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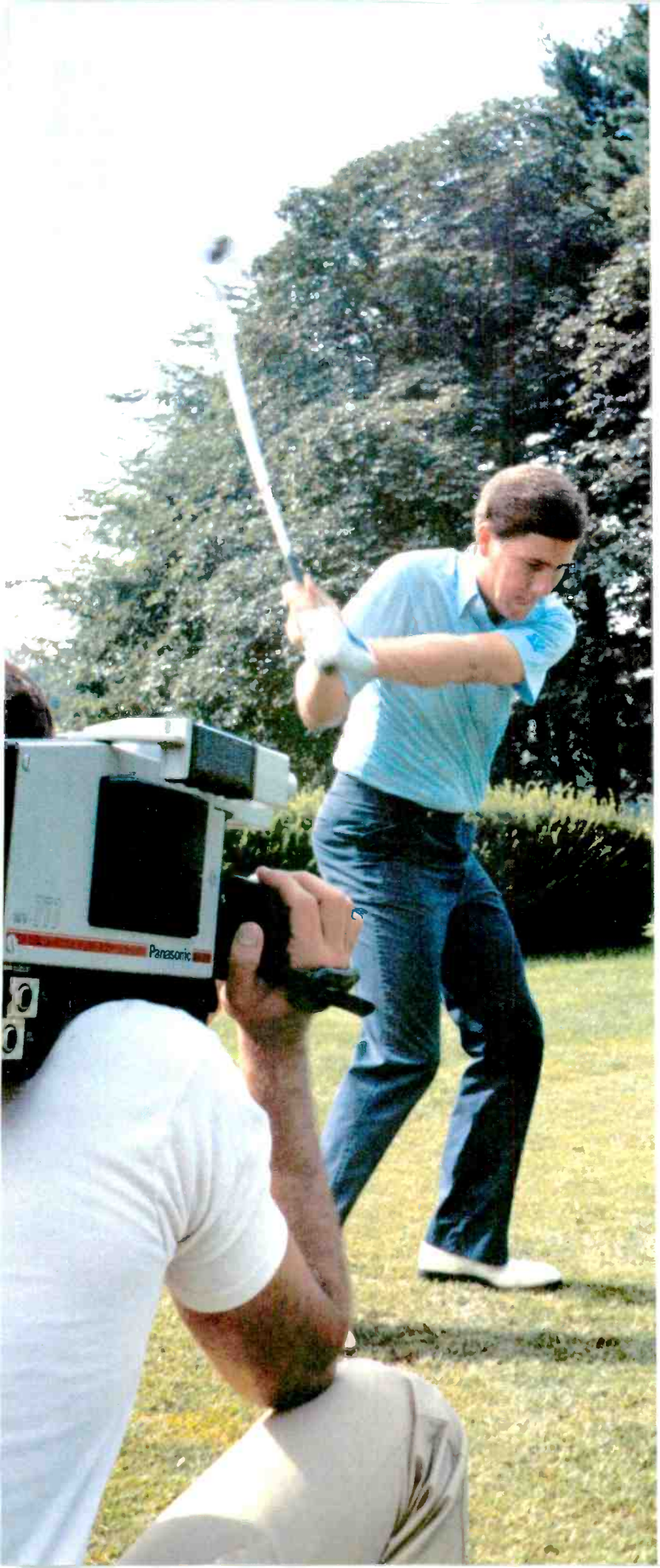

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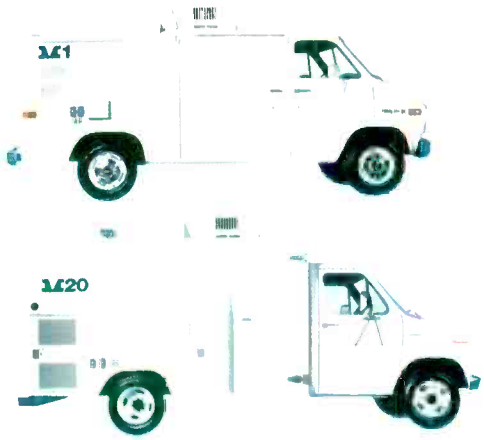

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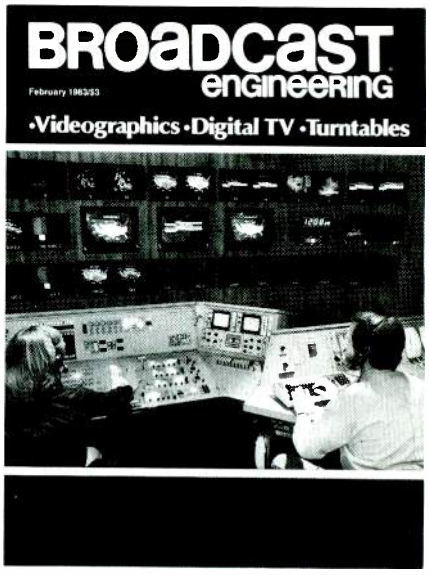
BROADCAST engineering

The journal of broadcast technology

February 1983 • Volume 25 • No. 2



THE COVER shows the control room at KRON, Channel 4, San Francisco, CA, and its Aurora system for creating electronic videographics for TV broadcasting. In this issue, an article by Blair Benson, **BE's** TV technology consultant, addresses broadcasters' needs for equipment to generate videographics and manipulate video images. (See "Electronic Videographics: A Perspective," on page 38.)

The cover photo was provided courtesy of Linda Guess, public relations director, KRON.

FEATURES

DEPARTMENTS

ISSN 0007-1994.

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NEXT MONTH we will focus on the NAB-'83/Las Vegas convention. Our preshow issue will provide a comprehensive listing of exhibitors and their products and a detailed map pinpointing exhibitor locations, and will highlight important sessions and events to occur at this year's show.

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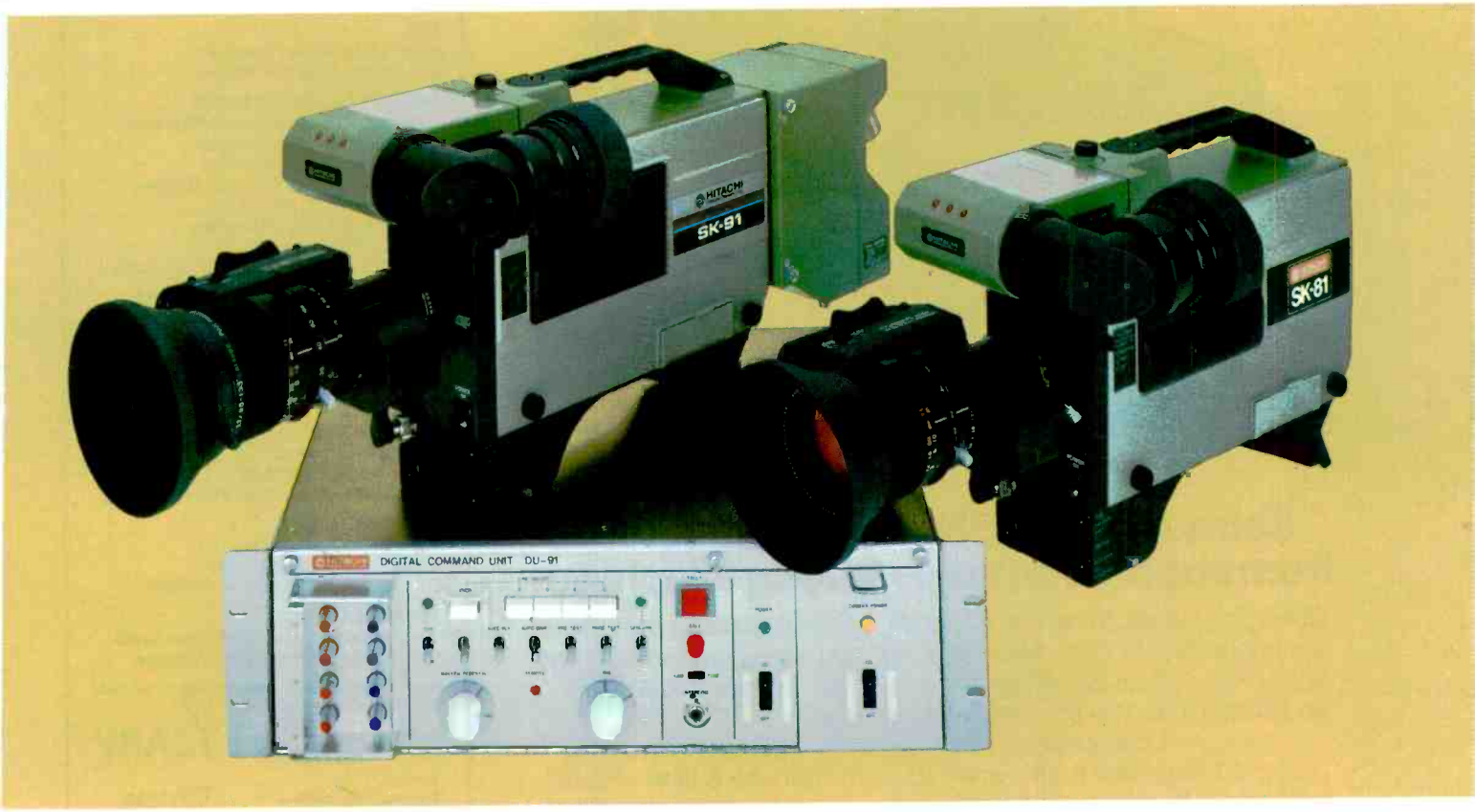

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BROADCAST ENGINEERING is edited for corporate management, engineers/technicians and other station management personnel at commercial and educational radio and TV stations, teleproduction studios, recording studios, CATV and CCTV facilities and government agencies. Qualified persons also include consulting engineers and dealer/distributors of broadcast equipment.

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FCC update

February 1983

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

In December the commission took several actions aimed at increasing minority participation in the field of telecommunications. These included issuance of a policy statement on advancement of minority ownership in broadcasting and adoption of a Notice of Proposed Rulemaking dealing with current restrictions on the security interests in a broadcast station that a seller may retain. Simultaneously the commission adopted a policy statement on minority ownership of CATV facilities; agreed to submit proposals to Congress to increase minority ownership through expansion of tax incentives; and signed a memorandum of agreement with the Department of Commerce formalizing a cooperative effort to provide management assistance to minority telecommunications entrepreneurs.

The FCC's policy statement in the broadcast area dealt with the eligibility of minority-controlled limited partnerships for tax certificates and *distress* sales. A tax certificate is a mechanism for deferring taxation of capital gains realized upon the sale of a station when the sale effectuates an FCC policy, such as minority ownership of the media. Under the commission's distress sale policy, a licensee facing an FCC enforcement hearing, in which his license is in jeopardy, may sell his station to a minority-controlled entity at 75% of its value and avoid the consequences of the hearing.

With regard to limited partnerships, the commission said such entities would be eligible for tax certificates and distress sales when the general partner is a minority individual owning more than a 20% interest in the limited partnership. The commission also changed its procedures by delegating to the Mass Media Bureau authority to grant routine distress sale requests. This will shorten the time for obtaining approval.

