Thus the only broadcasters with SCA paging potential are likely to be those Class B and C stations operating at their highest power and having over 1000 foot antennas.

Motorola's test data is extremely revealing and valuable to any broadcaster contemplating paging. It tackles four common misconceptions, substituting for them four facts: (1) Because of the poor sensitivity of pager's internal antenna, an SCA pager's range will be less than half that experienced in automobiles; (2) 9600 bps is probably the highest practical data rate, which translates to 1200 alphabetical characters per second, one-fifth the amount often claimed; (3) Although there are only 37 local RCC paging channels available, these channels can be used over and over in each of the 200 major markets as SCA is not the only paging service opportunity; (4) While the market for 20–25 million pagers may develop by 1990, this must be shared by RCCs, telephone common carriers, and other private sectors.

Motorola feels that voice paging would limit broadcasters to the use of only two subcarriers total; binary digital alert paging, on the other hand, would permit paging, other data, and two other voice services. On the floor, Motorola exhibited various encoder models each having the ability to address different sized systems. It also showed a small 5.6-ounce binary tone alert pager, the SCA 1000, designed expressly for the FM broadcast band.

Offering the opportunity to tie into a national service offering not only local and national paging, but electronic memos and voice mailbox plus discounted long distance service and cellular radio, was Reach Inc. (described extensively in *BM/E*, May 1984, p. 60). While the Reach booth did not contain much hardware, there was lots of literature describing its many services, present and future. Reach offered four options under its new Spantel Division: become your own paging company by purchasing Spantel paging equipment and selling pagers and the service in your local market; become a nationwide network affliate by purchasing the right to sell the total plan—paging, electronic and voice message forwarding, cellular radio, and data distribution services; pay a license fee and allow traffic on your station; lease your SCA to a Spantel affiliate.

Spantel's Cellular Controller, CC Mk VII, with 4000 subscriber capacity, handles all the aforementioned services (the more elaborate ones as options) and bills subscribers monthly. The Reach TVC-1 pager, weighing 4.75 ounces, provides not only a tone-only beep but also a 10-second voice message. Will the system work reliably? Don Naber of Reach, appearing on the technical program, said "yes," but experience to date indicates that all of the equipment in a broadcaster's plant should be under control and capable of meeting SCA requirements.

TFT Inc. offered some new equipment to help in the task of monitoring a station's performance. These included a new Model 844 and 845 FM/baseband/stereo monitor and FM/SCA monitor. The 845 SCA monitor, for example, measures modulation, injection level, SNR, and crosstalk . In conjunction with a distortion analyzer, THD. can be measured. In conjunction with a receiver, the unit acts as a standalone SCA monitor. Both the stereo and SCA monitors include a unique TFT patent pending Peak Modulation Duration differentiator scheme to differentiate peak

pulses generated by overshoot or multipath from true peak modulations. An accumulator counts actual modulation peaks. Frequency synthesized tuning is used.

For SCA reception, TFT exhibited a new SCA4 FM-SCA receiver module and an attractive desk-top unit, the 867. Both tune in both the main channel (sensitivity 2 μV at 30 dB quieting), and the SCA program (sensitivity 10 uV for 30 dB SCA quieting). S.C.A. Communications, a subsidiary of Emergency Alert Receiver, Inc., also had some new "all sidebands" SCA receivers. The subchannel decoders employ phase locked loop detection for noise free audio recovery. The detection circuitry is extremely linear, E.A.R. says. Johnson Electronics was also an SCA exhibitor, but had no new equipment. Another SCA-related exhibitor, Modulation Sciences, showed a data generator, the Data-Sidekick.

Using AM subcarriers

The virtues and techniques of using AM subcarriers for utility load management were described by William Holbrow, Altran Electronics (div. of McGraw Edison) and some of the equipment used was on display at the company's booth. AM SCA is better than FM SCA for load management, according to Holbrow, because the area of coverage is not limited to line-of-sight. As much as 30,000 square miles can be covered by an AM station. He also judged AM SCA better than private radio or powerline carriers. The technique calls for transmitting subaudible (less than 80 Hz) digital signals, which are superimposed on the broadcast signal using small-angle synchronous quadrature (phase) modulation. The subaudible signals do not interfere with the AM program, nor do they deplete the carrier power or coverage area. To produce a digital "1," the carrier is advanced and delayed by ±-30 degrees. The absence of phase modulation in the appropriate time slot indicates a "0." The phase-modulated signal is transmitted at 80 bps. Interface equipment at the station includes a redundant microcomputer (Z-80) and modulator. The microprocessor handles 32,000 control groups with a 32 command repertoire. Individual addressing would require a larger computer. Radio-controlled receivers decode the signal and control a single relay.

The system can be made two-way so that conditions at the receive site can be monitored. These conditions can include intrusion (high temperature, smoke) or other emergency situations. The broadcast station signal is the frequency reference for the return link (either VHF or UHF) providing a coherent source for a synchronous detector in the receiver back at central.

Opportunities besides utility load management include paging, traffic light control, highway sign display, signals for coordinating vehicle location, and two way communications systems. Holbrow said the synchronization provided by a stable AM carrier controlling a low cost phase-locked-loop receiver provides a highly efficient technique for time-division multiplexing as well as frequency control. This is the key to cellular systems involving multipoint communications. Will such a service interfere with AM stereo? Holbrow says definitely not. Altran's phase modulation signal will not trip stereo pilot tones, nor does AM stereo interfere with its data transmission. KNX Los Angeles is currently

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transmitting energy management signals and other tests are, or soon will be, underway in stations in the Detroit, Phoenix, Philadelphia, and Houston markets.

Cellular radio

While there were no exhibits devoted exclusively to cellular radio (aside from some Motorola radiotelephone designed for the new service), cellular radio was a topic at the Radio Management session, "Making $$$ With New Technologies." Paul Bortz, of Browne, Bortz & Coddington, described cellular radio as a bright opportunity. There will be only two licenses per market and telephone interests can have but one. But Bortz cautioned broadcasters to evaluate the competing services such as paging (much less expensive), private radio, and other new services of the future. While opportunites in the major markets are restricted and already filed for, all markets below 90 are available. They may open up this year.

The FCC is likely to make these awards on the basis of a lottery. This alters the method of filing—rather than put in an application that must withstand the test of a comparative hearing, broadcasters need merely file an application that would would hold up as competent. Such applications cost less than $10,000 according to panelists at the session.

Interactive broadcasting

An idea that seemed to catch fire at this year's NAB was CallCount, a trademarked name used by JBL to describe its interactive approach to broadcasting. An instant system for measuring telephone calls, CallCount hooks as many as 50 lines to any telephone system and can handle 15 calls per telephone line per minute. As a question is posed during a broadcast, two phone numbers are provided to callers to cast their ballot or opinion. The incoming results are immediately shown and continuously updated on a TV screen using an RS-232 interface. Or, in the case of radio broadcasters, results can be read from the readout counters on the CallCount unit. The system can be expanded to accomodate additional 50 line units. WXIA Atlanta uses 150 lines (75 for yes, 75 for no). Because of the speed of the system (four seconds for a transaction), about 50 lines serve a population of one million. WXIA typically gets 45,000 calls on questions; it logged 110,000 regarding opinion on a Martin Luther King holiday. Callers hear a computer voice that acknowledges the call.

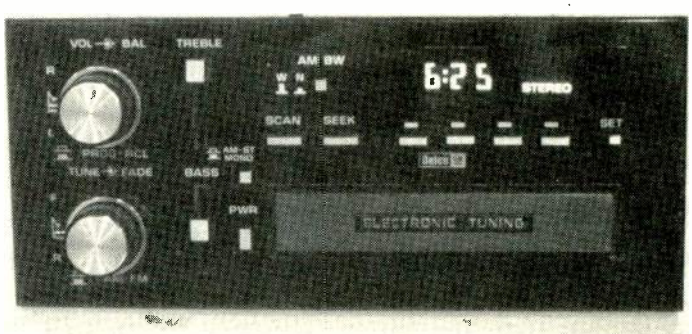
Automatic radio information

Yet another new opportunity for FM stations is to offer a traffic information service called ARI (Automatic Radio Information) being supported by Blaupunkt Radio. Gerald LeBow, a consultant, described the system and what is happening in the U.S. (It has been in operation in Germany for 10 years.) Essentially ARI uses a 57 kHz subcarrier. Several modes of operation are possible—a pilot light and a tone can indicate a traffic report is available, or the traffic report can come in automatically, overriding the program listened to. The station or region providing the report can be identified. ARI started in the greater metropolitan New York area; it now runs a corridor from New Haven to Wilmington, DE. Since only Blaupunkt sells ARI equipped receivers at present, motorists equipped to receive the service are counted in the "tens of thousands."Stations benefit by having good time buys and the publicity gained from ARI promotion. Detroit and Los Angeles (in time for the Olympics) are the next markets to be served. This will bring the total of ARI stations to 19.

AM Stereo Excitement Builds: Motorola Is On a Roll but Sony Is Savior for Others

Radio managers eyeing AM stereo as a means of gaining parity with FM were bullish at NAB. Doubt and confusion left in the wake of the FCC's infamous decision to duck standards-making by letting the marketplace decide was shaken for many with the advent of the Sony SRA-100 multi-system receiver, introduced last summer.

Strong praise was heaped on Sony at the Radio Management Session, "AM Stereo, Chapter II" by all of the broadcasters participating—Fred Walker, Broadstreet Communications, Wayne Eddy, KYMN, Northfield, MN, and Don Dalton, KSI/KOST, Los Angeles. They urged other manufacturers to follow suit in promoting Sony so that broadcasters would not have to decide on any single system from among the four "all good" systems offered: Harris, Kahn, Magnavox, or Motorola. The same thing happened at the Radio Engineering session when the audience came out in praise of Sony and disdain for Delco. But other announcements at NAB seemed to smash such hopes for multi-systems receivers. Pioneer, in a joint annoucement with Motorola , said it favored a "single system" and commented, "from a combination of technical and marketing factors, Motorola's C-Quam seems to us a clear choice." Pioneer made it clear that it expected its decision would add weight to the drive for a single system. The



Delco receiver outfitted for Harris AM stereo listening test.

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Features include two types of interface to video editing systems: Post-fade balanced line level direct outputs from each channel for those switchers/editors requiring independent audio sources; or a VCA interface that provides DC voltages to control the input channels gain. Cross-fades and cuts on the 5455 may now become part of the EDL.

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first AM stereo receiver will be a car model, priced at about $300 due this fall. Pioneer is a big supplier of auto radios, having sold more than six million sets in the U.S. Harris, acknowledging the momentum towards a single system, following Delco's selection of the C-Quam system and Motorola's aggressive promotion, announced it was changing the pilot tone frequency in its linear AM stereo system so that it would be compatible with radios designed to receive only the Motorola system.

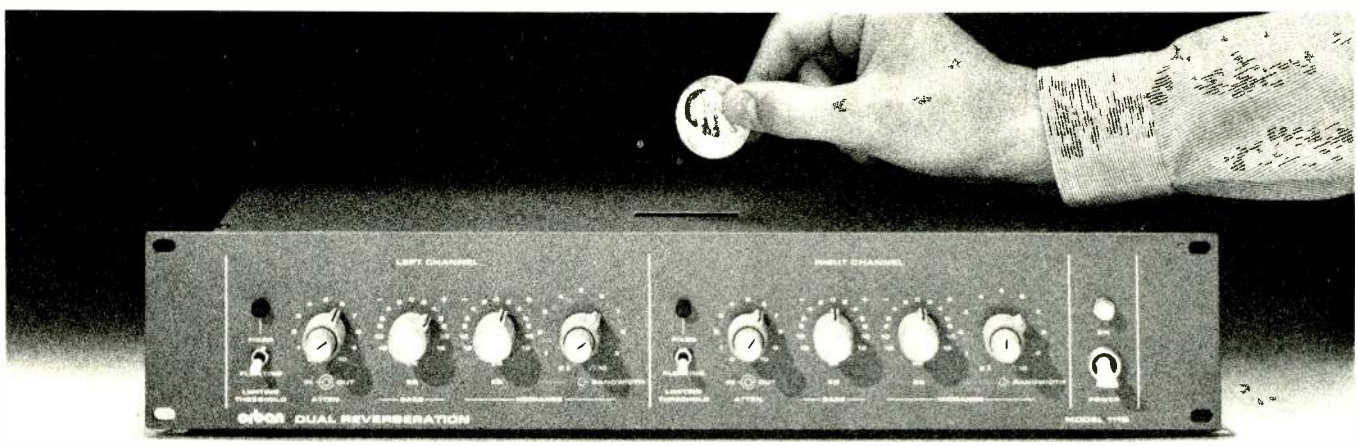
Although Harris still favors multi-system radios it feels broadcasters must serve the largest number of listeners possible by providing a signal compatible with both types of receivers. Harris expects its move will stimulate the AM stereo marketplace and has dropped plans to produce a chip of its own. Listening tests run by Harris on a Delco receiver indicate that both the Harris- and Motorola-generated signals are perceived to be of comparable quality, although it admitted a minor change in the Delco circuit would optimize linear reception. These tests also confirmed that the change in pilot tone (from 55 Hz to 25 Hz) does not affect the "superior reception" of the Harris system on multi-system receivers. (The change does not alter reception on the Sony set because it did not use a pilot tone.) Modification kits will be available to broadcasters currently using the Harris system who wish to change to the 25 Hz pilot tone.

Although Sansui is in the multi-system camp with its TU-S77AMX automatic AM stereo/FM synthesized tuner, it has not been as aggressive as Sony in promoting AM stereo. Other set makers appear to be headed the single system route. Motorola claims at least six more are preparing C-Quam only receivers. Its score card thus reads Chrysler, Concord, Delco, Jensen, Marantz, McIntosh, Pioneer, Samsung and Sherwood. Motorola has been outspoken in opposition to the use of multi-system sets, charging that they would most likely compromise performance. It has attacked the Sansui TU-S77 AMX as seriously distorting the signals from Kahn, Magnavox, and Motorola systems.

If there is a bandwagon now going for a single system, Sony is committed to the other way. It promises a car AM stereo tuner this fall, a cassette model with an AM stereo decoder, and a Sony Walkman version (for $79.95). Magnavox as a receiver manufacturer apparently prefers a multi-system but has not announced plans to make such a set.

Despite the past confusion and the limited number of receivers in consumers' hands (Sony's number in the tens of thousands concentrated in a few markets; single systems are more numerous but diffused amongst many markets), broadcasters are buying equipment. Motorola claims over 141 exciters shipped; Harris reports 100 worldwide (Australia is a big customer); Kahn says over 100 have been delivered. Continental, supporting the Magnavox PMX system, isn't bragging about systems sold but is still advertising PMX merits and asks broadcasters to make comparisons. Several are going on the air very shortly with the Magnavox system.