In its accompanying rulemaking proposal, dealing with security interests in broadcast properties, the commission is seeking comments on whether the current prohibition against retention of reversionary interests could be modified to encourage further use of seller-financing, particularly where the transaction would promote minority ownership of the media. The commission invited comments on what types of security interests could be retained by seller-creditors and, if retention of a reversionary interest in a license is legally permissible, under what circumstances could it be exercised.

In the cable TV area, the commission agreed to consider requests for tax certificates from owners of cable systems who have sold their interests to minority-controlled entities. The commission said this would assist minority entrepreneurs in becoming owners of this medium of communications also.

The commission's legislative recommendations included a proposal that the tax certificate policy, restricted by Section 1071 of the Internal Revenue Code to "radio broadcasting stations," be extended to non-broadcast communications properties. Also, the commission suggested that the provisions of the Internal Revenue Code dealing with the investment tax credit be amended to raise the amount of used equipment that a taxpayer could count in computing his investment credit. The current ceiling on used properties is $125,000, which amounts to a maximum credit of $12,500. The recommendation would raise the amount to $5,000,000, which would allow a maximum credit of $500,000. This increase, the commission said, would make the investment credit a more attractive and effective financing device for minority entrepreneurs to use in attracting investment capital to purchase existing stations.

Rulemaking to reduce UHF *noise figure* limit

The commission has proposed to reduce the acceptable *noise figure* limit for TV receivers to 12dB. The current level is 14dB.

The noise figure is a technical measure for one of the factors that influences how well a TV receiver displays a weak signal. Generally, the lower the noise figure, the better a TV receiver will perform in this regard.

The commission's initiative in this area is based upon a new analysis by its Office of Science and Technology that indicates that about 70% of color TV sets produced in 1981 and 1982 would meet the proposed 12dB noise figure limit. In 1980, the commission was ordered by a court to vacate its previous rules establishing the limit at 12dB. The court found the lower limit was beyond the commercially feasible state of technology at that time. The FCC believes that this situation has changed significantly over the past two years.

The new effort is predicated on a desire to preserve the improvement in UHF noise figures achieved in more recently manufactured TV receivers. The new standard, the commission observed, appears to be obtainable at a reasonably low cost.

FCC form information reduced

As part of its continuing deregulation effort, the commission has reduced the requirements of many FCC broadcast application forms. Among the recent changes are the following:

- **Form 302—Application for Commercial License.** Applicants no longer need respond to questions seeking financial information.
- **Form 316—Pro Forma Transfers or Assignments.** Applicants no longer need to supply a copy of the corporate resolution or other instrument authorizing an assignment or transfer, or supply copies of articles of incorporation and bylaws. Further, no balance sheets or other financial information need be supplied. A certification of the applicant's ability to complete the transaction is now all that is necessary.
- **Form 340—Application to Construct or Modify a Non-commerical Station.** Public educational institutions and political subdivisions are no longer required to provide written evidence of their legal authority to operate a broadcast facility. Further, instead of completing Section III dealing with financial qualifications, a certification as to an applicant's financial ability to construct and operate the station now is acceptable.
- **Form 341—Application for Noncommercial License.** Applicants no longer are required to respond to questions requesting financial data.
- **Form 345—Consent to Assignment of Translator or Low Power TV Station.** Applicants need not submit any financial data or enter in the form the consideration to be paid in connection with the transfer.
- **Form 347—Application for Translator or Low Power TV License.** Applicants need not respond to questions dealing with their construction expenditures or financial status.

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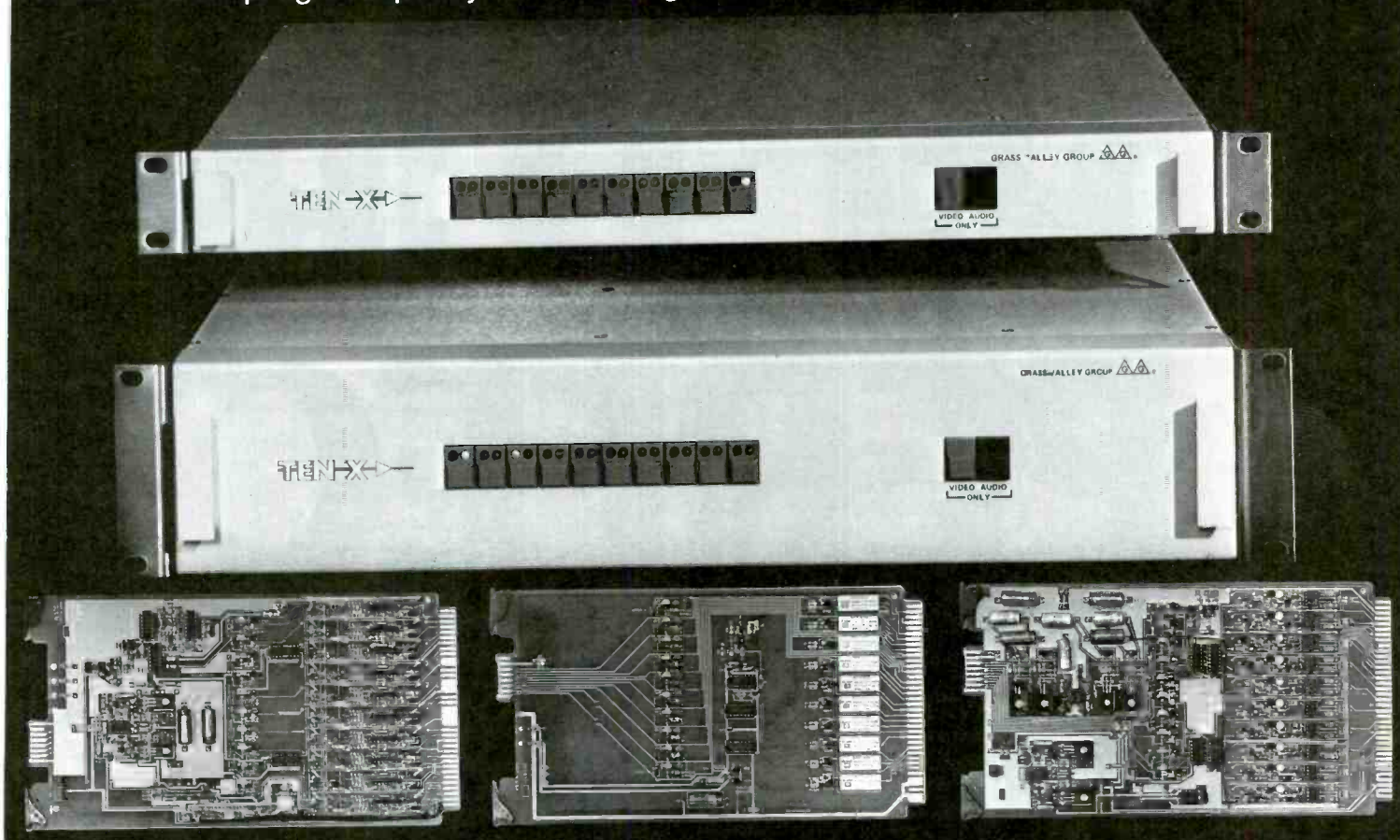

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See you at NAB.

Digital & self-diagnostics

The SMPTE has designated the 1980s as *The Digital Decade*. As we teeter on the brink of this digital decade, we stand at the threshold of a new host of problems and opportunities. One of the major problems that all broadcasters must face in this new era is that of maintenance for a whole new generation of complex and sophisticated equipment, equipment that will require a departure from traditional thinking when it comes to care and maintenance. Associated with this problem will be the difficulty of finding and keeping qualified engineers and technicians for repairing these new systems—if, indeed, repairing in the future is to be done at the station level.

The attendant opportunity inherent to this forthcoming era is that the new digital equipment offers enormous possibilities for inclusion of built-in self-diagnostics circuitry. Planned for at the outset, self-diagnostics will add only nominally to the cost of the equipment. But the returns will be extensive in terms of aid to the engineers and reduction of maintenance work and downtime.

But it's up to the industry to demand that these circuits and techniques be included in the design of new digital systems. Standards organizations are urged in their committee activities to devote suitable attention to diagnostic circuitry while they are considering the bigger picture of equipment functions. Furthermore, it might even be helpful to have a separate committee review all digital recommendations to ensure that self-diagnostic techniques are properly included.

However, in the final analysis, it will be up to the end users to demand that these circuits be included in new digital equipment. Constant feedback to manufacturers is needed if the full capabilities of modern circuitry and components are to be realized. With continued diligence and a united effort, all station departments will benefit, and the next generation of broadcast equipment will be the best that the industry has ever seen.

NAB-'83/Las Vegas can be a golden opportunity to begin emphasizing our needs, when manufacturers are especially tuned to receiving feedback. If we work together, history might record the 1980s as: *The Digital Decade, with Self-Diagnostics Built-in.*

Broadcast freedom in '83?

The First Amendment: "Congress shall make no law...abridging the freedom of speech or of the press." Even so, the constitution has not granted broadcasters freedom of expression.

Will 1983 mark a turning point in the thrust for this freedom? There are vague indications that this might be the case, but only time will tell. Last year's NAB convention witnessed several strong efforts toward this goal—major speeches by Sen. Bob Packwood (R-OR); Vincent Wasilewski, then NAB president; and Mark Fowler, FCC chairman, all pleaded for equality for broadcasters.

More recently, in November 1982, Dan Rather, CBS news anchorman, appeared at a congressional hearing and testified that the First Amendment would be in jeopardy unless broadcasters obtain their just rights of communications, in equality with their counterparts in printing. "The most direct kinds of regulation of broadcast content," he said, "such as the Fairness Doctrine and Equal Time Provision, should have no place in a society that is rightfully proud of having the freest press in the world."

To the legion of broadcasters pleading for this freedom can now be added a leading member of the printed media. Arthur Ochs Sulzberger, of the *New York Times*, spoke on this subject at the 1982 Alexander Hamilton Awards Dinner, Nov. 17, 1982, Columbia University. Regarding the formulation of the First Amendment, he said, "Today, 200 years later, we are debating the same issue. To wit: Should the First Amendment to the Constitution protect the newer electronic forms of journalism? Should not radio and television, historically government-regulated by the limited availability of airwaves, be set free?"

But Sulzberger recognizes that he is in the minority, that "it is interesting to note how many of my colleagues of the printed word are putting distance between themselves and electronic publishers when it comes to the First Amendment. They share a fear that what the government gives, the government can take (away)."

Continued on page 116

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feedback

Using the 12.2-12.7GHz band

On July 14, 1982, the FCC released a Report and Order adopting interim policies and rules for the operation of a DBS service that is to be superimposed on the 12.2-12.7GHz band presently allocated to the terrestrial operational fixed service. Although there is talk of DBS experiments being started in this band in the northeastern United States sometime in 1986, the rate of growth and timing for actual commencement of a DBS direct-to-home service is unknown.

In the July 14th Report and Order, the FCC expressed its intention to ensure that sufficient spectrum will continue to be available for the terrestrial fixed service and that a Notice of Proposed Rulemaking on the subject would be forthcoming. In the meantime, the FCC will continue to accept applications and issue licenses for terrestrial fixed operations in the 12.2-12.7GHz band. Licenses issued on or before Sept. 4, 1983, will be *grandfathered* for five years (i.e., until Sept. 4, 1988) and licensees may continue to operate in the 12.2-12.7GHz band thereafter, but must be prepared to adjust to avoid interference to the DBS service. Licenses issued after Sept. 4, 1983 will require terrestrial fixed users in the 12.2-12.7GHz band to avoid interference to DBS without a grandfathering period being allowed. The definition of what constitutes interference is to be defined in a later FCC Report and Order. Adjustments envisioned by the FCC to avoid interference to DBS could be made by moving to other frequencies in the 12.2-12.7GHz band or into other alternative spectrum the FCC is yet to propose.

For more details, readers may contact the following: Jerry D. Schulman, P.E., Comsearch, 11503 Sunrise Valley Drive, Reston, VA 22091.

Correction

In the cable TV section of your November 1982 **BE** (page 16), a line was omitted from the last paragraph of my article, "CATV Signal Carriage: Broadcasters' Rights Under FCC Rules." The paragraph should have read: "Finally, even if *you feel that your station would be carried even if* there were no mandatory carriage rules, you should still...

This was an important point, and I fear that the omission of the line of text makes the last paragraph less effective.

Dane E. Ericksen
Hammett & Edison
San Francisco, CA

Computing error

The program for computing distance **(BE** October 1982, page 142) has an error in line 240. It should read as follows:

```
240 I2 = ATN(1/(TAN(.5*C))*(COS(H1))/(SIN(H2)))
```

Richard L. Plessinger
Miami Valley Radiotelephone
Dayton, OH

Cover request

I would like to get a poster-size copy of the **BE** December 1982 issue cover. We use one of the Satcom birds for all of our music programming and would love to have this picture for display in our station.

James Perry
Chief Engineer
WKSS-96FM
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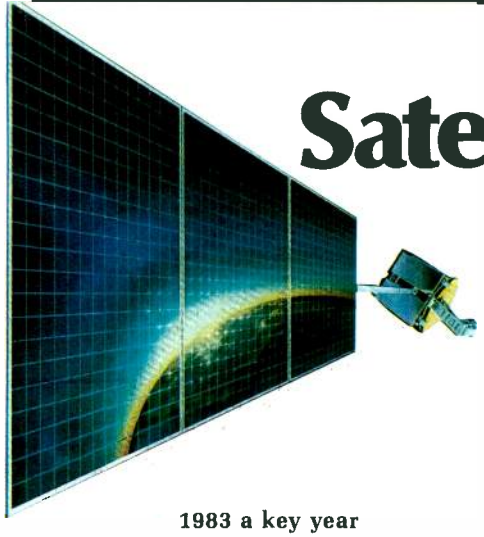

Satellite update

By John Kinik, satellite correspondent

1983 a key year

1983 will be a significant year in the history of satellite broadcasting technology for several reasons. The *first* is that a major package of 48 TV channels will be available when Hughes' Galaxy 1 satellite goes into operation alongside RCA's Satcom 3R in mid-year. These two satellites, each carrying 24 channels, will be 4° apart in the orbital arc at 135° west longitude (Galaxy 1) and 131° west longitude (Satcom 3R). Both can be received with a single antenna equipped with a dual-feed system, at an insignificant penalty to the performance of a normal single-feed antenna. These 48 channels will provide a tremendously attractive selection for cable TV operators and broadcasters to use.

The *second* reason is that 1983 will see the commencement of a prototype Direct Broadcast Satellite (DBS) system. United Satellite Television (USTV) will begin transmitting four channels on the Canadian Anik C2 satellite on an interim basis until 1984, when USTV will switch to one of the new US satellites. This will not be a true DBS system because the receiving antenna required for the Anik C2 is larger than the 2- to 3-foot diameter antennas to be used for DBS satellites, and the very low cost receiver electronics projected for DBS will not yet be available. The trial system will, nevertheless, be an important test of the market demand for DBS. (Eight applications for DBS systems have been approved by the FCC, and the first system is scheduled to begin operation in 1985).

The *third* reason why 1983 will be significant is that April will mark the 10th anniversary of satellite broadcasting in North America. Surprising as it may seem, TV broadcasting via satellite began in 1973, when the Canadian Broadcasting Corporation (CBC) initiated a 3-channel national network on the Anik A1 satellite. The same basic technology has been employed on the RCA Satcom satellite series to deliver television to cable TV systems, and will also be used on the new Hughes Galaxy satellites. This "first generation" satellite technology operates in the 4GHz and 6GHz frequency band (C-Band) and at satellite transmitting powers that require receiving antennas in the 10- to 15-foot diameter range. The new DBS satellites will deliver signals at higher levels making the use of small roof-top receiving antennas feasible, and will operate in the 12GHz and 14GHz frequency band (Ku-Band).

C-Band or Ku-Band?

Satellite broadcasting in the 1980s will use two delivery modes: the conventional C-Band technology and the new Ku-Band technology. No dramatic shift to Ku-Band can be accurately predicted, for fundamental technical and economic reasons. C-Band satellites will continue to serve cable television and broadcasters with an increasing number of signals, which could reach a total of several hundred channels by 1987. The only questions about this growth rate relate to the availability of programming and the market demand for television, radio and other broadcast services. Can the programming be produced and will the demand for channels be there? These questions also apply to DBS, but, there are several other areas of doubt.

Financing is a major hurdle, because the DBS companies must convince the financial community that the market demand will be sufficient for direct-to-home television in spite of the availability (by that time) of many channels via cable and broadcasting. The DBS companies are basing their business plans on non-urban markets, claiming a potential of 20 to 30 million homes that are not well-served today by other technologies. In spite of this posture, there is little doubt that DBS intends to compete head-to-head with cable, broadcasting and C-Band satellite technology—and this point is well-understood by the financiers.

Technology is another problem area for DBS. Due to the high transmit power requirement, satellites can only provide a few channels instead of the 24 on C-band satellites. The high frequency Ku-Band is also subject to fading and noise increase in heavy rain conditions, which tends to require larger antennas in fringe areas. The high frequency band also makes the electronics more touchy, presenting a potential reliability problem. None of these problems exist for C-Band delivery systems, and marketplace competition has driven C-Band receiving terminal costs below $2000 for low cost configurations. There is every indication that even more dramatic cost reductions, to below $1000, are possible by the time the first real DBS system goes into operation in 1985.

Thus, the increasing cost-effectiveness of the proven C-Band technology will compete effectively with the new DBS technology throughout this decade.

Orbit resources

DBS may eventually become the dominant satellite delivery mode for one overwhelming reason. More efficient use can be made of the orbital arc covering North America with Ku-Band satellites than with C-Band satellites, because antenna beamwidths are narrower at the higher Ku-Band frequency, allowing a closer spacing of satellites without harmful interference into adjacent satellites by transmitting antennas, or interference from adjacent satellites into receiving terminals.

The FCC has recommended that satellites be spaced 2° apart in the future (instead of the current 4° or 5° spacing), indicating that a favorable climate for DBS is here, at least as far as the current administration is concerned. Because the North American orbital arc is shared by the United States, Canada and Mexico, and because there is some overlap into the South American orbital arc, an important international conference will be held this year to determine allocations for DBS satellites. The 1983 Regional Administrative Radio Conference (RARC-83) will plan the orbital positions and frequencies to be used in the Western Hemisphere. All DBS applications are subject to the decisions and recommendations made at RARC-83, a conference that participating countries have been preparing for over the past few years, and that is conducted under the auspices of the United Nations.

Thus, 1983 will indeed be an interesting year in satellite broadcasting.

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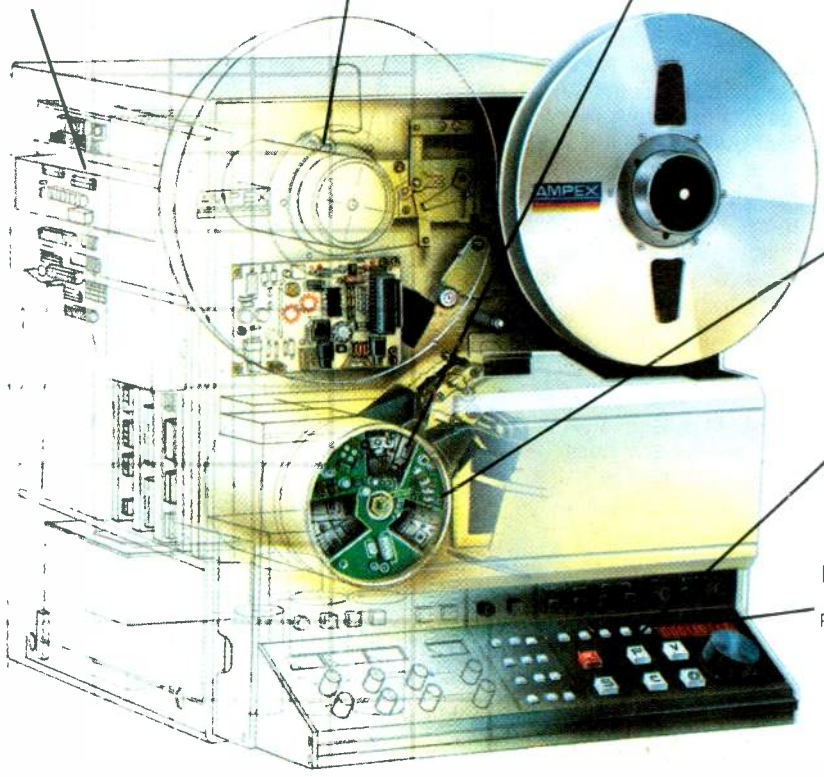

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Television in Senate gets positive response

A majority of the US Senate is either in favor of or leaning in favor of televising Senate floor debate according to a survey just completed by C-SPAN, the Cable Satellite Public Affairs Network. However, the same survey indicates 28 senators have shifted their positions during the past year since C-SPAN previously queried lawmakers.

The total number of senators reported firmly in favor stands at 40. (See Table I.) Those leaning in favor fell from 17 to 14. (Senators favoring or leaning in favor are composed of 35 Republicans and 19 Democrats for a total of 54). The biggest change from last year's survey was in the undecided column, which now totals 29, up from 23. In the leaning against category, the figure remained at five (all Democrats) and those firmly against dropped from 13 to 12.

Senators shifting positions from previous surveys from being against or leaning against to a favorable response were Senators Goldwater and Bumpers; those who were undecided and now showing a favorable position are Senators Biden, Denton, Gorton, Melcher, Metzenbaum and Nickles. Senators who were either undecided or leaning favorably toward televising and changed to a position of being against were Senators Bensten (supports radio), Dodd, Laxalt and Nunn; senators who were leaning favorably but changed to undecided included Danforth, Dole, Durenberger, East, Exon, Hatfield and Mattingly; senators previously against but now undecided are Glenn, Levin and Wallop.

Table I.
Statistical box score of 1982 survey

	Democrats	Republicans	Total
In favor	12	28	40
Leaning for	7	7	14
Against	9	3	12
Leaning against	5	0	5
Undecided	13	16	29
	46	54	100

Group W urges FCC to increase FM modulation limits

Westinghouse Broadcasting and Cable (Group W) has recommended that the FCC increase FM modulation limits to as much as 115% during use of SCA subcarriers. The recommendations were part of Group W's recently filed reply comments in the FCC's Notice of Proposed Rulemaking concerning use of the SCA.