Jon Strom of Sony, who claims neutrality in terms of system preference, reports 225 stations on the air, four times more than a year ago. These are located in 160 cities. In 29 cities, multiple systems are in use. Only Kahn claims to have significant network support.



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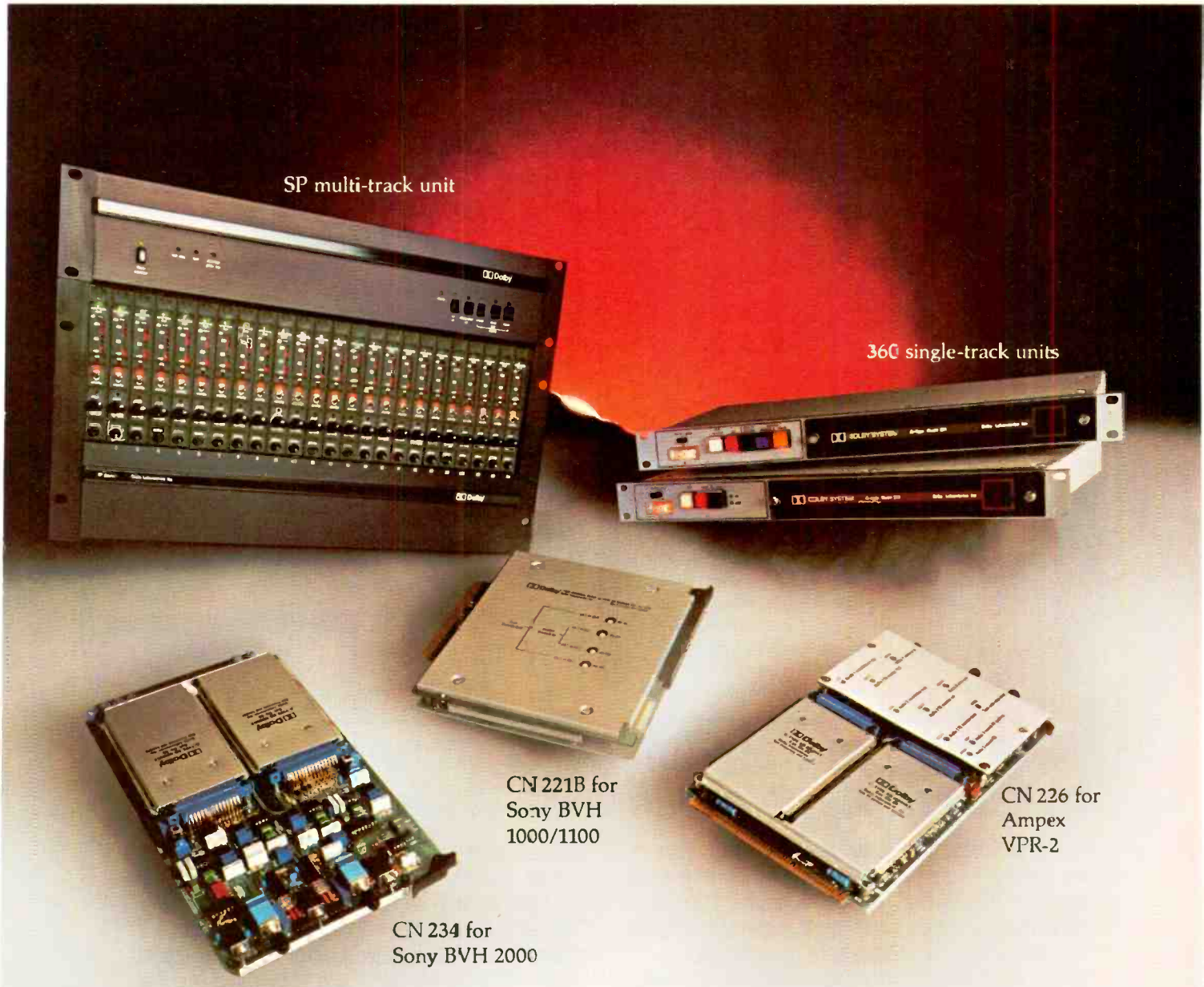

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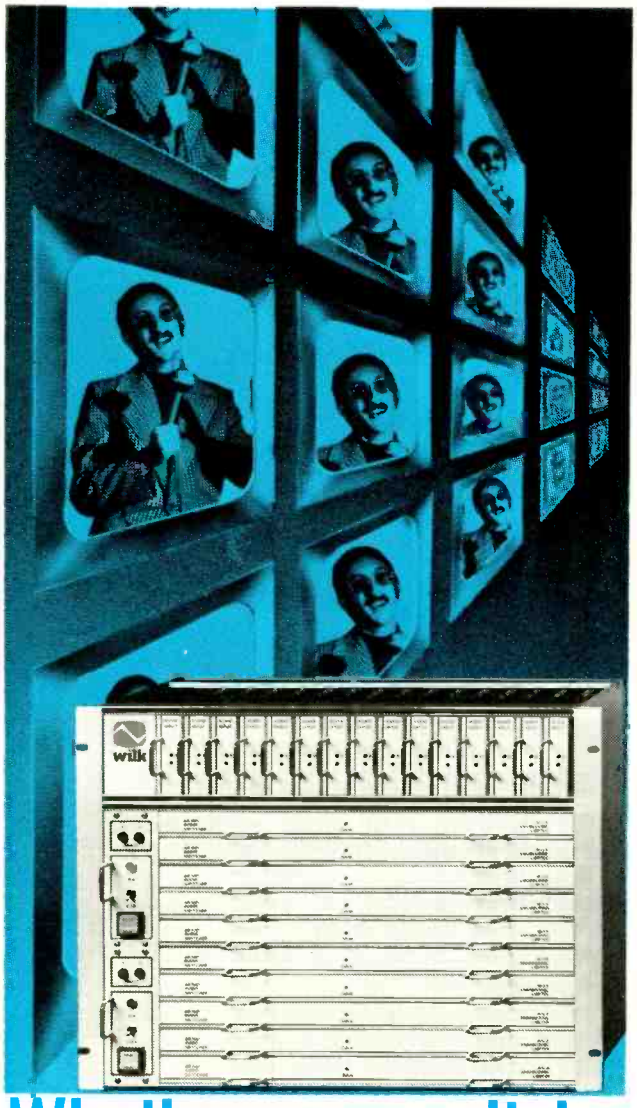

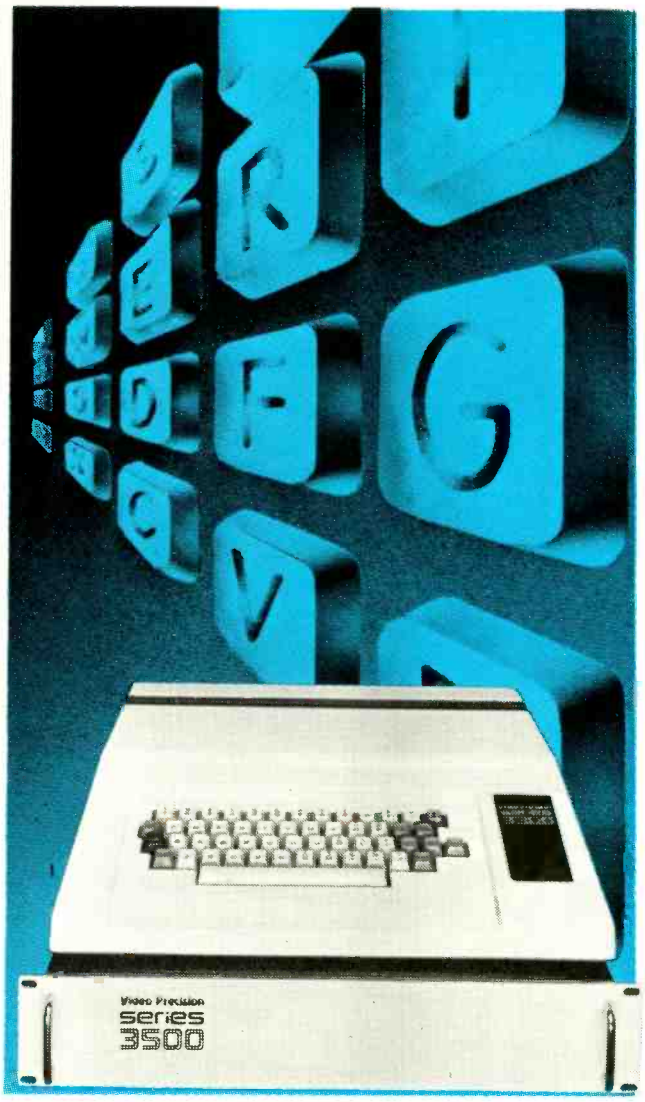

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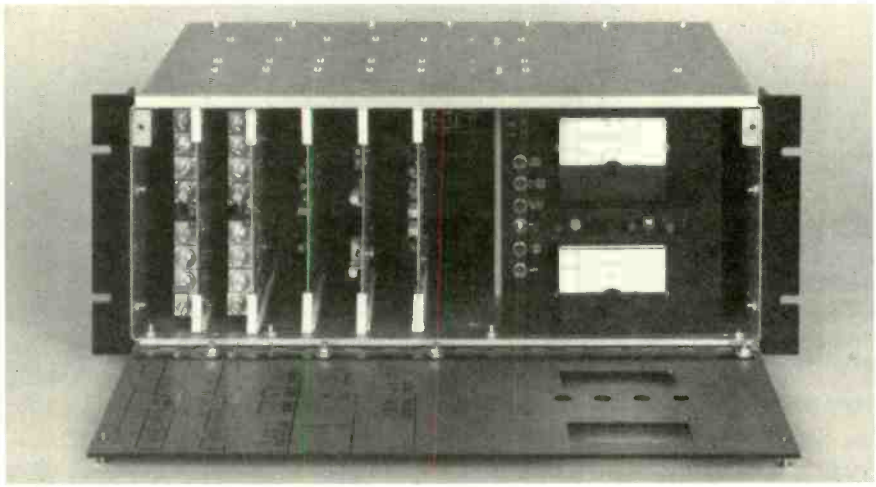

TFT's AM stereo exciter for C-Quam transmission.

It is the slowness of some major market stations to get into AM stereo that has some of the forerunners upset. Wayne Eddy is annoyed that no one in Minneapolis or St. Paul is promoting AM stereo. That hurts him in his suburban market. NAB panelists urged that broadcasters get in there and help sell sets. Don Dalton takes AM stereo Listening Posts (a pedestal equipped with an SRA-100 and four headsets) into stores to increase awareness. Crowds of 30 to 400 are attracted to listen and participate in a drawing to win a SRA-100. Dalton's promotion is not expensive since the merchant pays well for the extra traffic drawn to his store. Dalton says you have to tell consumers where AM stereos can be bought just as you informed people where they could get Cabbage Patch dolls.

One of the best ways for broadcasters to promote is to join forces. Fred Walker lauded the four New Orleans broadcasters who formed the Louisiana AM Stereo Broadcasters Association as a move other cities should take. Such cooperation will spark receiver distributors to get more active

Awareness of AM stereo is high where it is promoted, according to a fresh McGavern Guild study of nine markets. But there is a problem. According to the study, some 60 percent think they are already receiving stereo when they have only the capability of hearing mono. Thus education is vital, according to McGavern Guild, to get people to go out an buy a good AM set. Educating 18–34 year olds is vital since this group, which grew up on FM, has rejected AM as inferior. Real listening on quality wideband receivers will be essential to win converts.

While most of the demonstrations at NAB sounded good, Robert Orban of Orban Associates told an engineering group that bandwidth is not as high as might be expected. He declared the Sony receiver as good but rolling off about 12 dB after 9 kHz. Sansui is down 20 dB at 9 kHz; the Delco is down 5 dB at 6 kHz. Although the latter doesn't appear to be wideband, its a

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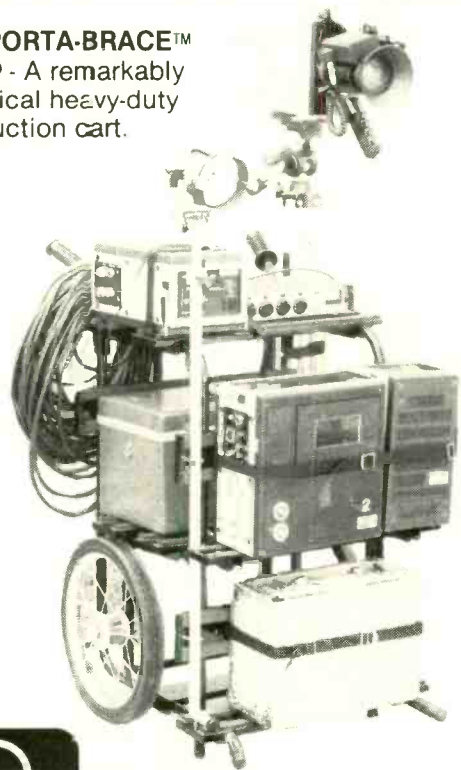

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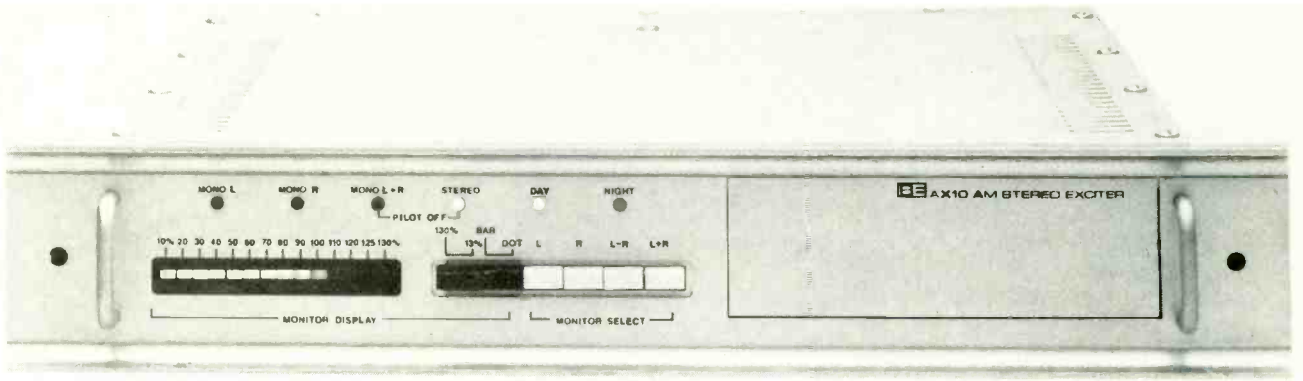

Broadcast Electronics AX10 C-Quam AM stereo exciter.

good choice for cars to avoid adjacent channel interference, he said. Since bandwidth is not as high as might be expected, Orban feels preemphasis should be included in the transmitter link. Among some processing suggestions from Orban were the absolute need for multi-band processing and the essential requirement that the pilot not be clipped. All positive clipping is done at high risk, he said.

Processing equipment for AM stereo was prominent on the exhibit floor. Orban showed the Model 9100A and Circuit Research Labs demonstrated the AM-4 Stereo Matrix Processing System. This system includes a matrix processor, a stereo prep processor, a spectral energy processor (four bands) and a modulation unit. The matrix processor is important because you can have a loss in mono loudness if the program material has a L only signal or a R only signal. While simple processing can adjust for the problem, loudness can be increased unduly during single channel stereo transmission. The matrix processor provides a continuously variable control to adjust between the two extremes. The unit actually improves the mono signal.

Improved mono reception when using a stereo exciter, even in the absence of a stereophonic input, is a phenomenon being observed by several broadcasters, and particularly those using Kahn exciters. While the exact reasons are not clear, exciter adjustments presumably compensate for certain transmitter characteristics that lead to clearer mono. Thus there is a reason for talk-show stations to go stereo!

But such improvements aside, there are still some troublesome aspects of AM stereo broadcasting cropping up now that its practice is becoming more widespread. Ignoring platform motion, which may not be a real problem because it's a phenomenon occuring when signals are weak and listeners won't stay with a weak fringe signal in any event, "occupied bandwidth" is coming under increased scrutiny. Some broadcasters are finding their signal is being interfered with by spectral energy from another station. The culprit is assummed to be Motorola systems, stemming from the high degree of separation they deliver, particularly at 5 kHz and above. If that is the cause, Motorola may have to crank down on its separation, thus losing one of its features. At least one processor maker adds 70 percent limiting. On the other hand, there is some suspicion that some such reports are simply rumors started to slow down the momentum now going for Motorola, which said again at the Engineering Session at NAB that it can't find any data supporting the charges.

The momentum tilting to the Motorola system will increase from another quarter. At the NAB show AM stereo exciters of the C-Quam type were shown by three other sources: Broadcast Electronics, Delta, and TFT. Type acceptance for these entrants is either a recent event, or one shortly to happen, so all can now actively sell.

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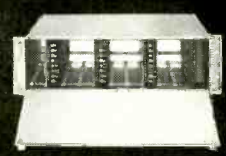
VRM0637	0-637.5	2.5	Slide Switch	*1.00	.4	28
VRM1275	0-1275	5.0	Slide Switch	*3.00	.4	33
VRM2270	0-2270	10.0	Slide Switch	*3.00	.5	40
VRS0317	0-317.5	2.5	Strap	.40	.5	26
VRS0635	0-635	5.0	Strap	.75	.5	35
VRS1270	0-1270	10.0	Strap	1.50	.5	37
VRS2260	0-2260	20.0	Strap	3.00	.5	40

*±.2db variation at any delay setting.



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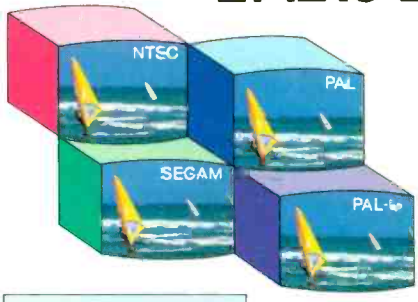

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INDUSTRYWIDE DEVELOPMENTS

Spectrum Management: Getting More From Less

The number of AM, FM, and TV stations has grown, but frequencies for auxiliary services such as STL, remotes, and electronic news gathering have not—indeed, some auxiliary bands must be shared and others moved. Bandwidths are becoming more occupied with the addition of stereo and SCA. Presunrise and postsunset authorizations for AM daytimers pressure the spectrum. Signals spilling in from international stations are interfering with domestic broadcasting. Increased private use of radio and expanding carriage by common carrier are leading to spectrum pollution. Enlargement of the FM band, upgrading in accordance with 80-90, and VHF station drop-ins are adding to the saturation of the ether. It's no wonder the FCC is trying to rethink the whole area of spectrum management.

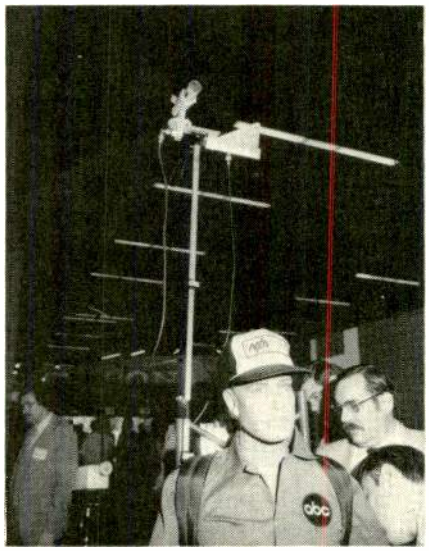
A new approach is exactly what Alex Felker of the FCC proposed on the last day of NAB at the Spectrum Management session. Under a new concept of decentralized spectrum management, users, not the FCC, would determine how frequencies should be assigned in an area. Not just in the category of auxiliary services, which SBE's National Frequency Coordinating Committee (with its 70 regional coordinators) is tackling on a local basis, but for *any* use of the spectrum in the UHF line of sight band. Under this new plan, anything goes under a user license as long as specified contours are protected.

Such a drastic change was a little too much for engineers attending NAB to cope with, but a number of other possibilites presented at various technical sessions were intriguing and solutions to one or another problem. These included multichannel amplitude modulated microwave, amplitude companded single sideband radio (ACSB), and 18 GHz microwave. But then there were those problems that didn't seem to have an answer. STL was one of them.

John Moseley told engineers that increased selectivity of STLs against adjacent channel interference has resulted in 72 dB SNRs—with even better figures possible should digital STLs arrive. But broadcasters are fighting a losing battle because of increased usage. In larger metropolitan areas where the 950 MHz band is congested, larger antennas to achieve greater directivity may help, Moseley said.

What doesn't help was the FCC decision to give the 942–947 MHz portion to mobile radio. Considerable pressure was put on FCC technical representatives attending NAB to at least grandfather in existing license holders in that range. The band proposed in exchange at 21 GHz is already overcrowded with private operational fixed service users (POFS) and common carriers, said Michael Rau of NAB. STL in the 1.7 GHz and 2.5 GHz band as permitted in other countries would help, but this is not a current FCC consideration.

Splitting the bands for remote pickup use (in the 153, 161 and 450 MHz bands) as proposed in docket 84-280 would be helpful, said Rau, and would encourage development and use of ACSB repeaters. Although no ACSB equipment was seen on the exhibit floor, Dick Rudman of the National Frequency Coordinating Committee was able to mention two American manufacturers: Stevens Technology, and Sideband Technology Inc. Haller of the FCC suggested broadcasters get involved with ACSB equipment as a possible solution to their problems.



M/A-COM's portable microwave.

While TV broadcasters enjoy 2 and 7 GHz bands for ENG, STL, or ICR use on a non-shared basis as a result of the First Report and Order of Docket 82-234 (thanks to NAB and broadcast industry efforts), there is limited sharing at 13 GHz. Currently broadcasters' use of 13 GHz for mobile ENG is on a secondary basis. Fixed service users, cable TV (CARS) and POFS have primary rights, Rau said. Pressure for more POFS is growing, but the NAB will fight to permit broadcasters

Multiplexing Products Save Wire

Two unique approaches at NAB '84 to getting more capacity out of limited facilities were the Vector 4000 audio wire distribution system by Broadcast Technology and the digital video fiberoptic transmission system by Quante Corp. Both employed multiplexing.

The Vector 4000 is capable of carrying 24 audio channels over a single twisted dry pair of telephone wires. This is helpful on remotes and is particularly useful in setting up a monitoring system in the field—no bulky cables. The system uses narrowband FM modulation operating in the 60 to 520 kHz spectrum. A single VT 4001 transmitter handles 12 lines; two carry 24 lines. Receivers can be located up to two miles away.

Quante's digital encoder feeds video and audio into a fiberoptic transmission system. Wavelength multiplexing is used to transmit up to four component or composite video channels per fiber. RS-250B quality is maintained throughout the system.

to continue to use 13 GHz, according to Rau. Looking to the future in the 21 and 23 GHz band, broadcasters will presumably be eligible for POFS frequencies themselves (as many as four channels).

Docket 82-334, now under reconsideration by the FCC, did orginally open the 18 GHz band to any and all wideband users, including broadcast auxiliary service. It presumably will be available to broadcasters but signals are subject to atmospheric and water vapor absorption. Heavy rain will attenuate the signal. A paper by Steven R. Smith of GTE reporting on tests in the Puget Sound Basin thinks 18 GHz will be useful as the 2 GHz spectrum fills but warns that wet snowfall can cause an outage. He said more tests on the effect of rain cell size on satellite reception should be studied.

One means of spectrum conservation is to transmit multiple TV signals on SSB microwave using amplitude modulation. T.M. desribed how six channels can be carried in the 11 GHz common carrier band and four in the 13 GHz broadcast auxiliary band. The rigid stands of RS 250B short haul can be met except for S/N, Smith said. These approaches seem suitable for ICR when multiple signals such as those associated with satellite distribution must be carried, according to Smith.

There was some new microwave equipment on the exhibit floor at NAB. M/A-COM showed a 40 GHz portable ENG microwave as a new millimeter window type. Producing 50 mW of power, the nominal range is 1.5 miles using 15 dB transmit-to-25 dB receiver standard gain horns. Twenty-eight channels are available with this transmitter that weighs less than two pounds. Back in the more traditional 2/2.5 GHz, 6/7 GHz and 12/13 GHz bands, M/A-COM introduced the first of its kind multi-band portable receiver. This compact unit can receive 72 channels in the first two bands and another 36 if the optional 12/13 band is added. Frequency bands are all front panel selected.

New Harris Broadcast Microwave equipment included a new 2 GHz portable transmitter, a new 10 W power amp for the 7 GHz band, and some new fixed wideband systems. ENG portable FV-MP mini-link series covers 2, 2.5, 6.5, 7, and 13 GHz bands. A frequency-agile central receiver is part of the system. Another new product not discussed by Harris but one useful to broadcasters is a variable output transmitter. Output power can vary from 3 to 12 W.

Frequency agile transmitters for 2 GHz were shown by RF Technology and Broadcast Microwave Services. Nurad joined the ranks of broadline microwave suppliers by coming out with the AR2 Series of ENG central receivers (in the 2, 2.5, 6.5, and 7 GHz band). The 6.5 frequency is for common carrier use.

One customer at NAB that owns all of Nurad's various microwave systems on one or another mobile truck or helicopter was Microwave Mobile Systems. As a common carrier, MMS has for hire fixed microwave radios in the six, 11, and 23 GHz bands. Nurad showed a complete line of equipment for 6.5 GHz common carrier applications including a SuperQuad Receive Antenna, Silhouette Receive Antennas, portable transmitters (1 W and 3 W) and frequency-agile central receivers. Another new Nurad product was Superpod, an airborne Loran-C controlled ENG system in which the antenna pod extended only nine inches. This equipment was also available from Microwave Mobile Systems mounted on a helicopter. Two MMS vehicles were on exhibit in the parking lot at NAB.

Showing a new line in the 7 GHz band for ENG was NEC. The TVL-800-6F offers excellent frequen-

Telco Interfaces Feature Mix-Minus

Improved telephone connections for talk shows and remotes was the topic of a radio production session for engineers. Led by Mark Durenberger of KSTP, hybrids, speakerphones, and balancing schemes got a thorough going over. There's a limit to what a hybrid balancing can do for you on distant calls, said John Cheney, president of Comrex, because other hybrids will be used by the telephone system at distant central offices. At best balance is possible only between the studio and the first central office. You can't balance a whole system, he said.

The exhibit floor was loaded with telephone interface equipment, much of it including mix-minus hybrids. Comrex showed a studio/telephone conference integrator that is very useful in adding a distant caller, such as a political figure, to the local call-in/host show. Comrex provides a complete system: coupler, hybrid, four-wire termination set, control system, and composite mixer.

Allied was a major source of telephone interconnection equipment including Elgin voice couplers (EC-30A), Tellabs equalization equipment, and the Gentner Telemix IX conference caller.

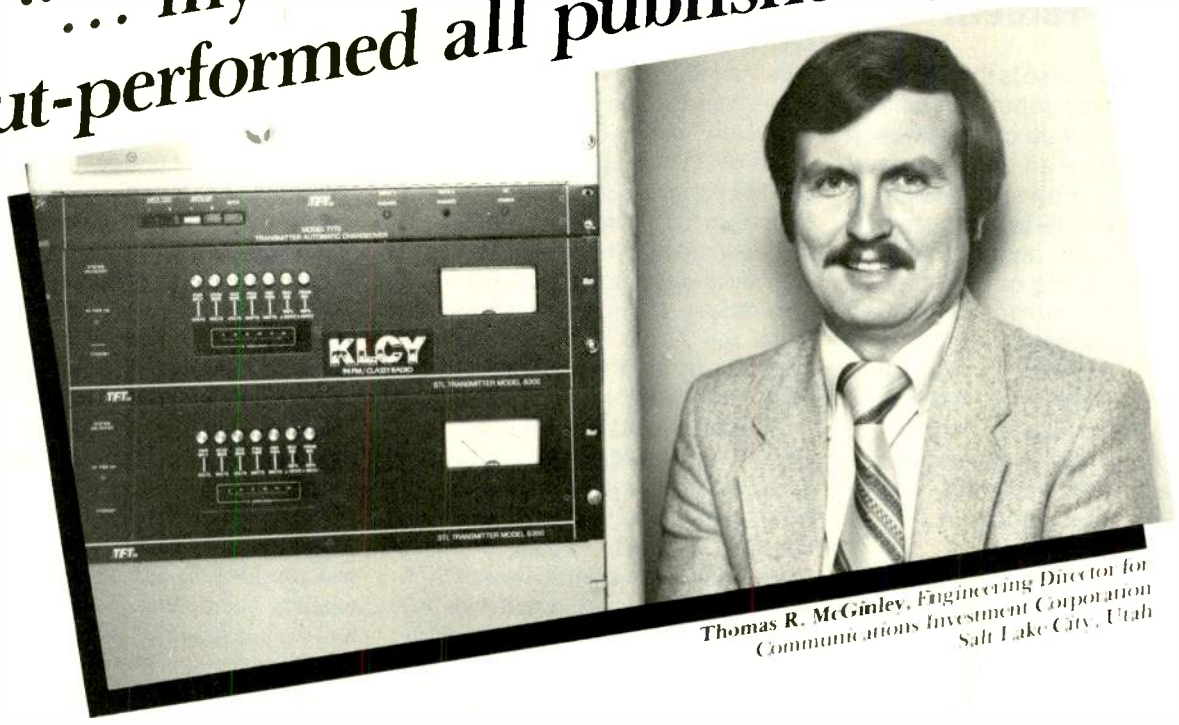
The Telemix IX is a 15-line, microprocessor-based interface system. Two groups of incoming lines are provided for balanced

Gentner Telemix IX.

conferencing of calls, and a hybrid ensures clean, clear audio on the air. Any caller on the first group can be conferenced to any caller on the second group. The system is software driven and can be programmed to a user's special requirements. Simpler Gentner interfaces were the SPH-3 and SPH-4, both of which include nulling hybrid adjustments to keep the host out of the caller's in line. Symetrix showed the T1-101 interface with an electronic hybrid introduced two years ago. Broadcast Technology introduced a TI 5000 interface unit. The incoming caller's signal is separated from the outgoing caller's signal by at least 20 dB. A limiter keeps the levels within limits.