The recommendations resulted from a series of laboratory tests designed by Harrison Klein, Group W's director of radio engineering. The tests were designed to measure the extent to which a reduction in main channel modulation is necessary when one or more subcarrier chan-

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nels are used. Present FCC rules require a full 10% main channel reduction when a 10% SCA is in use for a total modulation of 100%.

Group W concluded that use of a single 10% injection subcarrier requires only a 5% reduction in main channel modulation for a total modulation of 105%; and use of two 10% injection subcarriers still requires only a 5% reduction in main channel modulation, for a total modulation of 115%.

In the reply comments, it was stated that these higher modulation limits are possible without adverse impact on channel performance or interference to adjacent channel stations.

Shorthaul fiber-optics systems to grow despite technology gaps

A major multiclient study, recently completed by ERA Technology Ltd., highlights a number of technological gaps that exist and hamper the growth of shorthaul fiber-optics systems. The 5-volume report, *Fiber-Optics for Process Control and Business Communications*, points out that although fiber-optics is already being used in process plants and data communications applications, the absence of a low cost means of signal regeneration and an efficient, simple coupler will restrict the growth in European shipments of these systems to 40% annually.

Peter Baker, project leader, said that although the total current European market for shorthaul systems is small compared to longhaul telecommunications, many companies are working in this area and should be able to provide suitable solutions for the key gaps. The total 1982 UK market for delivered systems used in shorthaul business communications and process control applications will be £2.5 million and will exceed £13 million in 1987. The market split of 40% for process control and 60% for business communications probably reflects the resistance to fiber-optics in some process control industries, although some organizations are taking up the technology enthusiastically. There is a shortage of funds for capital expenditure in the continuing recession. Computing, on the other hand, is a vigorous growth industry, and as it expands, the sector is expected to improve its share in the market.

The application of fiber-optic technology to business communications is confined mainly to links for intercomputer communication and for communication between computers and VDUs. However, applications in process control and similar environments are wide ranging, and it is clear from the interview program that some suppliers are tending to specialize in certain industry sectors or types of application. This can be useful to the system user, especially when the supplier has an understanding of the end-user systems and the various interfacing requirements.

Traditional Process Equipment manufacturers are beginning to offer optical fiber communication options; two recent examples being by Leeds and Northrup and MEM (Midland Electric Manufacturing). The MEM range of Memaster modular programmable control systems now offer a fiber-optic link module that offers up to eight input and output channels per module. Leeds and Northrup have developed a fiber-optic data highway to provide a safe, noise-immune process control system. Up to four such highways can be used with the system, and each highway can support 31 stations.

Cable television could have the most dramatic impact, economically and technically, if the appropriate decisions are taken and the potential major suppliers are actively involved in fiber-optics technology.

The 5-volume study is available for a fee of $3150 from IPI. For more details, contact Dr. Murray Disman, chairman, International Planning Information, P.O. Box 71046, Sunnyvale, CA 94086.

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Videotape recording: Digital component vs. digital composite recording

By E. Fraser Morrison, Ampex Corporation, Redwood City, CA

In the following, digital composite signals for NTSC and PAL and a single digital component signal are described. User data rates and channel-coded rates for a digital VTR are developed for the three types of signals. Methods of error correction for the types of signals are shown and performance results are compared. Continuous standard signals for stop-motion and slow-motion operation of the tape transport are derived, and the anticipated performance results are compared.

A digital composite system with analog inputs and outputs will interface directly with existing TV signals. Although providing the benefits of digital signal processing, the system still retains limitations imposed by the original analog composite system.

A digital component signal bypasses the modulation process that enables the total information to be carried as a single signal and retains the information as separate independent signals. The restrictions caused by encoding the color information are eliminated, and greater flexibility in post-production processing can be achieved with minimum distortion.

Digital composite signals

A digital composite signal is one in which the final transmission analog signal—NTSC, PAL, PAL-M or SECAM— is digitally encoded. For NTSC or PAL, the sampling frequency of the analog-to-digital converter is usually three or four times the subcarrier frequency. The frequency of four times has the advantage (for NTSC) of producing 14.318Megasamples/s or 910 samples for a full horizontal line. Eight-bit linear quantization is adequate for analog applications. Nine-bit linear quantization is desirable if the signal is to be converted to a digital component signal or subjected to any processing that would introduce least-significant-bit rounding errors. Such is the case with digital filters used for averaging, picture size changing and other effects that can only be performed in the digital domain.

Provided the original timing information contained in the analog signal is preserved in the analog-to-digital (A/D) conversion process, then the analog output signal will be a replica of the original input signal. The assumption must be made that sufficient samples of the synchronizing information and subcarrier burst are taken to describe the phase of chroma. Also, the continuity of the digital signal must be maintained through the processing system and subsequent digital-to-analog (D/A) conversion. For this basic application, the sampling phase of the A/D converter is unimportant.

The power of a digital system is in its capability of performing post-production effects that have, in the past, been extremely difficult to create in the analog domain. Examples are luminance and chrominance separation, field stores, picture size changing and bandwidth compression by bit reduction schemes. For these forms of picture processing, it is necessary to have knowledge of the values of luminance and chrominance at every sampling instant. If the sampling phase is precisely defined with respect to the chroma subcarrier

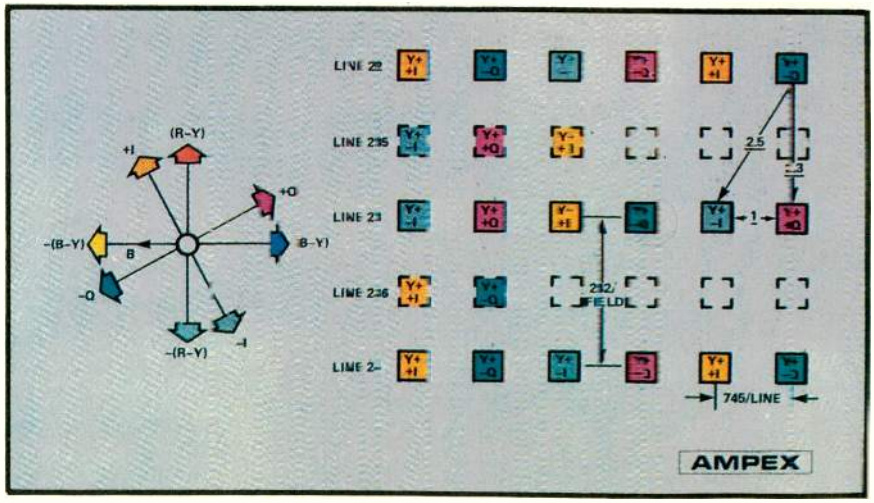

Figure 1: Alignment of samples, 525-line, NTSC, 4 x f_{sc}.

phase and four times subcarrier sampling is used, then each sample represents a luminance value plus a color difference value equivalent to the values of the color difference signals before encoding in the original NTSC or PAL analog encoder. If the sampling phase is defined in the A/D converter, then it is unnecessary to carry the burst of subcarrier, occurring in the back porch of the horizontal blanking interval as a timing signal, for the phase of the clock represents the phase of the chroma information. Linear quantization levels of eight bits and nine bits are currently used for composite signals, with eight bits adequate for current applications. Post-production processing of the signal will necessitate 9-bit quantization if a very high quality level is to be maintained throughout the digital system. With four times subcarrier as a sampling rate and 9-bit linear quantization, the resulting user bit rate created is 129 Megabits per second (Mb/s) for NTSC and 160Mb/s for PAL.

Figure 1 shows the alignment of samples on a 525-line TV picture for NTSC, and Figure 2 shows the alignment of samples on a 625-line TV picture for PAL. The number of samples per line and field is shown, and the horizontal and vertical spatial separation of the samples is given in relation to the aspect ratio of the active picture.

Sampling takes place along the I- and Q-axes for NTSC, which follows the convention of a NTSC analog encoder and along the (U+V)- and (U−V)-axes for PAL, which provide a distinct advantage in some signal processing operations that will be described subsequently.

Digital component signals

A digital component TV signal is one in which the original gamma corrected *Red, Green* and *Blue* source signals are matrixed to produce a full bandwidth luminance signal, E_Y, and two narrower bandwidth color difference signals, E_R and E_B. The bandwidth and the dynamic range of the signals is in excess of that required by the final color TV transmission system signal (NTSC, PAL, PAL-M or SECAM).

The ratio of luminance bandwidth to chrominance bandwidth of 3:1 would be adequate for TV standards; however, a ratio of 2:1 is preferred with its attendant 50% increase in chrominance bandwidth. This is necessary if post-production effects such as downstream chroma-keying are to be performed with the digitized TV data. The dynamic range requirement is satisfied by 8-bit linear quantization of all three signals.

The sampling frequencies are described by a set of numbers of a hierarchy. In the (4.2.2) hierarchy, the highest number (4) describes the luminance sampling frequency and the lower numbers (2.2) describe the chrominance sampling frequencies. Many sampling frequencies have been discussed and, for the sake of this comparison, a frequency for luminance sampling of 13.5MHz has been chosen and is written as (13.5:6.75:6.75). The luminance is sampled at 13.5MHz, realizing a luminance bandwidth of 5.8MHz, the chrominance is sampled at 6.75MHz, realizing a chrominance bandwidth of 2.2MHz. A luminance sampling frequency of 13.5MHz produces 858 luminance samples per full horizontal line for the 525-line TV system and 864 samples per full line for the 625-line TV system. As an even number of samples are presented on every line, the samples will align orthogonally on adjacent TV lines and adjacent fields of the picture.

Figure 3 shows the number of samples of an active line and active field and spatial separation of samples for a 525-line TV system. Figure 4 shows the number of samples of an active line and active field and spatial separation of samples for the 625-line system. A (13.5:6.75:6.75) component system with 8-bit linear quantization represents a total user bit rate of 216Mb/s.

Channel data rate

The digital user data must be converted to a frequency spectrum suitable for reproduction from magnetic tape. The modified signal is referred to as the *channel-coded* signal. It is desirable to drastically reduce or completely eliminate the dc component from the incoming data; otherwise, there will be considerable distortion of the data recovered from tape during the reproduce process. This conversion is achieved by frequency modulation of the analog TV signal in an analog VTR. Codes such as *8-10 block* or *Miller squared* can be used in digital VTRs.

Additional overhead is required for error protection and error correction. Extremely sophisticated systems are used for the data processing industry and for other serial data such as digital audio in which close to 100% correction is desired. It is difficult to justify these types of correction systems for a digital TV signal in which large redundancy already exists in the TV picture that can be used to an advantage with error concealment schemes. Many codes are currently in use for high density digital recording. However, it is not the purpose of this paper to discuss the relative merits of the various types of codes. The most efficient require about a 12% increase in overhead for error protection and/or correction and the amount of overhead would be identical for either a composite or a component TV signal.

The synchronizing information that was carried during the horizontal and vertical blanking interval of the composite signal, or as a separate timing signal with the component signal, is converted to timing information that is carried digitally as a separate signal with the parallel digital signal in both the component and composite digital TV standards. As the sampling phase was precisely defined in the composite standard, the back porch burst contains no useful information. The removal of this information from the horizontal blanking interval allows the active picture of 52μs to be expanded out over the full line of 64μs, resulting in a reduction in data rate of approximately 17% for both the 525-and 625-line TV standards. This saving of data is achieved at the

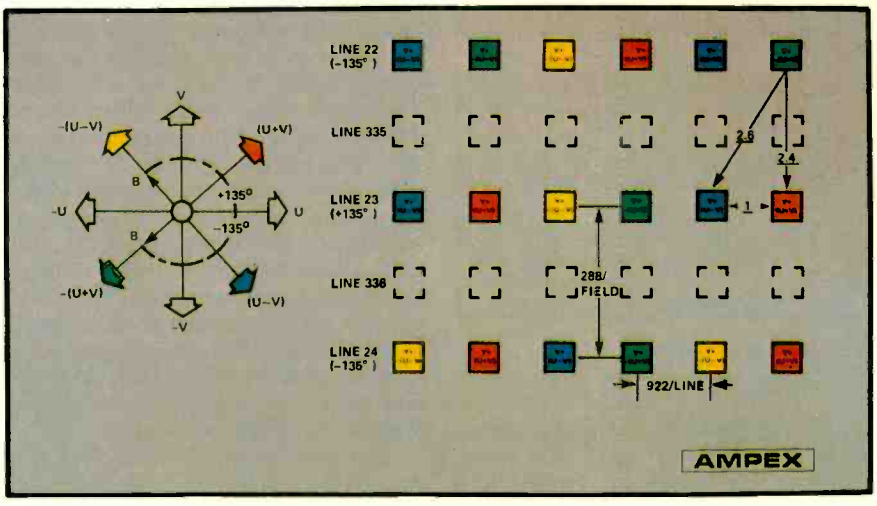

Figure 2. Alignment of samples, 625-line, PAL, 4 x f_{sc}.

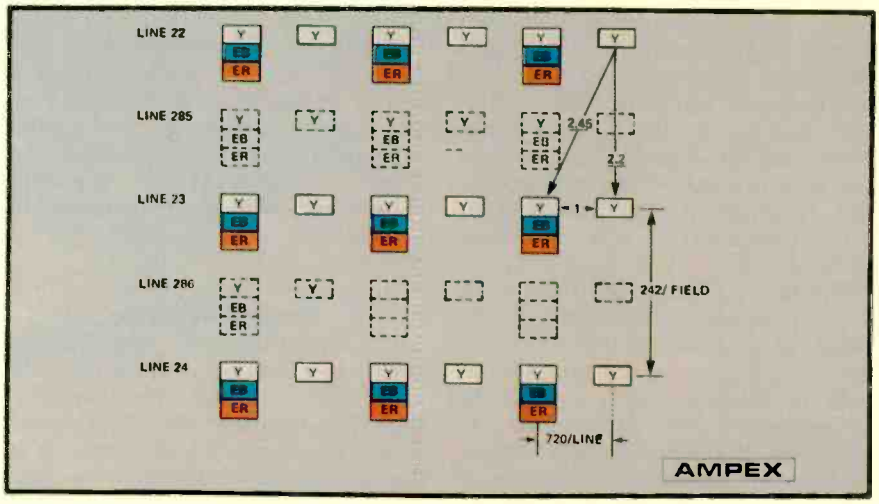

Figure 3. Alignment of samples, 525-line, 13.5MHz component system.

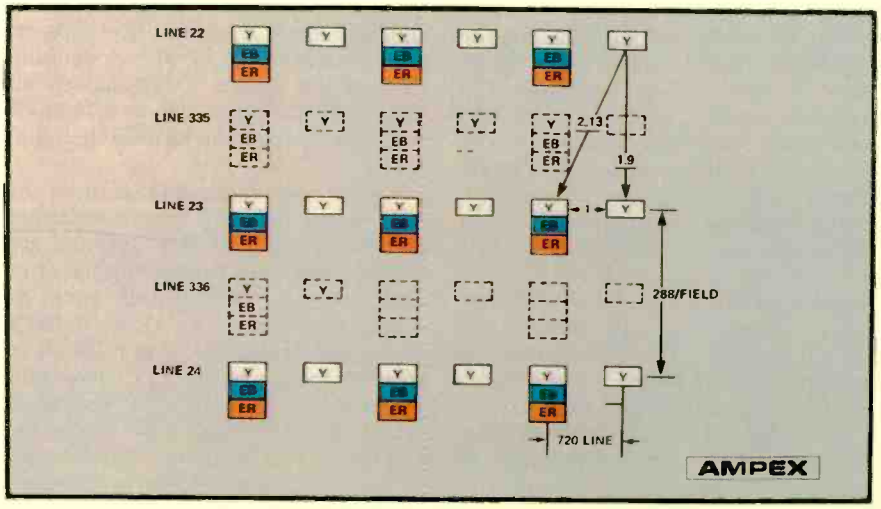

Figure 4. Alignment of samples, 625-line, 13.5MHz component system.

TELEVISION SYSTEM

	COMPOSITE NTSC	COMPOSITE PAL	COMPONENT
	525/30	625/25	525-625
SAMPLE RATES	4 Fsc	4 Fsc	4:2:2 13.5 MHz
SAMPLES/SEC	14.32×10^6	17.72×10^6	27×10^6
DATA RATE	129 Mb/s	160 Mb/s	216 Mb/s
SAMPLES/ACTIVE LINE (i)	764	945	720 + 360 +360 = 1440
USER DATA RATE	108 Mb/s	133 Mb/s	180 Mb/s
CHANNEL DATA RATE (ii) (ONE CHANNEL)	121 Mb/s	149 Mb/s	202 Mb/s

(i) ESTIMATED, DOES NOT INCLUDE SERIAL SYNCHRONIZING INFORMATION
(ii) 12% OVERHEAD ONLY ASSUMED

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Table I. Comparison of composite vs. component recording systems.

relatively small expense of adding one TV line memory in the record electronics and a one TV line memory in the reproduce electronics.

Table I shows the user bit rates and the record channel rates derived from three TV systems used for comparison. If a maximum head-to-tape speed that is practical is considered to be in the region of 50m/s and a linear packing density that may be recorded on tape reliably on an interchange basis be 2000b/mm, then the highest data that can be recorded on a single track is approximately 100Mb/s. It can be seen, therefore, for the data rates in question that it is unlikely the data can be recorded on a single channel, and multiple channels in parallel need to be used. At present, the most desirable number of channels range between two for composite and two-to-four for component video data.

A block diagram of a typical signal processing system that could be used in a digital VTR is shown in Figure 5. For simplicity, the video A/D and D/A converters are not shown. Inputs and outputs are referred to as user *digital data* in a format yet to be determined.

The record electronics consist of the 1-line delay network necessary to expand the data of the active picture and eliminate most of the horizontal blanking interval. The data is then reorganized, or *scrambled*, converted to the channel code, distributed over the number of channels of the system and fed to the record drivers and the record heads mounted on the rotary scanner. The reason for scrambling the data before recording will become apparent in the description of the error correction and concealment schemes that form part of the reproduce process.

In terms of efficiency, the shortest possible wavelength should be recorded on tape irrespective of the channel data rates. This implies a constant packing density measured in Mb/cm² of tape. Tape consumption is now proportional to the channel data rates, which in turn are proportional to the user data rates. It can be seen from Table I, using the component standard as a reference, that tape consumption is only 76% for PAL and 62% for NTSC. This is clearly a significant advantage of composite recording compared to component recording.

The reproduce electronics consist of preamplifiers located in the scanner or adjacent to the scanner on the transport. Some form of RF signal equalization may be required before the error correction scheme. The error rate of the system is usually measured after correction and represents the errors that the system was unable to correct. It is an important characteristic of the scheme chosen that these errors be identified in some manner for the error concealment system, which must replace the *samples in error* with other information from surrounding known *good samples* in the TV picture.

After error correction, the data can be converted from the *channel code* to user *data*, which will include compressing the active horizontal line

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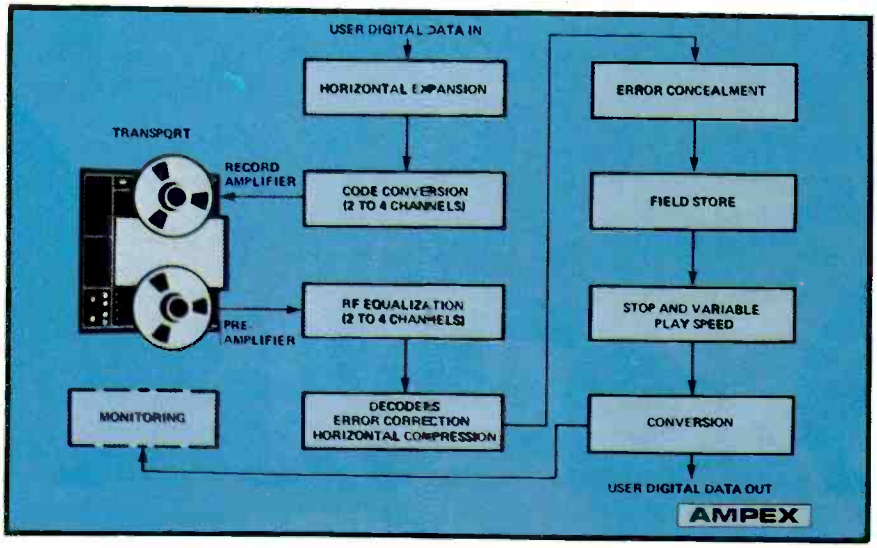

Figure 5. Digital VTR, signal processing.

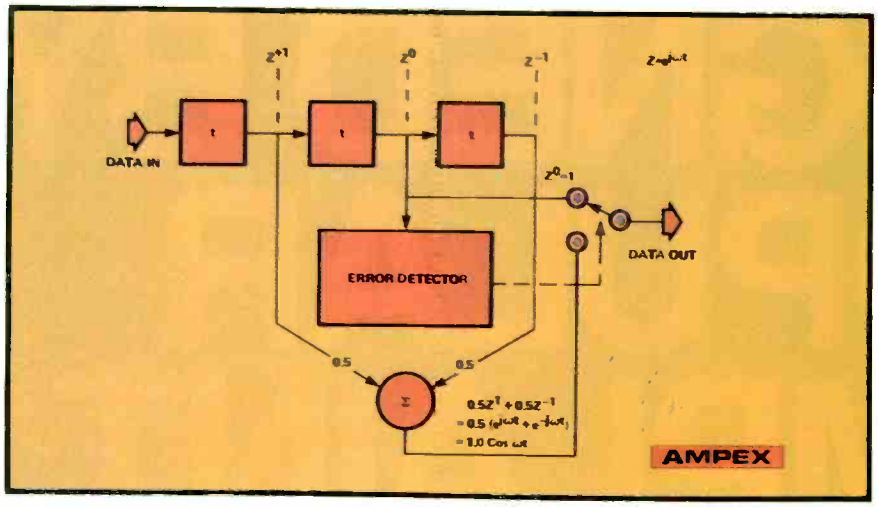

Figure 6. Error concealment, averaging adjacent samples.

and restoring the horizontal blanking interval.