Broadcast Technology showed two mix-minus consoles. The ability to hear all originating locations without hearing themselves is a must on satellite hookups. The larger unit, the MM2121, has 10 inputs and is well suited for large "pool" operations.

"... my TFT 8300 STL clearly out-performed all published specs."



Thomas R. McGinley, Engineering Director for Communications Investment Corporation Salt Lake City, Utah

As Engineering Director for a 12-station AM/FM group, as well as a 92-station regional network, all of Tom McGinley's equipment decisions are big ones. With this kind of responsibility, he knows he's got to be tough... and he is. Based on past experience with TFT monitors, he decided to give us a shot at upgrading his STL system at KLCY, competing against the leading suppliers in the industry. Here are the results:

"No Question, I'm a TFT Booster"

"We purchased the TFT 8300 because we needed to develop SCA subchannels beyond 67 kHz by directly multiplexing the STL. Our old STL couldn't handle the job. Newer equipment by the same supplier needed costly 'piggyback' subcarrier add-ons. TFT was willing to work with us to provide the bandwidth and filtering we needed in an extended STL baseband."

"The delivered product had S/N ratio better than my test equipment could measure. Linearity was almost as straight as a string all the way to 100 kHz. It was unbelievable. We watched the monitor and a spectrum analyzer as subcarriers were switched on and off, and absolutely nothing happened to the main channel. No stereo subchannel interference, no pilot interference, no noise floor, NOTHING.

TFT's service was excellent. Before, during and after the sale, TFT personnel worked with us on every detail of the system. I think I got better service than I deserved."

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Interference a Major FCC Problem

Limiting interference is the FCC's most important function, said Mass Media Bureau chief James McKinney before an engineering audience. One area of immediate concern to regional broadcasters is interference for about 30 minutes in the evening caused daytimers using new post sunset rules. It's definitely there, said Wallace E. Johnson, former bureau chief, now with Moffett, Larson, and Johnson. Interference broadcasters cause land mobile and radio navigation was the subject of two papers.

cy stability, two audio channels, and 10 switchable channels. A double heterodyne method of modulation is used.

STL equipment exhibited at NAB was attuned to current issues. TFT reported that its new Model 8300 was designed expressly for a dense RF signal environment in the 950 MHz band. Its features included a selectable bandwidth receiver for obtaining the best selectivity when adjacent signals are available, a preamplifier that will protect the RF amplifier from being overdriven, and an IF modulation design that improves S/N by as much as 14 dB over conventional designs. TFT also upgraded its Series 7700 to 7700B. Improvements include: IF modulated and frequency synthesized transmitters, an ultra-linear pulse-counting RM demodulator, and 45 dB of stereo separation and 72 dB S/N. The 7700B is available in all STL bands from 35 MHz to 960 MHz.

A popular question at NAB was: will my STL handle additional FM SCA frequencies and will it handle TV stereo? TFT's answer was yes; it offered an option card to handle 92 kHz. Moseley Associates gave a qualified yes to SCA although it hasn't been tested with five subcarriers simultaneously. A little more work may be necessary for TV stereo. Marti proposes a dual STL system for AM stereo. Its STL-10 stereo unit costs $5795, considerably cheaper than TFT's or Moseley's composite systems. Micro Controls Inc. said its PTS-10C could go wideband composite, narrowband single or dual. The PTS-10CD is a dual system for AM stereo priced at $6425. Moseley's top of the line remained the PCL-606/C.

One thing that emerged from the session on the new telephone environment for radio was the fact that the new telephone operating companies are inordinately slow in responding to broadcasters' orders for lines for remotes, due in large part to experienced personnel going to AT&T or given early retirement. Further, they are going for tariffs which call for a lot of questionning by the FCC. Thus STLs, ICRs, and microwave common carriers are likely to be more necessary than ever before.

No new remote pickup units were shown on the exhibit floor, but there was considerable activity in the area of wireless microphones, equipment that will see much service at the national political conventions this summer and the summer Olympics. Wireless mics are covered in a separate article in this issue.

Satellites: Stacking the Dishes as Land Lines are Cut

There will probably be 42 U.S. communications satellites operational by 1987 for television, radio, and cable programming as well as DBS, teleconferencing and other applications. Of this group, it is expected that 27 will be C-band; nine, Ku-band; and six, hybrid C and Ku-band. By that time all existing and new antennas will be required to adhere to the FCC's two-degree spacing requirements.

Clearly, the next few years will be eventful ones on the satellite front and the action at NAB '84 reflected the intensity of broadcasters' interests. With virtually every TV and radio station operating or about to operate a satellite earth station, the serious shopping going on at the show was understandable.

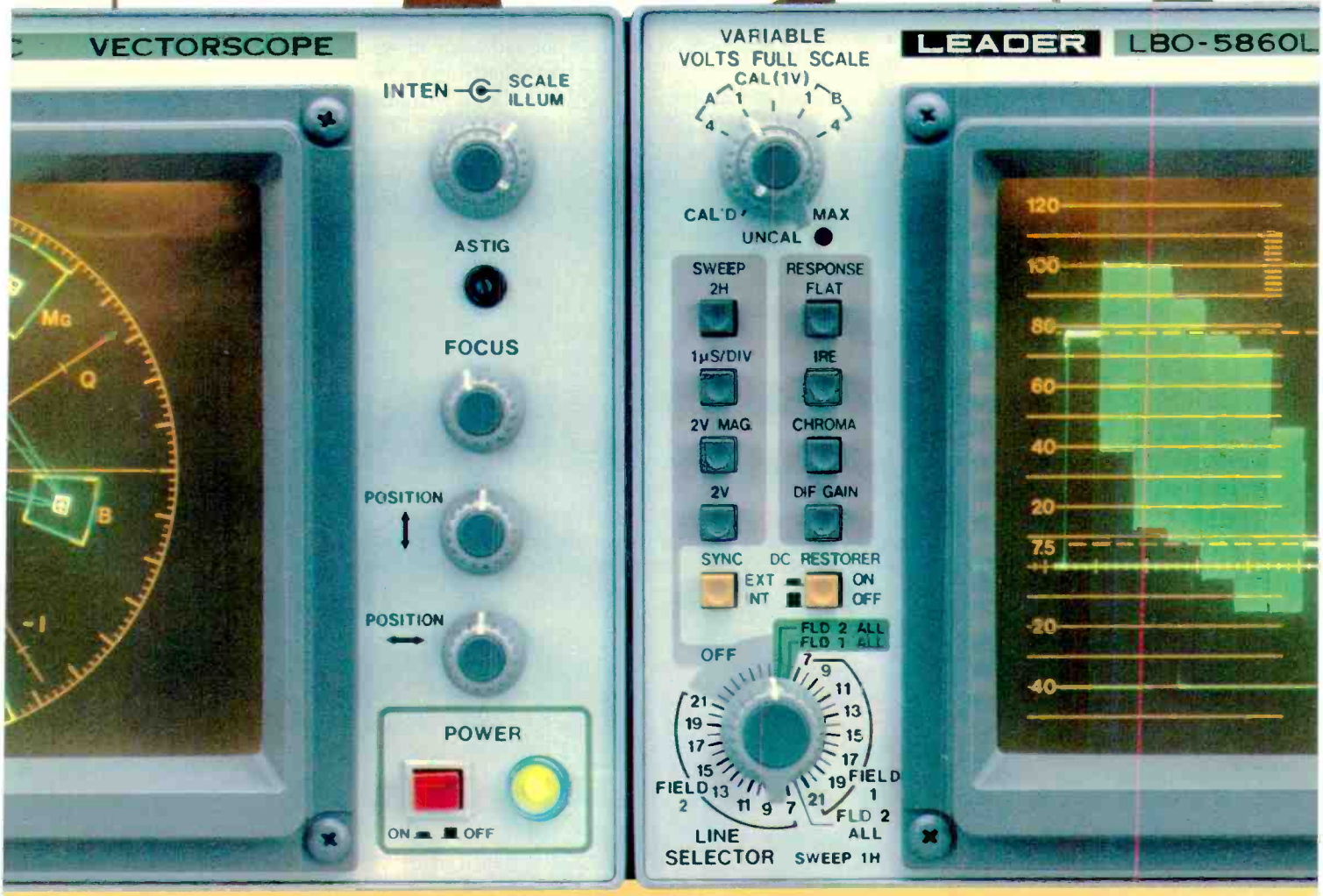
In addition, NAB offered an opportunity to air some of the important issues surrounding satellites, for all is not settled despite the seeming finality of the two-degree spacing requirements. For one, there is still discussion over the merits of C-band (3700 MHz to 4200 MHz) and Ku-band (11.7 GHz to 12.2 GHz) in the wake of the choices made by the three major TV networks—CBS and ABC for C-band and NBC for Ku-band. Radio stations are involved in digital versus analog. And everyone is concerned with interference, despite the manufacturers' claims of pattern envelopes in compliance with FCC two-degree spacing specs. Redundancy and how best to achieve it are also concerns.

Another trend clearly in evidence at the Convention Center parking lot was transportability—dishes on wheels for both radio and TV applications. More and more broadcasters will be taking their uplinks into the field.

Overall the theme out in the lot, in the booths and inside the conference rooms was maximizing the efficiency of satellite communications. In some respects many broadcasters involved with satellites are now "second generation" users and "cherrypicking" (a term Andrew is popularizing) from multiple satellites is now standard operating procedure. The operating efficiency theme was evident in new earth stations from Scientific Atlanta, GEC McMichael, Microdyne, Antenna Technology, Dalsat, Broadcast Microwave Systems, Marcus Satellite Systems and Comtech Data. Moreover, sophisticated antenna control systems featured by Andrew Corp., Harris, and Scientific Atlanta, for example, were also evidence of the desire to gain maximum operational efficiency. Greater flexibility was key to the remotely controlled stations demonstrated by

Hubcom's Newstar van.

LEADER



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to look at any 50 degree segment of the orbital arc.

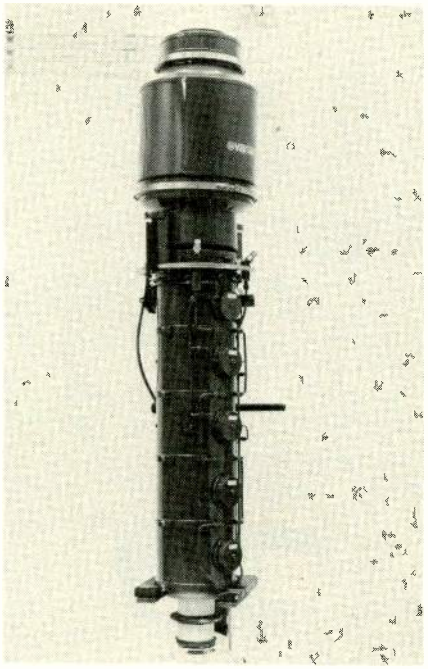
While the Torus is relatively high in cost ($45,000 for the 4.5 m system), Satcom points out that the price should be measured against the cost of owning and installing two or three antennas. The Torus is much larger than a typical single beam antenna, an important factor in site selection.

Microdyne's answer to the growing number of satellites is the Multiple Satellite Feed system. The MSF can receive up to five satellites on the same parabolic reflector when the satellites are located in close proximity. Existing Microdyne antennas can be retrofitted with minor changes in the struts and brackets of the feed support hardware. When installed on a 5 m antenna, isolation between beams is better than 20 dB, with a loss of about 1 dB at four degrees off boresight.

Among the other developments at NAB for radio, Scientific-Atlanta introduced the DAT-800 digital audio terminal to provide multiple satellite access capability for point-to-point and point-to-multipoint network applications. Comparable to the DAT-32 now being used by the major radio networks, the 800 single channel per carrier terminal is aimed at smaller networks or broadcasters who cannot economically use exisiting uplinks to originate their own programming.

To its SCPC products, Microdyne added the 1100 SDC synthesized tuned downconverter, a rack-mounted tuner designed to work in conjunction with the 1100 BDC series antenna-mounted block downconverters. With an input frequency of 270 to 770 MHz, the SDC will downconvert to an output frequency of 50 to 90 MHz.

Among the satellite services, Wold Communications confirmed that the transition has begun to the new Telstar 301 satellite in the AT&T Skynet system. Meadowlands Communications reported progress in setting up its Starlink centers, audio and video uplink services in 26 U.S. cities. The company also demonstrated its digital audio sound quality. AT&T was very much in evidence to promote its Skynet services as broadcasters continue to cut the Bell lines.



High-efficiency klystron from Varian.

Efficiency Is the Name of the Transmitter Game

"Cost efficient" or "high efficiency operation" were the terms most often used by transmitter manufacturers at the 1984 NAB Convention and Exhibition. More solid-state design enabled FM transmitter makers to boast cost efficient design. The use of some new Varian super-efficient klystrons spurred UHF transmitter suppliers on to new superlatives in describing power savings possible. At the same time, new power output levels have been achieved. But there were also advances in exciters, diagnostics, and overall performance.

FM transmitters

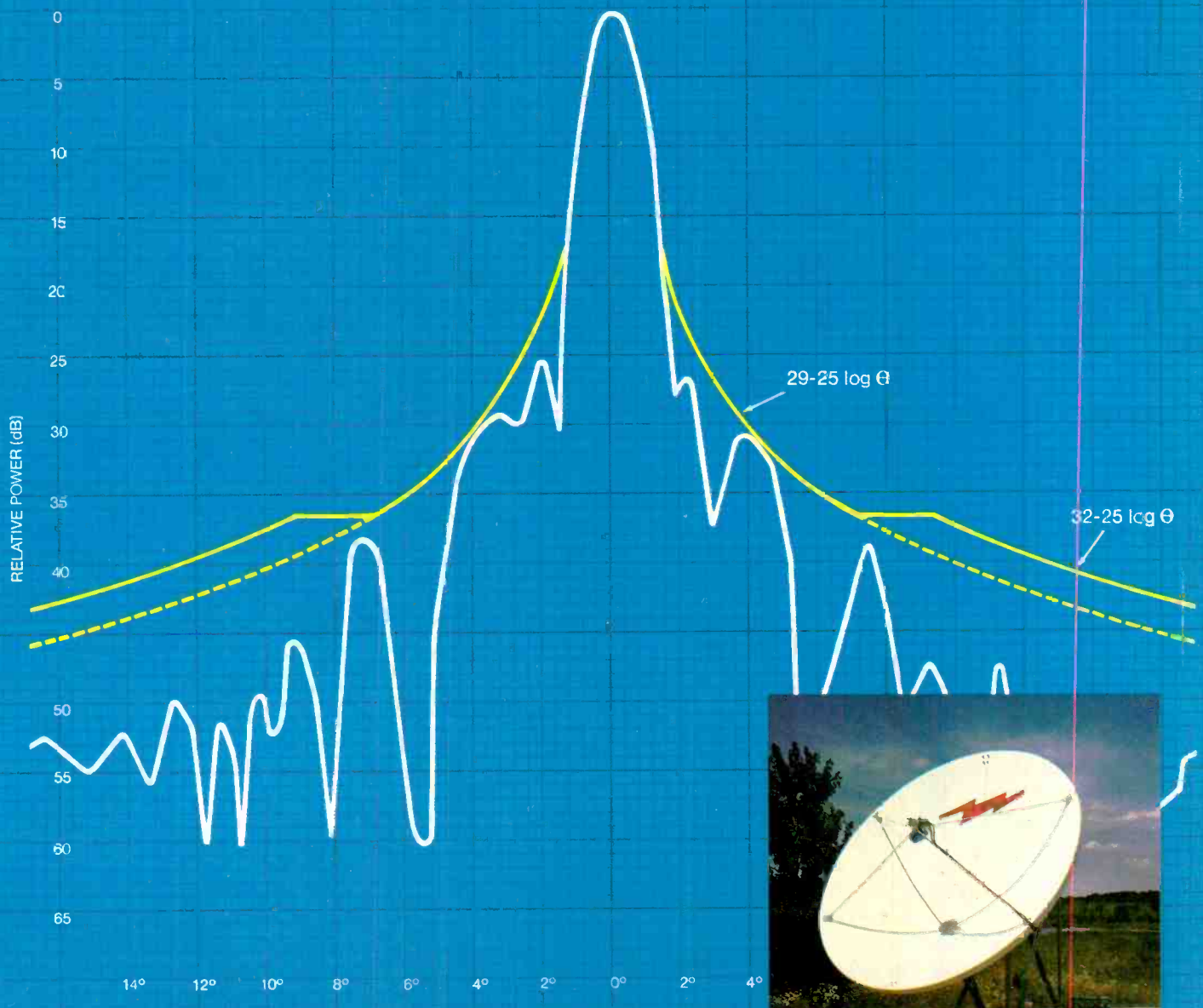
The news in FM transmitters was not only the cost efficient designs made possible by more use of solid state but the fact that the push was coming from European manufacturers. Entering the American and Canadian markets for the first time with great expectations were Pye TVT and Thomson-CSF. And there was new competition from Japan: NEC introduced a new series, the FBN-9000 with 10 kW, 20 kW, and 40 kW models. Much of the remaining news related to other new power levels spurred by the FCC's 80-90 rule requiring broadcasters to operate at their maximum capacity or risk encroachment by others.

While Pye TVT's line of FM transmitters range from 100 W to 20 kW, it was the LDM 1200 line of solid state units with outputs of 300 W, 500 W and 1 kW that were featured in the Philips Television Systems Inc. exhibit. Common to all is the LDM 1248 exciter (which can be operated as a 100 W low power unit) driving the higher powered units. The LDM 1248 uses direct carrier FM for optimum linearity; frequency is determined by a synethesizer. Stereo and SCA encoders are built in as required. The higher power units are built up from combinations of 300 W amplifier modules and high efficiency switching mode power supplies. The 500 W and 1 kW transmitters have the ability to stay on the air should one amplifier module fail. Higher power units include a single tetrode tube. Prices will become known as soon as the units gain FCC type acceptance.

Built to last is the main claim of Thomson-LGT FM transmitters since the circuit designs have already been incorporated in over 12,000 LGT units sold worldwide. The highest powered solid state FM transmitter is another claim since the EFM-2500 (2.5 kW) is in a class by itself. The EFM range covers 10 W to 2.5 kW. A frequency synthesizer referenced to a very stable TCXO permits any frequency in 10 kHz steps to be generated. The IF modulator (10 MHz) is a state-of-the-art low noise high performance type. The stereo generator is built in the IF modulator and takes a balanced or unbalanced audio input. Construction is all modular; power amplifier modules consist of 300 W sections and can withstand excessive VSWR. Front panel LEDs indicate peak audio levels, SCA levels, pilot level, deviation, RF output power and power supply voltages. The 1 kW unit is priced at around $17,000.

Solid state design up to the final tube is a feature of the NEC FBN-9000 series (the 40 kW model uses two tubes). A highly stable cavity designed to eliminate complex tuning and local oscillation is featured. A new frequency synthesized exciter is incorporated. The transmitter can be operated by remote control.

Broadcast Electronics expanded into the solid state transmitter field with 250 and 300 W units. Both use the well-known FX-30 FM exciter. The FM-250 uses a single PA stage; the FM-300 consists of two broadband 150 W am-



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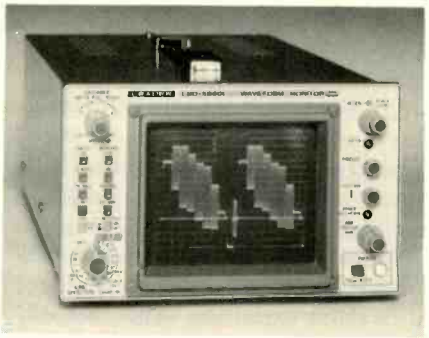
set AM daytimers. As an alternative to power reducers, LPB offered some low power transmitters rated at 5 to 150 W for presunrise and post-sunset operation.

A new tube that will undoubtedly show up in new transmitting equipment is the EIMAC 3CX5000A7 ceramic-to-metal power triode for grounded-grid circuitry. To save cost the tube has no socket—it bolts directly to the chassis. It is a high-mu focused grid-cathode type.

With a host of new remote control systems introduced last year, what visitors saw this year were production models—from Delta, Hallikainen, Micro Controls, Potomac, and Symetrix. Moseley offered a few new options including a CRT display.



Leader's LBO-5860L waveform monitor.

Test Equipment Gets Smarter to Meet Today's Many Needs

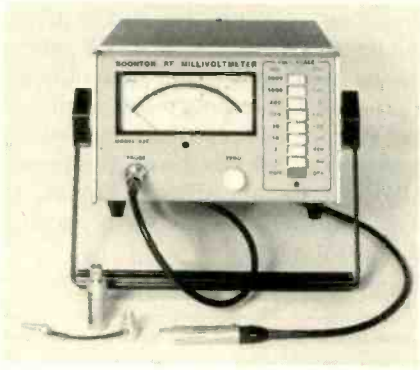
"I could not appreciate how complex broadcast equipment has become until I got here. It's amazing." These were the words of a first-time NAB exhibitor selling test instruments for the complex equipment that so amazed him. Broadcast equipment has indeed challenged test and measurement companies to design systems that can keep up with the changes and are at the same time easy to use.

With microprocessor controls cropping up in more and more test systems, key words heard around the show floors were "automatic" and "automated." Thus, the answer to the growing complexity of broadcast equipment testing is to mobilize the silicon chips.

Microprocessors are programmed to run series of tests automatically, to display results digitally or graphically, to monitor remote sites, to present procedure menus, to troubleshoot, to diagnose failures, to store field test results, and on and on. Because so much broadcast equipment is now packed with large scale integrated circuits (LSI), microprocessors are put to work testing other microprocessors.

Even the old war horses of station T&M, the meters and test generators, can boast of added sophistication. There will be no more manual test gear as such. Instead, testing can be seen as having two levels of sophistication. One is self-run on the circuit board and the other is preprogrammed to run by computer bus interface. Some studios are now completely bus controlled, including test equipment, so that a computer can operate everything directly.

Inevitably, a dynamic market attracts newcomers and this NAB had a few in the T&M field. Of the big three in traditional test equipment markets,



Boonton's RF millivoltmeter.

to date only Tektronix has made a mark in broadcasting. Now John Fluke has entered the arena aided by a boost from Grass Valley and Chyron. The product is the 9000 Series microsystem troubleshooters and the boost came because Grass Valley recommends and documents the Fluke system for its customers and Chyron uses it on its production line.

While new to the NAB show, the 9000 Series has been out for some time. There are three models in the line 9010A, 9005A, and 9020A. Each has a keyboard and display to set up the troubleshooting tests with keys to identify the microprocessor and control the testing procedure. A pod test fixture connected to the control unit plugs into the sockets on the printed circuit board. Once the microprocessors on the pc boards have been described, the four built-in functional tests let the operator automatically check the electrical integrity of the processor bus, the read/write capability of the I/O registers, the data in the ROM, and the operation of the RAM. If a fault lies outside these tests, there's a probe attachment that checks address and response functions.

With the 9020A model, which has IEEE-488 interface bus, the user can put together a custom automatic test system with digital and analog capabilities. Base price for the 9010A is $3995; eight-bit pods, $995; and 16-bit pods, $1995.

The new Bell operating environment may have pumped renewed interest into one of Tektronix's oldest automated test systems, Answer. "This is the eleventh annual introduction of Answer," Steve Kerman of Tektronix quipped. "Because this system identifies the source of distortion and stamps time and date for any variation, broadcasters and carriers are now using Answer as an arbitor to decide which party is responsible for introducing the distortion. In the new transmission environment, we've had a 10-year-old overnight success," he added.

A microprocessor-based VITS analyzer, Answer software makes transmitter monitoring possible. It will monitor and measure signals in any cycle determined and programmed by the engineer.

Broadcast Electronics demonstrated the Microprocessor Video Diagnostics System (MVDS) as an add-on option to its model FM-1.5A, FM-3.5A, or FM-5A single-tube FM broadcast transmitters. The MVDS monitors and controls all major parameters of the transmitter.

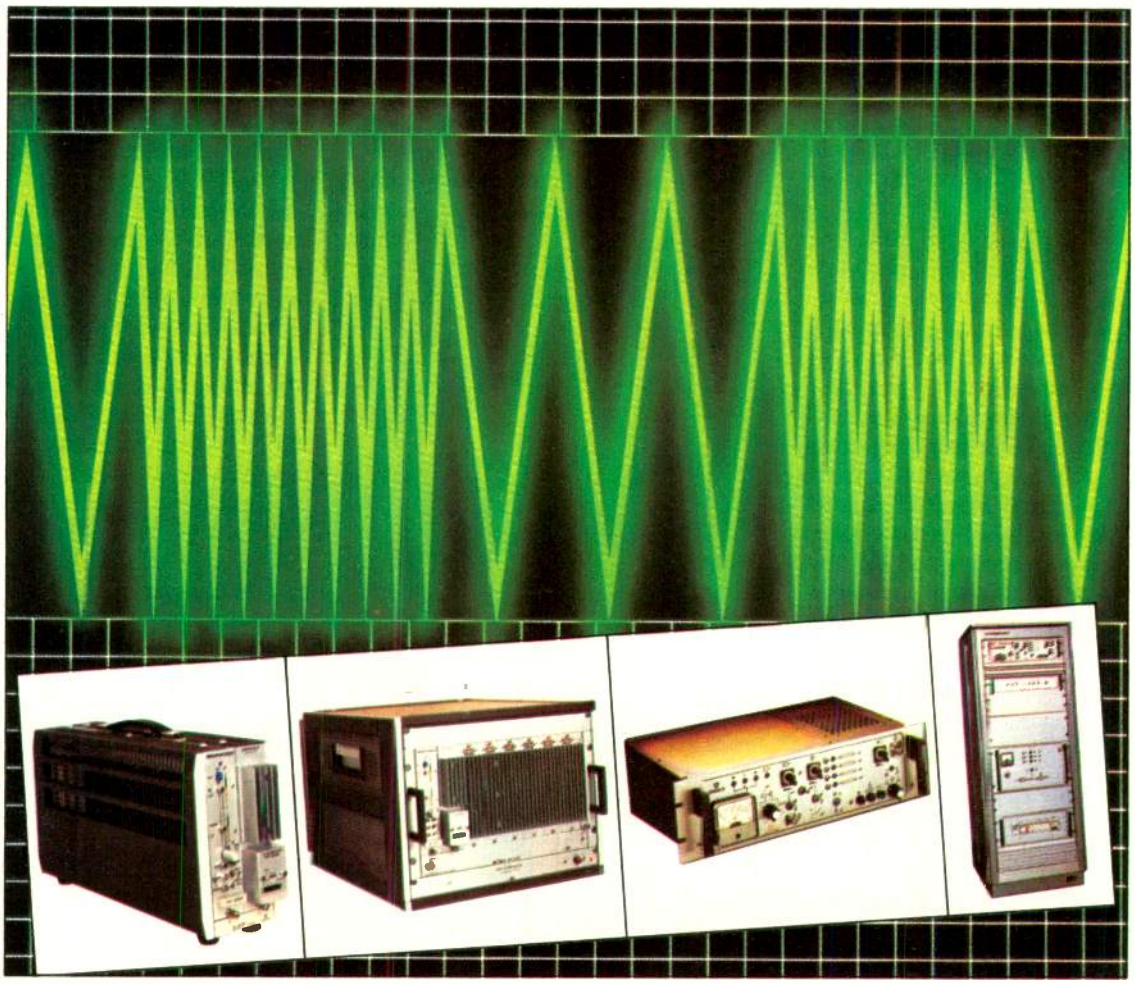
There are three display formats. The normal screen contains basic transmitter operating information in chart form as well as a listing of carrier interruption times and causes. Out of limit readings are displayed in reverse video to alert the user to the undesired condition.