The reproduce process described, and the performance obtained, is independent of the TV system used. However, the following operations and their performance are *very* dependent on the TV system.

Error concealment

Error *concealment* is a process that makes use of the redundancy that occurs in a TV picture by nature of its 3-dimensional structure. When an individual sample is destroyed, it may be reconstituted spatially by averaging adjacent samples in the horizontal direction, the vertical direction, or temporally, i.e., the sample on the preceding picture averaged with the sample on the following picture.

Horizontal samples become available by means of 1-sample delays, *vertical samples* by means of 1-TV line delays and *temporal samples* by means of TV field delays. It is unlikely that 1-field delays, each requiring 400kbytes of memory, would be included in the reproduce electronics system for the sole purpose of correcting errors whose maximum rate are in the order of one-in-10^{-4}. If one single field of delay were used, a movement interpolator must be included to ensure the sample on the field that is stored is identical to the sample that was lost. One error in 10^{-4} corresponds to 45 errors/field; one error in 10^{-6} corresponds to 0.45 error/field. Consequently, it seems inefficient to dedicate 400kbytes of memory for the correction of such few errors.

Within a TV field, at 13.5MHz sampling rate for the luminance signal, there are 2.2 times as many horizontal samples *spatially* as there are *vertical* samples from the adjacent TV lines. Greater accuracy of concealment can be obtained using *horizontal* samples for the luminance in place of *vertical* samples. Furthermore, higher vertical frequency samples already contain alias components caused by the scanning process that could only be eliminated by optical filtering of the image presented to the camera pickup device. At the moment, this is considered impractical.

The most powerful application of error concealment is the reconstruction of the area of a TV picture that has been damaged due to a tape dropout. A data formatting scheme and error concealment system that is optimized to eliminate the subjective distortions on the TV picture caused by tape dropouts will adequately conceal random single-bit errors. The maximum data rate that may be recorded on a single serial channel of a digital wideband recorder lies in the region of 100Mb/s. To record the data rates of the digital composite or digital component signals will require multiple channels; numbers between two and four seem appropriate at this time. If a two-channel system is used, then the data may be scrambled such that adjacent samples both horizontally and vertically are placed on adjacent channels, which may then be spatially separated on the tape. When the information from one channel is destroyed by a dropout, then the other channel is used to reconstitute the lost data from the bad channel.

Averaging adjacent samples in equal proportions to reconstitute a known bad sample results in the correct positional value of the information and may be accomplished by the system shown in block form in Figure 6. Continuous data is fed to a set of *delays* (delay = t). The normal output, occurring at Z^0, becomes the data output when the switch is in the upper position.

Outputs at the time Z^{+1} and time Z^{-1} are fed to the inputs of a summing network. If the delay (t) were equal to one sample, then the inputs to the summing network are adjacent *horizontal* samples. If the delay (t) were equal to one TV line, then the samples become adjacent *vertical* samples. The delay (t) may be equal to a TV field if adjacent *temporal* samples were required.

Assuming information is available in the data to instruct the error detector to operate the switch when a sample is known to be in error, then the output of the summing network will replace the faulty sample (switch in lower position).

Output of the summing network is:

$$\begin{aligned} Z &= e^{j\omega t} \\ &= 0.5Z^{1} + 0.5Z^{-1} \\ &= 0.5\,(e^{j\omega t} + e^{-j\omega t}) \\ &= 1.0\ \text{Cos}\ \omega t. \end{aligned}$$

For t = (1/13.5) MHz, or 74ns, the graph of the transfer function is shown in Figure 7. The curve is a cosine with an origin at zero frequency, a null at one-quarter the sam-

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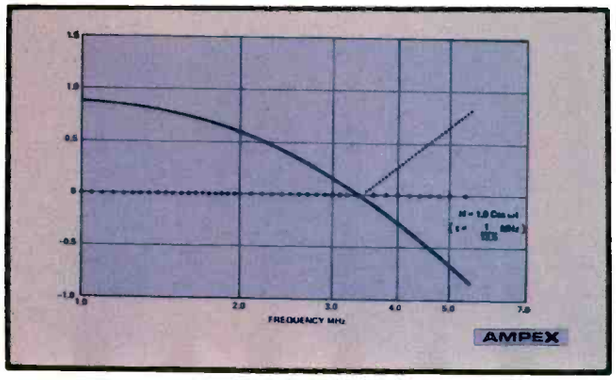

Figure 7. Error concealment, averaging adjacent horizontal component luminance samples.

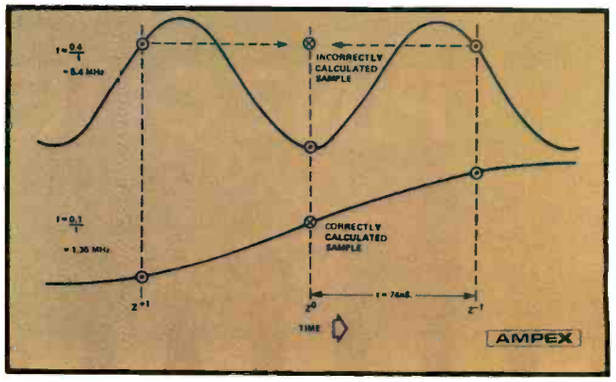

Figure 8. Error concealment, averaging adjacent samples.

pling frequency (in this case 3.375MHz), and a negative value above one-quarter sampling frequency which produces an error in the output.

This effect is shown in time in Figure 8 where t = 74ns. For a frequency of f = 0.1/t or 1.35MHz, averaged horizontal samples produce a resultant shown at time Z^0 which is reasonably accurate. For a frequency of f = 0.4/t or 5.4MHz, the averaged sample is inaccurate and would produce a visual error on critical material.

Error concealment—NTSC

The NTSC signal, sampled at four times the subcarrier frequency, will have a sampling structure in one field of the TV picture as shown in Figure 1. The sampling phase as depicted is on the I- and Q-axes, but it may just as well be on the (R – Y)-, (B – Y)-axes. Each sample represents the arithmetic sum of the luminance value and the color difference value at that sampling instant. If the samples were alternated between channels A and B, the two channels of a digital video recorder system, and Channel A on a section of Line 23 were in dropout, requiring reconstruction of the signal from horizontal samples on Channel B, the transfer function is:

$$H = 1 \cos \omega t,$$
$$\text{Where } t = 1/4f_{sc} = 70\text{ns}$$

The curve of the transfer function is a cosine with an origin at zero frequency, a null at the subcarrier frequency and a negative value above subcarrier frequency. (See Figure 9.) It can be seen from the graph for low frequency values of luminance that the

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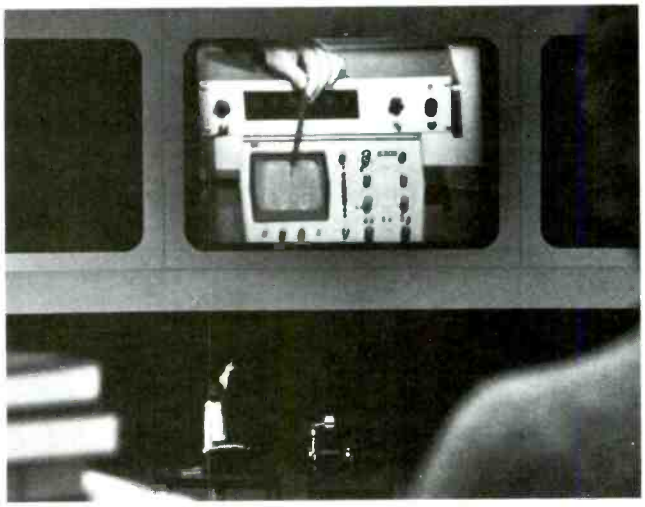

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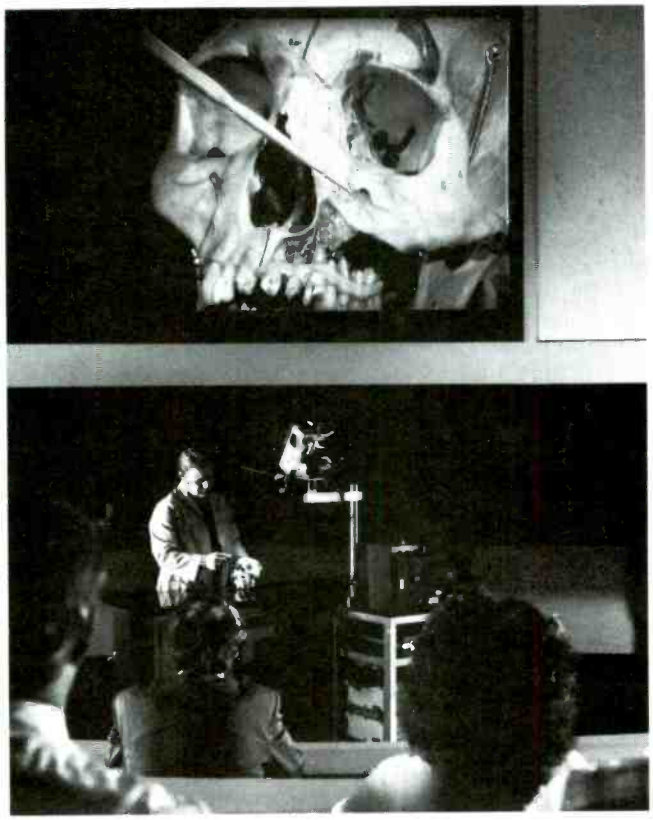

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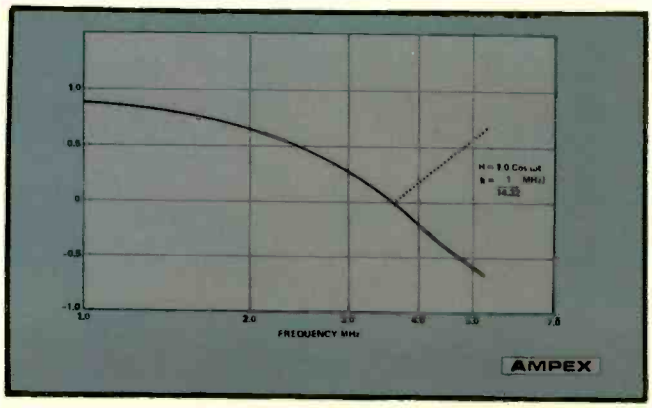

Figure 9. Error concealment, averaging adjacent horizontal composite NTSC samples.

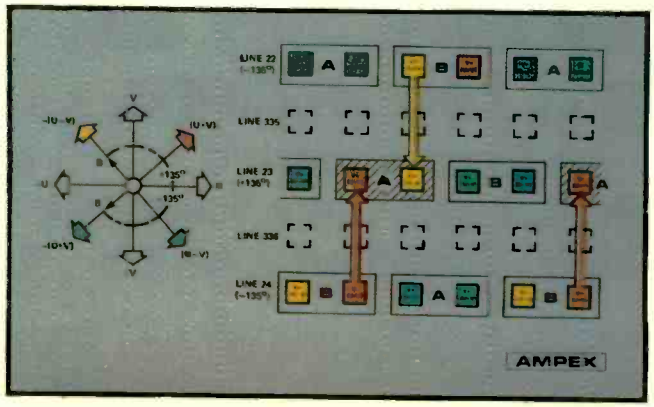

Figure 10. Error concealment, 625-line, PAL, 4 x f_{sc}.