The customer configuration screen allows the user to tailor the display, such as changing one of the factory preset values. Access to this screen is by eight-digit password to prevent unauthorized persons from changing the limits.

The bar graph display is useful in

Thomson-LGT. FM radio broadcasting

SPANS THE WHOLE RANGE



Thomson-LGT, leader in the field of transmission, offers modular FM transmitters
– from 50W to 20kW
– with technical characteristics better than CCIR recommandations and FCC standards.

All these systems are based on the synthesized driver modulator which, whatever the transmitter power, always features a very high spectral purity of better than 90dB.

Combined with a solid-state broadband amplifier, the driver modulator is used for setting up transmitters from 50W to 3kW.

With a tube amplifier, it is possible to reach 20kW.

What is more, Thomson-LGT offers a choice of 25,000 frequencies between 87.5 and 108MHz.

The bandwidth, from 20Hz to 100kHz, allows a stereo program and a secondary program to be broadcast simultaneously (SCA).

With their high frequency stability, oustanding reliability, adjustment-free operation and compact size, Thomson-LGT transmitters rank among the top performers in the field.

Finally, a complete range of antennas – trombone, twin dipole, log-periodic, circular polarization array and arrays adapted to selected radiation patterns – helps users optimize station efficiency by giving better coverage.

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Circle 212 on Reader Service Card

BAZAINE 5311

ator priced at $3895, Philips stressed, the price is now attractive enough to have a unit in each van or another assigned for remote transmitter monitoring, or others assigned to cameras.

Fortel came to NAB with the new Digitest digital test signal generator. It provides five front-panel selectable video test signals, two reference signals, and nine front-panel selectable audio test signal combinations. The video test signals are color bars, ramp, multiburst, convergence, and color/mono. The reference signals are composite sync and subcarrier. The audio test signal combinations (three frequencies, three amplitudes) cover 400 Hz, 1 kHz, 12 kHz and 0 dBm, +8 dBm, −20 dBm.

The Rohde & Schwarz SPF2 digital video test signal generator, available in NTSC and PAL, delivers 32 different test signals. This unit too was designed for light weight, low power consumption for portable applications. Signal information is stored in ROM, so that the SPF2 can adapt to various measuring tasks by simply changing memory boards.

Other interesting introductions at NAB included the QSI Systems new CB 1680 color bar generator/video source identifier that combines a genlocking SMPTE bar generator/black burst source with a multifaceted 16 character source ID. The ID has built-in vertical interval switching between the color bar and an external video source, with on-board options of deleting the ID or placing it in the vertical interval of the external source.

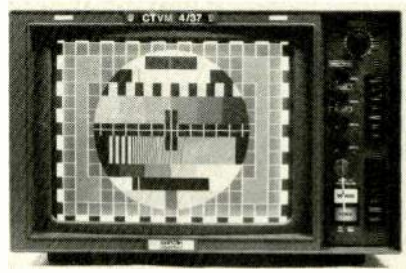
The new 3M 212A color bar and sync generator produces the standard split field, eight-bar pattern and all of the normal studio sync signals as well as a 1 kHz test tone, "Pluge," and black alignment test bars, separate black burst output and color background output. Price is $1575.

Among the new products featured by Rohde & Schwarz was the UPSF2 video noise meter with a frequency range of 40 Hz to 10 MHz. It consists of three parts: the basic unit for measuring luminance noise, the plug-in UPSF2E2 for extended luminance and chrominance measurement and the IEC-bus option UPSF2-Z for remote control using IEEE 488 interface bus.

With the growing use of laser-based compact audio disc and videodisc players, Leader introduced the LPM-8000 laser power meter for measuring the power output from laser devices used in the players. The portable unit has two wavelength and three power measuring ranges available.

For adjustment of studio cameras, Porta-Pattern had a new depth of modulation chart. In addition to the measurement of TV camera center resolultion, the chart provides sizing setup references for different diameter tubes, a wobble circle in the center for beam align and bursts at 4 MHz in the corners.

For color adjustments of studio monitors, Minolta had the second generation TV-Color Analyzer II. In addition to the usual beam intensity mode, the analyzer features a chroma mode that shows chromaticity coordinates and luminance.



Barco CTVM 4/37 color monitor.

Monitors

The march of color TV monitors goes on with in-line gun tubes, comb filters, NTSC/RGB switchable inputs, and chassis built for easy maintenance offered as common features. Small screen sizes for vans and small studios are particularly popular. Essentially, the viewpoint of designers is that a poor picture on the screen should not be caused nor corrected by the monitor—only displayed to identify a problem.

All of these trends were in evidence at NAB. Conrac displayed the 6200 Series 19- and 13-inch color monitors, which it claims meets the technical requirements of Europe's CCIR Class I display devices for picture quality and stability. Featuring NTSC/RGB inputs, A and B switchable, and comb filter or notch filter selection, the 6200 sets also monitor themselves. A front panel status light indicates satisfactory operation.

Meanwhile, Sony hit the show with two new 19-inch units, called universal monitors, designed for broadcast studio, computer and/or videodisc displays. The PVM-1910 and PVM-1911 have RGB inputs, loop-through outputs for the two line inputs and for RGB, and a built-in interface for IBM PC computers. Prices are $895 for the 1910 and $1485 for the 1911.

The Studio-13 from Videotek is loaded with broadcast application features such as three looping NTSC inputs, high voltage regulation, A/B split screen, switchable comb filter and switchable notch filter. Among the additional standard features are blue gun switch, H-AFC, switchable underscan, and automatic chroma control defeat for detection of chroma loss. Price is $2360.

Videotek's portable entries are two new five-inch ac/dc sets, the VM-5T color monitor and the RM-5T color receiver/monitor. They each weigh 15 pounds and are listed at $899 and $929 respectively.

Ikegami added a new 10-inch, in-line gun monitor to its line. The TM10-9RH portable operates from ac or dc power and weighs under 22 pounds. It has several standard features including on-demand degaussing.

Sharp's XM-1300 13-inch monitor features 0.31 dot pitch for 600 lines resolution, in-line gun tube, switchable comb or notch filter, and A/B video inputs plus direct RGB or TTL input. The price is $2995.

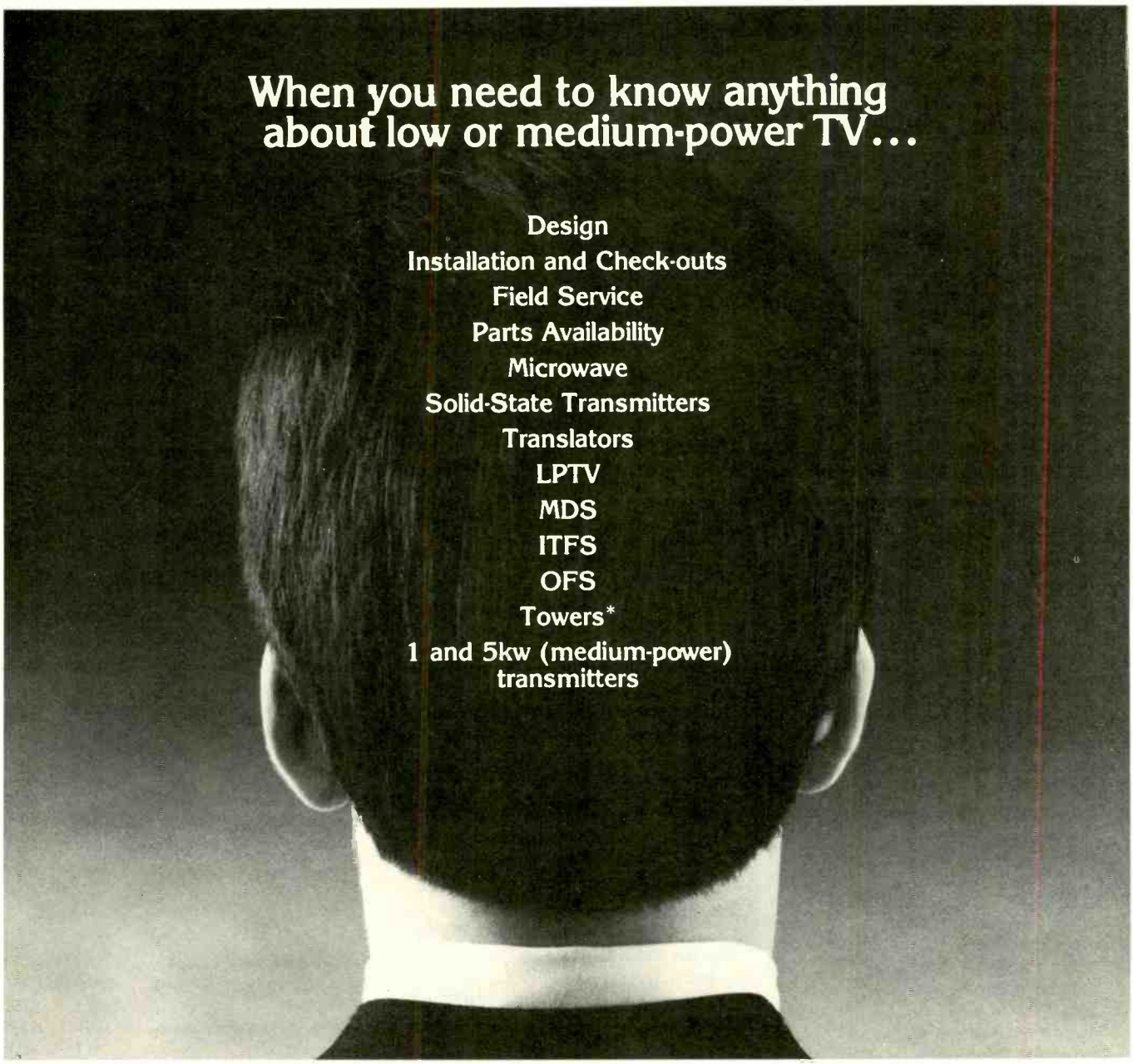
On the larger screen sizes, Barco monitors at the Elector booth featured the new CTVM 4 20-inch and 14-inch monitors equipped with automatic kinescope biasing (AKB). AKB automatically stabilizes the picture tube color temperature and maintains black levels constant with time, temperature and CRT parameter drifts.

The Philips LDH 6220 is a 20-inch color monitor that features an in-line Hi-Bri picture tube. It has the usual goodies: two video inputs, RGB inputs, pulse cross or setup switch, external sync, and split screen.

Lenco's line, PCM 514-4, consists of high resolution, precision in-line gun tubes in 14-, 19-, and 22-inch models. Though high voltage regulated, the monitors do not limit voltage at the expense of picture brightness—up to 125 foot lamperts.

For sound monitoring, JBL came to NAB with a range of quality speakers for broadcast and recording applications. The 4301 Broadcast Monitor provides radio and television station engineers with the ability to detect background noises while getting wideband sound reproduction. It produces a sound pressure level of 98 dB and has a power capacity of 15 W.

Electro-Voice has upgraded its familiar Sentry studio monitor with the addition of an integral 50 W power amplifier in the Sentry 100EL. Frequency response is 45 to 18,000 Hz with a 3 dB variation.



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Equal Employment Opportunity

By Harry Cole, FCC Counsel

It's June, so most broadcasters have probably just filed their Annual Employment Report—FCC Form 395—with the Commission. Irrespective of the various deregulatory efforts at all levels of the broadcast industry, Employment Reports are still required. Regrettably, those various deregulatory efforts might lead some broadcasters to think that the Commission is no longer interested, or at least no longer *as* interested, in the employment practices of its licensees. That, however, would be a mistake. The FCC continues to enforce its equal employment rules and, as we shall see below, may be under some pressure to *increase*, rather than relax, its enforcement efforts.

Let's start with an understanding of precisely what the FCC's EEO rules really do require. The basic premise, of course, is that broadcast licensees should not, in their employment practices, discriminate against job applicants on the basis of race, color, creed, sex,or other such characteristics. That much is easy to understand.The difficult part is the mechanisms with which the Commission enforces that basic premise. First, it requires licensees with five or more full-time employees to submit EEO programs with their initial applications—whether they purchase an operating station or apply for a construction permit to start one from scratch. The five-point model EEO program utilized by the Commission is a relatively routine document in which the applicant agrees not to discriminate. The applicant also is expected to indicate how it intends to notify job applicants of the EEO rules.

A matter of commitment

In addition to these notice provisions, the Commission expects its licensees (or at least those with five or more full-time employees) to make a commitment to recruit minorities and/or women. Thus, the model EEO program includes paragraphs in which the applicant is expected to list the minority/women's groups, local publications, local employment agencies, and other resources on which it expects to rely in its recruitment efforts. No specific minimum or maximum number of such groups, publications, etc. is specified by the Commission, and an applicant can generally list as many (or as few) as he or she may deem appropriate. Finally, applicants are invited to indicate whether they intend to establish any on-the-job training program at their stations. On this latter point, however, the Commission's model EEO plan gives applicants the option of stating that "station resources and/or needs are such that...specific programs for upgrading the skills of employees" will not be provided.

So much for the EEO obligations of applicants seeking to get on the air. Once an applicant has become a licensee, the continuing obligations don't appear, on surface at least, to be all that burdensome. Once a year, in May, each licensee is expected to file an Annual Employment Report (FCC Form 395) indicating the station's employment profile. Also, with each station's renewal application, the licensee is required to submit a 10-point EEO program. That program closely resembles the five-point EEO program described above. The primary difference is that unlike the five-point program, which is prospective in nature (i.e., it asks the applicant what steps will be taken), the 10-point program is historical in nature, and seeks descriptions of the licensee's EEO practices during the preceding license term. Additionally, the licensee is asked to provide information concerning the minority and female populations of the relevant workforce from which it has done (or should be doing) most of its recruiting. The 10-point program also gives the licensee an opportunity to offer an overall assessment of the success (or failure) of its EEO program, and to suggest ways in which its EEO performance could be improved.

The question, of course, is how these various filings are processed by the Commission, and what risks to licensees (or applicants) lie below the surface of this apparently trouble-free process. For openers, the Annual Employment Report rarely, if ever, triggers an inquiry on its own. In other words, the FCC's staff does not, as a general rule, pore over each and every Form 395 in May to make sure that each and every station has some adequate minority and/or female representation on its employment rolls. As we shall see below, however, that does not mean that the Form 395 is a matter to be treated lightly. In fact, the Annual Employment Report should be treated as something of a smoke detector, capable of providing the licensee with early warning of potential problems on the EEO front.