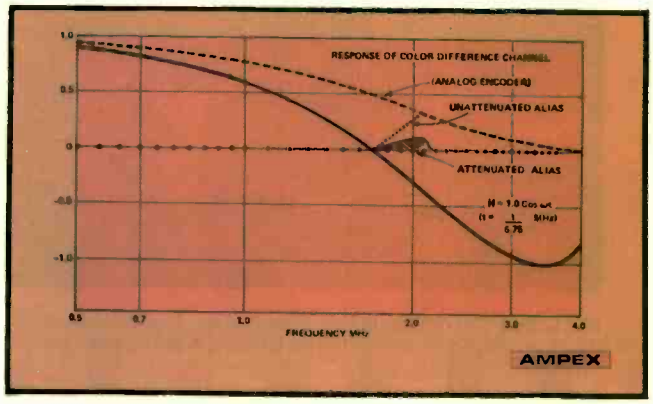

Figure 11. Error concealment, averaging adjacent horizontal samples.

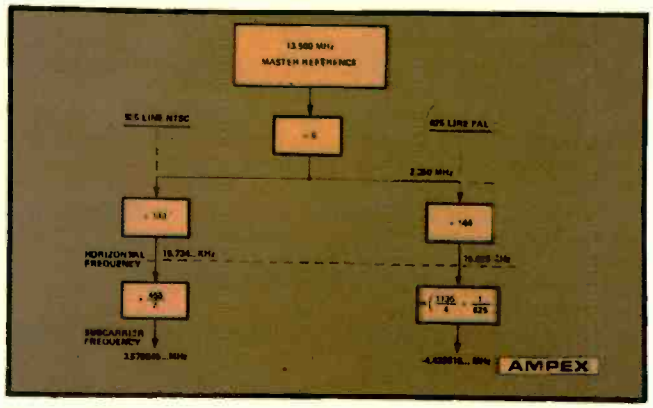

Figure 12. Derivation of scanning frequencies from 13.5MHz.

compensation is adequate; however, the chroma information is eliminated and information above the chroma information has the incorrect value and will, therefore, result in a distortion. By taking the values of the average samples from the line above and the line below Lines 22 and 24, applying them to a digital high-pass filter to remove the luminance component and subtracting the result from the values of the averaged horizontal samples, the chroma component may be reconstituted. This process reduces the chroma vertical resolution, and a means must be provided to ensure that the samples above and below after high-pass filtering are indeed chrominance information; otherwise the vertical spurious signal that is generated may appear subjectively worse than the original dropout. A method of adaptive comb filtering that could be used for NTSC has been described[1] and, as the author concludes, should be adequate for all but the most critical TV material.

Error concealment—PAL

If the PAL signal were sampled on the (U + V)-axes, the sampling structure of one field would appear as shown in Figure 2. An advantage of sampling at 45° to the U- and V-axes is that the sampling phase is the same as the burst phase. Each channel is then organized to have samples in pairs with the same interleaving as described before for NTSC. Referring to Figure 10, it can be seen that if Channel A on Line 23 were in dropout, the first sample lost may be replaced by the sample immediately below it on Line 24, and the second sample may be replaced by the sample immediately above it on Line 22. The system suffers a loss of vertical resolution, but does have the advantage that arithmetic computation is not required to generate the replaced sample.

A luminance horizontal transition in the picture will produce a $2f_{sc}$ component on Line 23, occurring at 8.8MHz; this may be satisfactorily attenuated by the D/A low-pass filter. The integrating action of the low-pass filter produces the correct vertical spatial resolution for the two samples.

Error concealment—component system

The three component signals are analogous to monochrome TV signals. The luminance signal with 13.5MHz sampling rate has samples spaced every 74ns apart. The chrominance signal sampled at 6.75MHz has samples spaced every 148ns apart. For a multichannel recorder, the data would be scrambled such that adjacent samples appear on alternate channels both horizontally and vertically.

For horizontal-only interpolation of the luminance signal, the transfer characteristic would be a cosine response as described in the example of Figure 7 with a null at 3.375MHz. The result would be adequate for the low-frequency luminance information; but, again because of the negative value above 3.375MHz, an undesirable spurious signal would be produced. Higher order digital filters could be used to move the null further up in the frequency spectrum and provide a more uniform response in the passband; it should be realized, however, that the shape of the curve always remains symmetrical. Consequently, moving the zero crossover point up will increase the amplitude of the alias in the negative direction.

Using horizontal-only interpolation for the chrominance, the cosine-shaped curve has a null at 1.69MHz, for a 6.75MHz original sampling rate, and the negative values of the cosine are above that frequency. If the chrominance bandpass of the final analog transmission system is considered, NTSC, PAL or SECAM, the

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alias is outside the chrominance passband and is considerably attenuated, as shown in Figure 11. Consequently, the color difference information will not be degraded as a result of the dropout when observed through the window of the final analog transmission format.

If the samples surrounding the error have considerably lower vertical resolution than horizontal resolution, by at least a factor of 2-to-1, then vertical interpolation for concealment will produce adequate correction without loss of horizontal resolution. The decision as to the selection of data for concealment for each of the three signals depends upon the picture content of the signals. Under extreme conditions, a region of indecision will result, and an imperfect result may occur in one of the signals requiring correction.

This capability of selection is not available with the composite digital signals. Only specific samples, either horizontally or with reduced spatial resolution vertically, or some computed value of horizontal and vertical samples, can produce the correct, or near correct, result. The composite signal is picture dependent, particularly in the presence of chrominance information.

Variable speed picture composite system

The production of a broadcast-quality composite signal from a videotape recorder at speeds varying from stop through slow motion to, say, two times normal speed, requires a mechanism that guarantees that the head scans the track or tracks to provide one continuous active field of video information in real time. In a helical recorder, this requires a scan tracking system. To identify the field recovered from tape, it will be necessary to code the field information during recording.

If we assume the tape is stationary and the heads are scanning across a track or tracks that correspond to the first field of the first frame (Lines 1 through 263) of a NTSC TV signal (See Figure 1), then it will be necessary to compute the other three fields of the NTSC 4-field sequence to generate the complete NTSC picture in real time. It can be seen that if the signal contained no chrominance information, then the samples of Line 285 on Field 2 may be computed by averaging the individual samples of Lines 22 and 23.

Line 286 may be computed by averaging adjacent samples from Lines 23 and 24; the process continuing in real time down the field until Field 2 is completely reconstituted. Field 1 would maintain its full vertical resolution as it is read off the tape in real time. Field 2, however, would have a cosine response with a null occurring at half the number of active lines of the 263-line TV field. A negative value, or a new alias, would commence at this null and continue to the vertical resolution of the full TV field. Unfortunately, the dissimilar resolutions between the two fields would show up as a disturbing 30Hz flicker on the reproduced picture for higher frequency vertical information and would not be considered acceptable in a production environment.

A method of overcoming this disturbance has been developed by subjecting both fields to similar processing[2]. During stop motion and slow motion with Field 1 coming from the tape, outgoing Field 1 is computed by a coefficient of 0.75 (the actual line in real time plus 0.25 of the line below). Thus, Line 22 on the video output would be made upon a sample-by-sample basis of 0.75 of Line 22 plus 0.25 of Line 23. For Field 2, Line 285 would be computed from 0.75 of Line 23 and 0.25 of Line 22. It is seen that both fields have the same arithmetic coefficient. The lines of both fields are displaced correctly, and the total picture on the output effectively moves up by one-quarter of a line of a field. The sampling points move down with respect to the original scanning. The process causes a slight reduction of overall vertical resolution but, as the two fields have identical resolution, the 30Hz flicker component is eliminated.

For the PAL system, it will be required to construct seven fields of the PAL 8-field sequence from the one field that is being scanned by the rotary heads. For stop-motion operation, the field recovered from tape will be synchronous with TV field rate. For slow-motion operation or variable speed operation, it may be necessary to include a field store in the reproduce electronics to guarantee that at least one field of signal is available at all times for the playback processing electronics. The processing electronics will naturally introduce a degradation in quality; therefore, the field that is recovered from tape should be subjected to similar processing so as not to produce a 15Hz flicker on NTSC or 6.25Hz flicker on PAL.

One of the simplest methods to *comprehend*, but not necessarily to *implement*, is to decode the signal from its composite form to the three components and have these component values available at every sampling instant of the 4 and 8 fields. The instantaneous components may then be reencoded to produce the new composite signal with its correct 4- and 8-field sequence. Such decoding for

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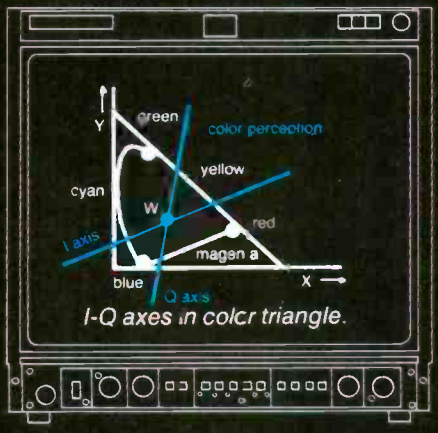

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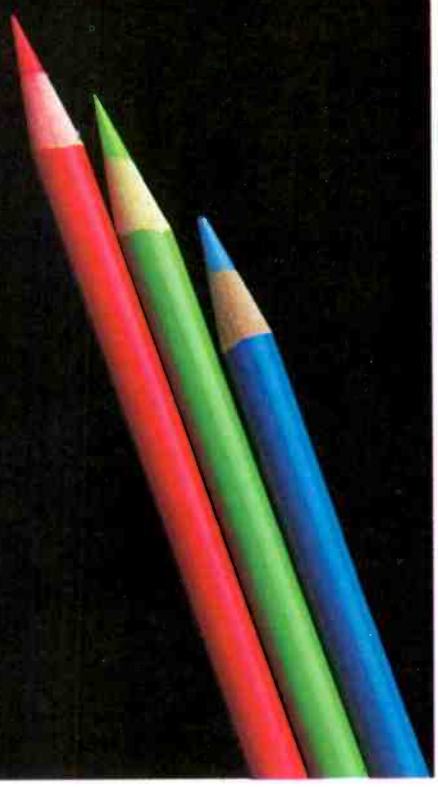

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NTSC has been described by Kaiser[1] and decoding and re-encoding for PAL by Weston[3].

Normally these distortions may be unnoticeable but, at the time when the machine is in slow-motion mode and going to play mode, a decision must be made to switch back to the normal playback processing circuitry. During this transition period, the change of quality will be markedly noticeable on the composite signals. Further processing is necessary to produce the two fields from the single field that is recovered from tape.

As the component signal repeats on a 2-field basis, the processing circuitry for generating the two fields from the one field on tape or in memory is the only processing required to produce a standard signal. As processing in the horizontal direction is not required, there is no degradation of horizontal resolution. As no more than two fields are required, there is no degradation of temporal resolution, apart from the inherent degradation caused by the 2-field repetition rate of picture.