The Commission's review of the 10-point program submitted with each station's renewal application is much less benign. Remember, a station's renewal application consists at this point of nothing more than a postcard with five "yes/no" questions. Thus, there really isn't that much for the Commission's processing staff to spend its time on relative to the renewal form itself. That leaves the 10-point EEO program submitted with the renewal form. And, while the number of renewal applications usually prohibits detailed, line-by-line analysis of each such program submitted, the staff has developed certain guidelines which can, and do, trigger such analysis.

50/50

What the staff looks for initially is compliance with the FCC's "50/50" processing standards. Those standards

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provide that, in each station's overall employment profile, minorities and women be represented in numbers equivalent to 50 percent of their respective representation in the general recruitment area applicable to the station. The standards also demand that minorities and women be similarly represented in the station's full-time upper four job positions. While this formula may, at first glance, seem somewhat complicated, it is actually fairly simple to calculate. First, it is necessary to determine what the relevant minority and female population statistics are. If you have correctly completed the 10-point EEO program (which requires a listing of just that information), that should not be too hard, although you should probably consult with your communications counsel to be sure that you are using the proper universe (i.e., city, county, SMSA, etc.) as your base for those statistics. Second, using the most current employment profile, you need to determine: the total number of full-time employees in upper four jobs; the total number of minorities in full-time positions and in full-time upper four positions; and the total number of women in full-time positions and in full-time upper four positions. Once you have compiled these various figures, it's all simplified. All you have to do are the following calculations:

OVERALL MINORITY FULL-TIME EMPLOYMENT:

$$\frac{\textit{Total number of minorities in full-time positions}}{\textit{Total number of full-time employees}} = ?$$

OVERALL MINORITY FULL-TIME EMPLOYMENT:

$$\frac{\textit{Total number of women in full-time positions}}{\textit{Total number of full-time employees}} = ?$$

FULL-TIME MINORITY UPPER FOUR EMPLOYMENT:

$$\frac{\textit{Number of minorities in full-time upper four jobs}}{\textit{Total number of full-time upper four jobs}} = ?$$

FULL-TIME FEMALE UPPER FOUR EMPLOYMENT:

$$\frac{\textit{Number of women in full-time upper four jobs}}{\textit{Total number of full-time upper four jobs}} = ?$$

Once you have completed these calculations, you should compare the results against the applicable population statistics. In other words, take the number of minorities in the applicable work force and compare it with the figures generated relative to overall minority employment and upper four minority employment; then do the same with respect to women. The figures generated by the calculations above should be no less than 50 percent of the applicable population figures.

While the FCC will place primary emphasis on full-time employment, it will also be interested in the station's part-time profile. Thus, once the full-time figures have been compiled, the same should be done for the part-time figures.

Penalty imposition

When a station appears to fall below the "50/50" guidelines, it is cause for concern, but would not trigger automatic penalties. Generally, when the staff finds a station with below standard employment in one or more respects, the staff will review carefully the licensee's EEO program to make sure that it is reasonably calculated to lead to effective minority and female recruitment and

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UPDATE

PROGRESS REPORT

A Tradition of Engineering Excellence and Innovation Continues

Since 1929, Bosch has been a leader in the Video Industry, and became the most successful system supplier in the world.

"We were there when television took its first Olympic steps" 1936-1984

Bosch has furnished the video equipment to broadcast Olympics and World Cup sporting events to the world, since the 1936 Olympics in Berlin, to today, with the Winter Olympics in Sarajevo, Yugoslavia.

"Bosch has the most comprehensive range of products"

Bosch has the broadest product line in the video industry, worldwide! Our products include: Film Scanners, Video Tape Recorders, Video Cameras, Editing Systems, Video Graphic Systems, Routing Switchers, Video Processors, Terminal Equipment, Production Switchers, and Video Monitors. Bosch is also heavily involved with the consumer/home video, and lately the telecommunications markets worldwide.

Bosch systems are to be found in television stations, networks, and production companies in 120 countries throughout the world.

Things You Should Know

A leader in television research

With over a thousand patents in television technology, Bosch continues its leadership in research and development, not only in Europe, but also in the United States. Located in Salt Lake City, Utah is Robert Bosh Corporation's Video Equipment Division; one of the industry's most modern research and manufacturing facility.

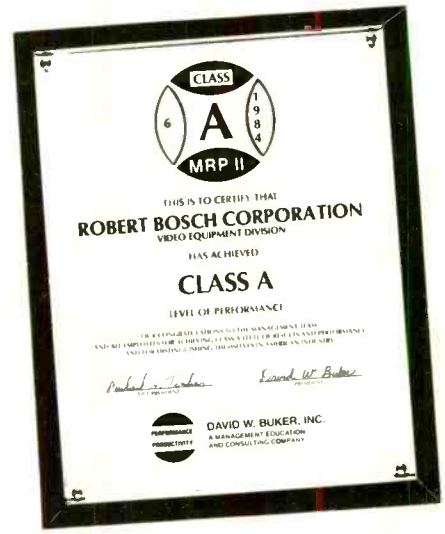
The transition from the Quadraplex 2" format to the 1" recording format was introduced by Bosch in 1975 as the "B" format 1" tape standard. The 2" to 1" standard for professional application was pioneered by Bosch.

This continued effort in R & D has also produced products such as the FGS-4000 real-time graphic system, and the Quarter-Cam Camera-recorder system. Other products on the drawing boards will continue this tradition of advanced television research.

Salt Lake City Video Division earns "Class A" MRP rating

A "Class A" performance rating in planning, scheduling and manufacturing efficiency has been awarded to the Salt Lake City based Robert Bosch Corporation, Video Equipment Division. The award recognized the company as one of about 75 in the United States to achieve the level of performance in the use of the computer-centered system.

This means when we promise to deliver, we deliver.



Remember the name Bosch for television products

We are Robert Bosch Corporation, Video Equipment Division, proud to maintain a long tradition to service to the visual communications industry.

All Bosch equipment is serviced and supported 24 hours a day through our regional offices nationwide.

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Video Equipment Division
P.O. Box 31816, Salt Lake City, Utah 84131
(801) 972-8000

BOSCH

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One SPIKE Can Cost DOWNTIME!

Overvoltage transients can bring the biggest installation down in a microsecond, or damage it cumulatively.

Surge-Master Heavy Duty Power Line Protectors give complete protection against all transients.

All audio and video transmission equipment is vulnerable to transients on AC power lines caused by heavy motors starting up (even elevators or testing your auxiliary power system), power company load adjustments—and of course, lightning. Even if your equipment operates from batteries charged by a UPS, you're not safe. If lightning knocked out your UPS, how long could you keep going?

The MCG Surge-Master offers two stage protection. The first reacts in nanoseconds to absorb lesser transients and the leading edges of major ones. The second stage absorbs the big ones, and has three modules on each line. So, in the unlikely event that one module should be knocked out, there are still two protecting you. And a system of indicator lights tells you not only when a fault has occurred, but exactly where it is. Modular construction (and the fact that Surge-Master is connected in parallel) makes replacement of damaged modules quick and easy. Initial installation requires minimal power interruption.

Available with capabilities from 100 to 3000 amps; for 120, 240 and 480 VAC; and for single, 3-phase, wye and delta power systems. MCG also manufactures smaller units for protecting individual pieces of equipment. To learn more, contact Department 31017 at 516/586-5133 or at the address below.

Protecting industry since 1967

MCG

ELECTRONICS, INC.
12 Burt Drive
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hiring.

The staff may also review the station's previous Annual Employment Reports to see whether the shortfall is a chronic problem, or a recent one. What the staff will be on the lookout for is any indication that the station may not be taking reasonable steps toward assuring itself of an adequate employment profile. For example, if the station has had a long-standing shortfall in one or more categories, and does not appear to have focused on the problem or taken any steps to correct it, the Commission could easily determine that the station is not living up to its EEO obligations. The result could be the imposition of a reporting condition relative to its renewal, a short-term renewal, or even designation for hearing. If, on the other hand, the station appears to have focused on its shortfall(s) and has clearly made corrective efforts, there is a good chance that the Commission will not penalize the licensee, even if its corrective efforts have not proven completely successful.

As indicated above, the Commission has recently been demonstrating a good deal of interest in EEO questions. This was most evident in its designation of a Florida radio station's license renewal application for hearing relative to questions raised by an irate former employee who questioned some of the representations made by the licensee in the EEO portion of its application. While this case may merit the drastic treatment of a qualifications hearing because of the allegations involved (the Commission tends to get concerned about claims of misrepresentation by its licensees), it may also be an effort by the Commission to demonstrate to the public and, more importantly, to Congress that the Commission really does care about EEO matters.

Irrespective of the FCC's motivation, it is apparent that the Commission is still actively involved in policing its licensees' employment practices. That being the case, broadcasters would do well to spend a little extra time to make sure that they are complying with the applicable rules and guidelines. Probably the easiest first step in that project would be to review the station's most recent Annual Employment Report to make sure that the station meets or exceeds the "50/50" guidelines with respect to women and any relevant minorities. A second step would be to review the station's files to see whether records are being maintained of all recruitment efforts. These would include letters or other notices sent to minority and/or women's organizations relative to job openings. Also, if the organizations to which such notices have been sent have not been effective in generating referrals to the station, new organizations should be identified and added to the list to which such notices are sent. And finally, all licensees should be especially careful to be sure that any information submitted to the Commission in *any* connection, whether or not EEO-related, is completely accurate. It is much easier, and much safer, to double-check factual statements *before* they are sent to the Commission than it is to try to explain any inaccuracies in them after the FCC has started asking questions about them.

The area of EEO compliance is one which, with proper preparation and establishment of appropriate record-keeping systems, is not difficult to achieve. You may wish to consult with your communications counsel for assistance in the development of internal systems to help you in this effort. **BM/E**

AM Stereo Without Compromise

C-QUAM® AM Stereo System by Delta Electronics, Inc. FCC Type Accepted

Delta Electronics, Inc. introduces the ASE-1 AM Stereo Exciter and ASM-1 AM Stereo Modulation Monitor: FCC type-accepted C-Quam System transmission equipment for the AM Stereo broadcast market. C-Quam is the *Compatible* Quadrature Amplitude Modulation system developed by Motorola, Inc. C-Quam is the system of choice for more than 70 U.S. stations plus additional Canadian stations. Users range from kilowatt day-timers to full-time network flagships. These stations report enthusiastic response from listeners using multimode and full C-Quam stereo receivers as well as typical monophonic receivers. The key is compatibility without compromise. All listeners, stereo and mono, receive a clear signal with low distortion. Delta's twenty-year leadership in the field of broadcast instrumentation solidly backs this technological advance.

The proliferation of receivers from GM's Delco Electronics, Inc., MacIntosh Labs, Sherwood Electronics, Chrysler Corporation, Concord Electronics, Samsung Electronics and others not yet announced, is creating a sizeable C-Quam audience. With the outstanding performance of this equipment, you can be sure that the audience will *stay* tuned to your Delta C-Quam AM Stereo transmission system.

For additional information, contact Bob Bousman at (703) 354-3350.

C-QUAM is a registered trademark of Motorola, Inc.
Manufactured under license from Motorola, Inc.

See us at NAB booth 105

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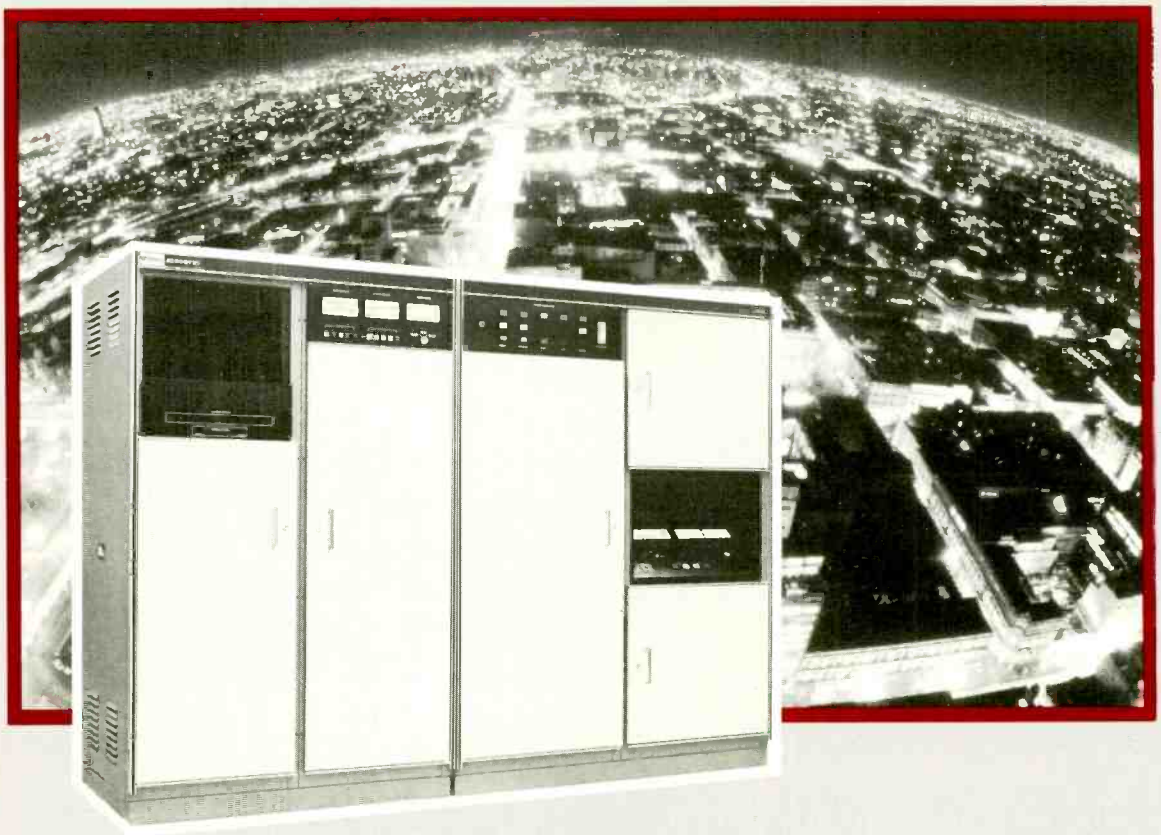

Acrodyne's TRU-10KV 10 kW UHF Bands IV and V transmitter is more than just another 10 kW transmitter. Supplied with an RCA CTM-20 or Philips PM5580 exciter and optional two carrier multichannel sound exciter, the TRU-10KV is ready today for worldwide applications.

Capable of precise offset, our newly-developed modular upconverter uses a synthesized local oscillator and phase locked VCO to maintain exceptionally stable carrier frequencies and carrier separation. Fully programmable for any UHF channel between 471-830 MHz, the upconverter's interchangeable modules simplify maintenance and reduce spares requirements for network stations. Acrodyne's field-proven, modular solid-state driver amplifiers and Hypervapotron® -cooled final amplifier enhance on-air reliability.

Available in main/alternate main and parallel versions for 20 kW visual power output, the TRU-10KV includes the following features:

- IF modulated and low level diplexed
- Single tetrode output
- Straightforward solid-state Logic/Control system
- Full remote control interface capabilities
- Independent redundant power supplies for solid-state amplifiers
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- Optional automatic 1 kW final amplifier bypass capability

Keep your broadcast capabilities at their peak. For further information on our cost-effective, low-maintenance TV transmitter equipment, **call or write Acrodyne today.**

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The Signal of Reliability

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BUSINESS BRIEFS

Artel announced a 1983 net income of $355,833 on net sales of $2,337,041, up from 1982 figures of $127,389 on $1,039,948 . . . . **RCA** reports earnings of $50.3 million for the first quarter of 1984, a 73 percent increase over last year's $29 million.

Kahn Consumer Products has made agreements with a number of AM stereo broadcasters which call for the stations to purchase and promote a new AM stereo adapter that will convert any "Motorola-only" stereo car radio so it can receive stereo broadcasts from all four FCC-accepted AM stereo systems. . . . **Today Video** has opened its third CMX editing suite . . . . North Miami facility **Mark III Productions** has purchased two JVC ProCam 950 cameras. . . . New York mobile production facility **Rimyth** has introduced its revamped "lease alone" generator truck. . . . New York's **ITI** has added the Lexicon digital audio synchronizer to its standards conversion system . . . . ABC has purchased a **Bosch** FDL-60 CCD telecine.

A TV translator system developed by **Electronics, Missiles & Communications** is helping more than 75,000 Florida Keys residents to receive a stronger signal from five Miami TV stations . . . . **Bogner** has received an order for a 24-bay, 59.8 gain (17.8 dB) antenna from KPOL-TV, an independent UHF station in Tucson . . . . **Modulation Associates** has been awarded a contract from **Kavouras** to provide the hardware for the Kavouras satellite date network . . . . Dallas and Washington, D.C.-based **Compucon** has moved its Washington office to larger quarters . . . . **National Video Center**, in New York, was the facility used for Richard Nixon's 38 hours of interviews, parts of which were broadcast on CBS in April.

Ford Aerospace will design, construct, test, and deliver for launch two Ku-band satellites for **Direct Broadcast Satellite Corp**. . . . **The Planned Technology Corp** of Dallas has announced its entry into the satellite and computer software industries. Initial services will include satellite system design and acceptance testing, cost trade-off analysis, and earth station site acquisition.

Video West has signed a contract with **ABC Sports** to provide live coverage of the 1984 Olympics using the Video West mobile unit. . . . **Panasonic/Ramsa** has been appointed the sound system supplier for the 1984 Olympics by the Los Angeles Olympic Organizing Committee.

Comark Communications has completed installation and testing of a

ABC-TV engineering manager Michael Lo Collo (right) and Sony Professional Audio Products engineer Merrill Sheldon check out Sony wireless microphone systems to be worn by ABC Sports commentators covering the Summer Olympic Games.

maximum power transmitting facility for **WHNS-TV**, Channel 21, in Asheville, NC . . . . **Varitel Video** has added two 1984 Dodge vans to its mobile production fleet, one to be based in Los Angeles, the other in San Francisco. . . . **Fiorentino Associates** was awarded a contract from **Infomart** to provide media capabilities and interior/exterior design for the Dallas Infomart.

ADDA will provide eight ESP-750-C digital still store systems to CBS for use in the network's New York broadcast center . . . . **Cineffects**, a New York duplicating facility specializing in multi-format videotape duplication, has added to its dubbing room a total of 35 BR-6400U VHS recorders and CR-6060U ¾-inch recorders from **JVC** . . . . **Bogner** has announced new orders to six stations for its television antennas. The new orders come from: Channel 11 Rawlings, WY; Channel 16 Burlington, NC; Channel 13 San Juan, PR; Channel 32 Tocca, GA; Channel 54 Muskegon, MI; Channel 21 Colorado Springs, CO; Channel 17 Bartlesville, OK; Channel 22 Blue Bell, PA.

News in building locations has increased recently. **Camera Mart** is expanding its Manhattan-based facilities to provide equipment to the 12 acre **Kaufman Astoria Studios** motion picture and television production center. Camera Mart will now have a complete on-site equipment support shop in Astoria . . . . **Antenna Technology** has announced the opening of expanded manufacturing capabilities with an additional 30,000 square feet added to its facility in Orlando, FL.

After 12 years of operation, **CMC Technology** will move to a new location in Santa Clara, CA . . . . **Leo Diner Film and Video** has completed its new home in San Francisco, CA, adding **Rank Cintel** film-to-tape transfer and a recently introduced videocassette duplication plant.

Vectrix will move to larger facilities in Greensboro, NC, a move necessitated by employee growth of 500 percent since the company was founded in 1982 . . . . **JRF Magnetic Sciences,** a firm which sells and services audio magnetic heads, recently expanded its facilities for the third time to accommodate a fully equipped laboratory and engineering facility.

There have been some notable personnel changes in the broadcast industry. Joseph Volpe has been named VP and general manager, **RCA Broadcast Systems Division.** Volpe had been VP operations for RCA Broadcast since October of last year. He succeeds Joseph Howe, who has become staff VP and chief engineer of the RCA Group.

At **Sony Broadcast**, Yumihiko Suzuki has been promoted to VP product management. Suzuki will be responsible for the product development and management of all Sony Broadcast product lines . . . . Christopher Golson will assume the duties of product manager for monitors at Sony.

ADM Technology has made three executive changes. Murray Shields has been promoted to the new position of VP corporate sales. Shields, who has been with ADM for 11 years, was most recently VP sales. Larry Mandziuk has been named to the new position of staff VP Advanced Programs. He had been manager of systems engineering. William Keely has also taken on a new position at ADM, VP engineering

BUSINESS BRIEFS

. . . . William Fink has been appointed director of marketing at **CMX.** Fink comes over from Bosch Fernseh, where he was VP product management . . . . Tom Beams has joined **Aurora Systems,** taking on the new position of VP and chief operating officer. Beams was formerly with Ampex.

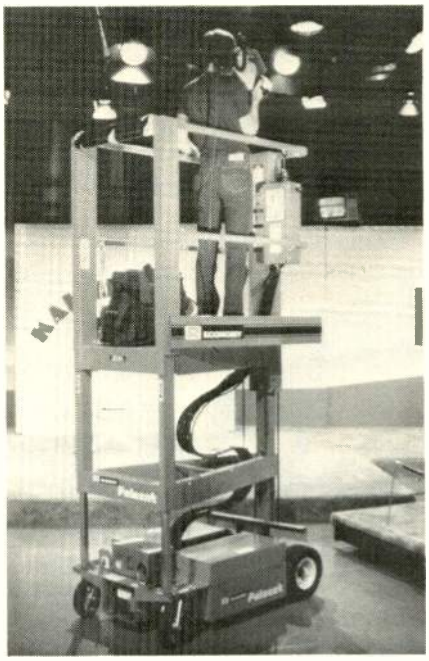
Ampex has announced international management changes: corporate VP Donald Kleffman has been appointed president of Ampex International and David Chapman, also an Ampex corporate VP, has been named general manager of the company's Americas-Far East Area, reporting to Kleffman.

Carl Turner has been named to head the **RCA Solid State Division** in Somerville, NJ . . . . The New Technology Products Group of **Panasonic Industrial** revealed the appointment of Tom Bensen to the position of national marketing manager for Professional Audio Systems. Nick Hudak will hold the position of national manager for systems development and marketing.

John Delissio was recently named VP of Systems and Service Operation at **Harris Broadcast Group**. Also at Harris, the Satellite Communications Division named Mark Fehlig as broadcast sales manager . . . . John Barraclough was given the position of operations coordinator/sales liaison for **Bonneville Telecommunications/Satellite Systems.**

Joseph O'Donnell has joined **Conrac** as a group executive reporting to Paul Graf, executive VP and CEO . . . . **STC** has named David Durand as assistant VP, and Lawrence Brody as director, broadcast engineering and technical operations.

The **Gerstenslager Company** announced a number of staff promotions in the firm's custom body division. Among them, Earl Daye has been promoted to sales and marketing manager . . . . Bob Wincentsen will join **Dynair Electronics** as director of engineering, heading the company's development of new products for wide band video, audio, data switching and distribution, as well as for machine control applications. . . . Jack Breitenbucher has been named by **Hitachi** as national sales manager for the Broadcast and Professional Division.



Economy Engineering's Polecat elevating work platform is used by KENS-TV, San Antonio, as a mobile studio minicam and a lighting and overhead work platform.

Squeezer

The Video Compression System With One Feature All Others Lack: Affordability.

Everyone today is facing the budget squeeze one way or another. Networks, affiliates and independents. Cable companies. Production and post production houses. One curious thing about budget squeezes is that they have a way of making equipment purchase decisions both easier and harder. Easier when it's clear that a particular item costs too much for the times. But harder when you are looking at equipment you know you need, but can't find the bucks for.

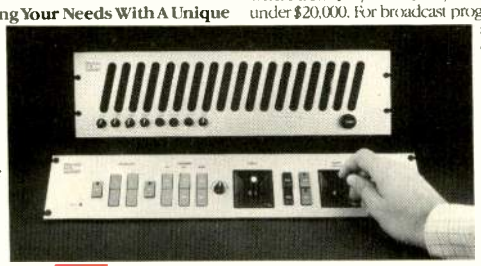
The Squeezer: Meeting Your Needs With A Unique Set of Special Effects Features.

The Squeezer, from Precision Echo, is a programmable video compression and positioning system that compresses an image down to four selectable sizes, places that image anywhere within the screen on command, crops any part of it to any size, and puts a variable-sized border of any color around it on request. It can even flip the image horizontally or freeze the action. Exclusive dual joy stick controls make image manipulation simple. And the utility of its design makes The Squeezer a versatile tool whether rack mounted in a production facility or used in mobile applications.

The Squeezer: An Affordable Alternative.

There's very little that you'll find on The Squeezer that you couldn't find on an ADDA, Vital, or a Quantel system. Except the price tag. Those other systems cost anywhere from $40,000 to $200,000. The Squeezer costs under $20,000. For broadcast programming, news and sports production, cable TV, educational and industrial applications, nothing comes close to the cost efficiency of The Squeezer.

The Squeezer from Precision Echo. High on quality and cost efficiency.



PRECISION ECHO

3105 Patrick Henry Drive • Santa Clara, CA 95050
(408) 988-0516 • TWX 910/338-2328

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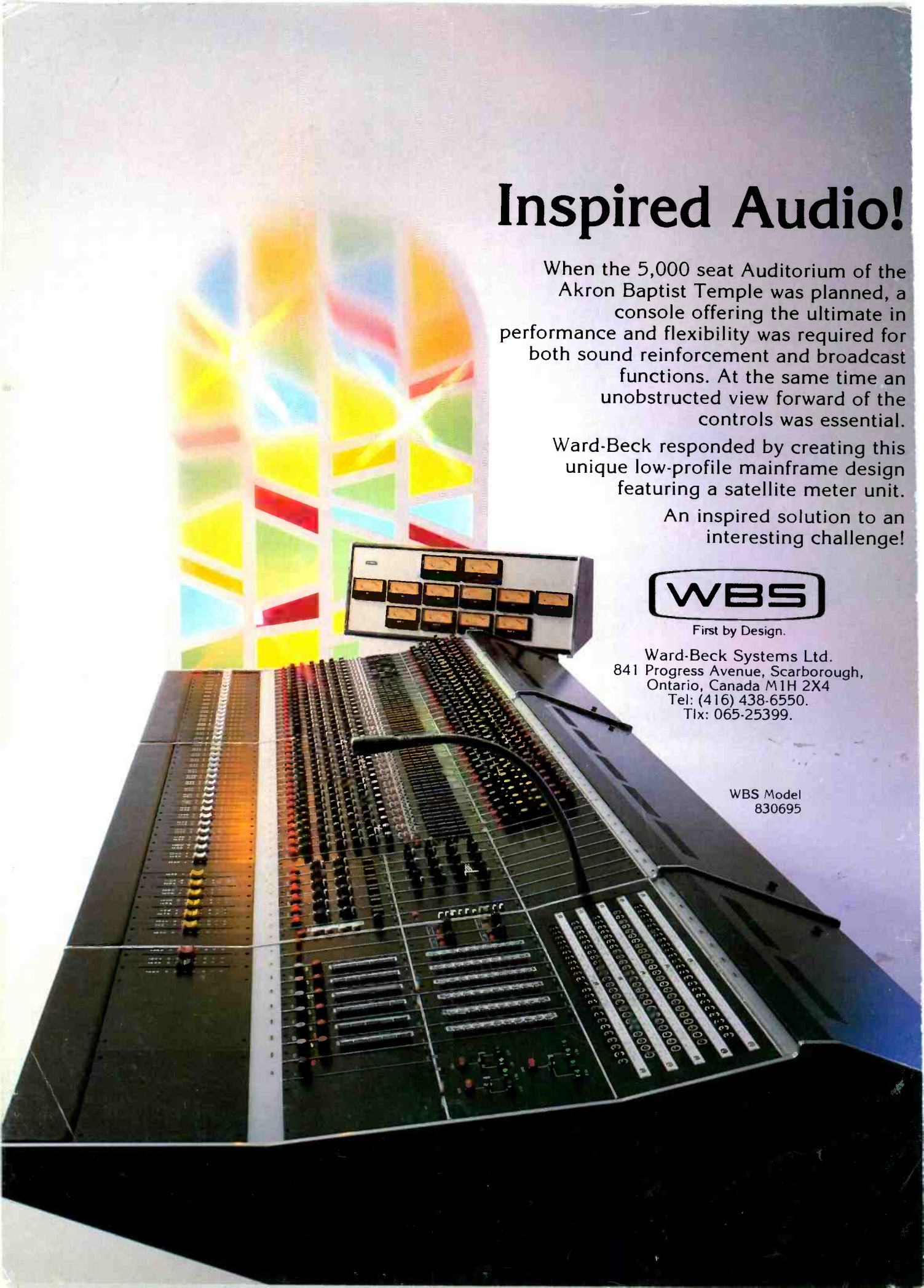

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