The digital component standard used in this discussion is based on a luminance sampling rate of 13.5MHz, which is a multiple of 2.25MHz, the frequency from which the horizontal scanning frequencies of both the 625-and 525-line TV services can be derived precisely (Figure 12). As this sampling frequency is common to both TV systems, and if both 525- and 625-line systems adopt the same number of active samples per TV line, then the signal processing circuitry of a component VTR, indeed most component digital TV equipment, would be common for existing broadcast TV systems throughout the world.

By using a mechanical design for the VTR scanner in which the ratio of scanner speed to TV field rate is close to the inverse of the ratios of the two field rates, 50Hz and 60Hz, then a common head-to-tape speed will result. A common machine for worldwide digital component systems results in savings of manufacturing and inventory costs to the supplier. In turn, this is reflected in a lower capital cost for the equipment by the user.

Conversion between 525- and 625-line standards, by the user, will produce superior results if only field interpolation is required, for decoding of individual samples is unnecessary.

Conclusion

A digital composite TV signal is the most efficient in terms of tape consumption, for an analog color TV signal is the most efficient in terms of signal bandwidth. A digital component signal, because the data is kept as three separate independent signals, is extremely rugged. There is no interaction of luminance and chrominance, and the picture repeats on a 2-field basis which is identical to the scanning standard of the TV system. Where any form of electronic picture processing is performed, such as in stop-motion, slow-motion, and slightly faster than normal speed, the processing operations are simpler to perform on a component signal and produce superior results. It would appear that, as a production tool, a variable speed VTR operating with a digital component TV signal would provide greater flexibility than the same type of machine operating with a digital composite signal.

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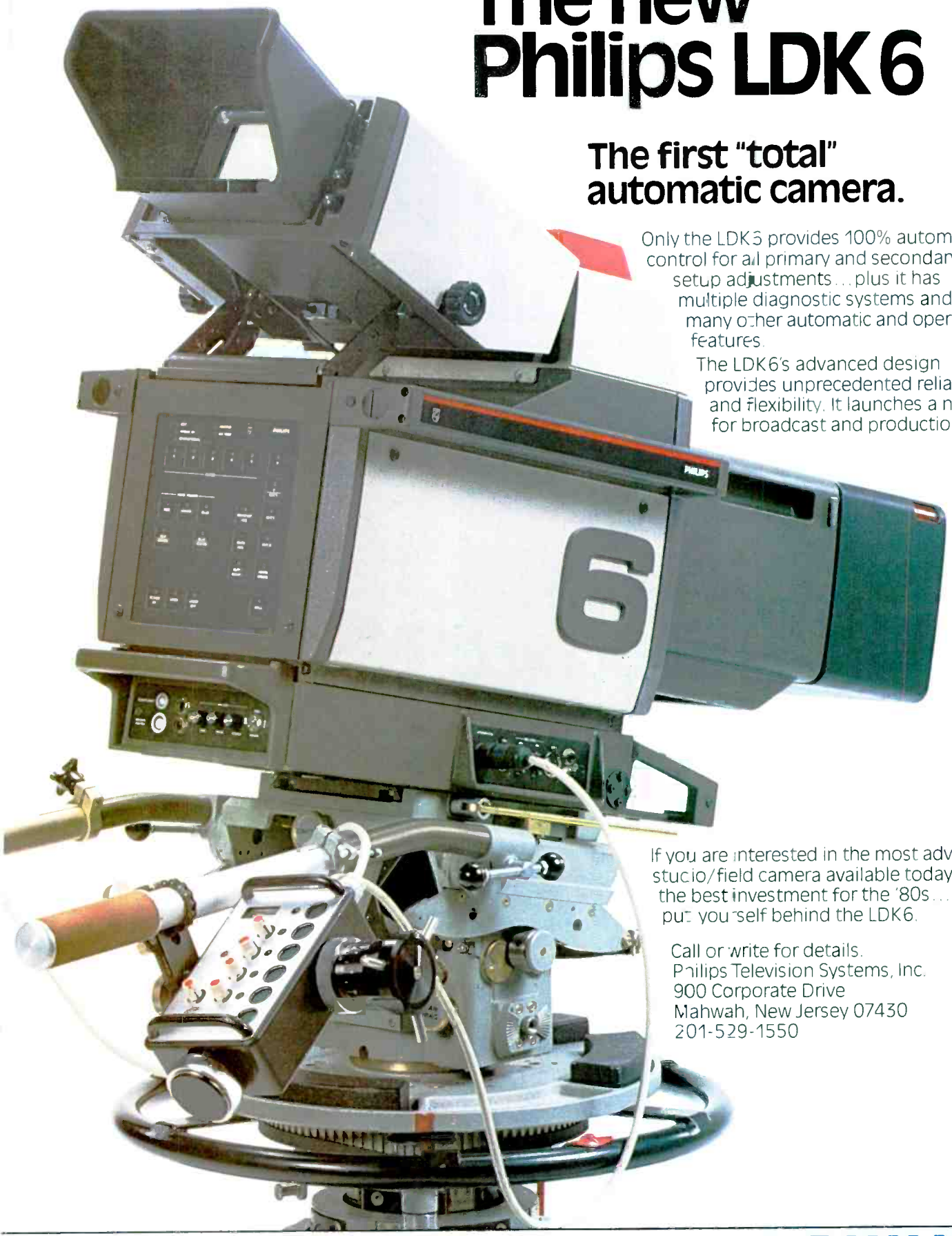

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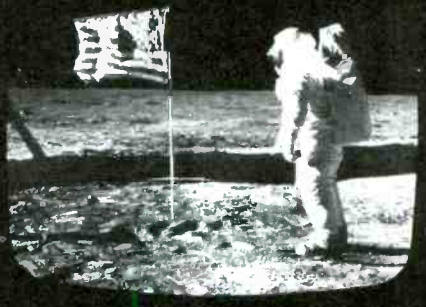

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Electronic videographics: A perspective

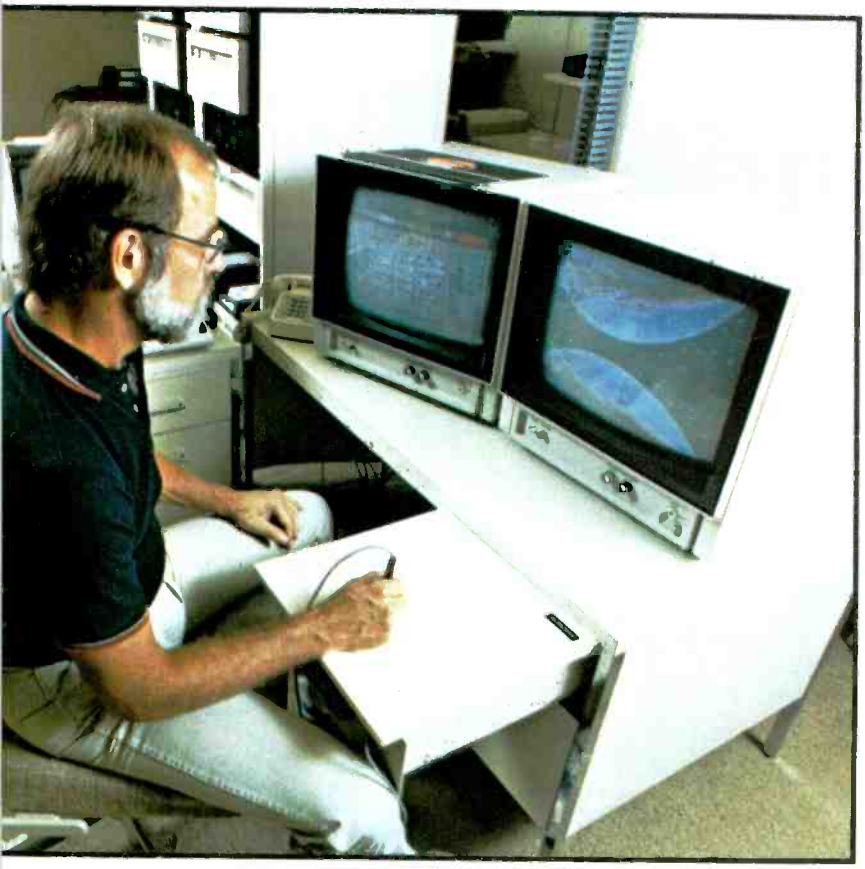
By Blair Benson, TV technology consultant, Norwalk, CT

Until the late 1970s, production of electronic graphics relied heavily upon original artwork created in the conventional manner by artists using the time-proven tools of their trade—the pen, brush and sketch pad. The use of digital electronics for the generation of original material was limited to composition of geometric patterns and alphanumeric figures by digital character generators with a storage capacity of several TV lines. When storage of a TV field or frame was required in post-production assembly and editing of *takes* or *scenes*, analog signals were transferred from camera-original and character-generator signals to a magnetic videodisc. For this purpose, the Ampex HS-100 and HS-200 programmable rigid disc systems were the workhorses of the trade.

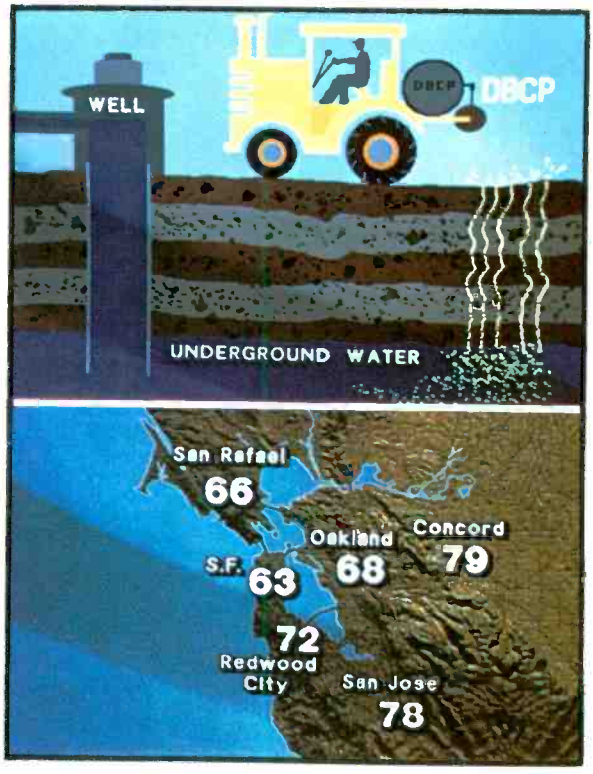
In fact, for every post-production operation and broadcast network sporting event, the availability of a disc system was a *must*, regardless of its inability to withstand the rigors of transportation, variations in temperature and humidity, and the attendant maintenance problems. Of course, the compelling attractions for production and post-production applications were the variable speeds for slow-motion and fast-motion, time-lapse and playback. Thus, when combined with matting and chroma-key special effects equipment, editors were enabled to create many effects, including those involving graphics providing the original artwork had been completed in advance.

Consequently, because of the need for advance preparation, the time restriction imposed in film editing by the necessary pre-production preparation remained, albeit some shortcuts were possible through the use of electronic processing.

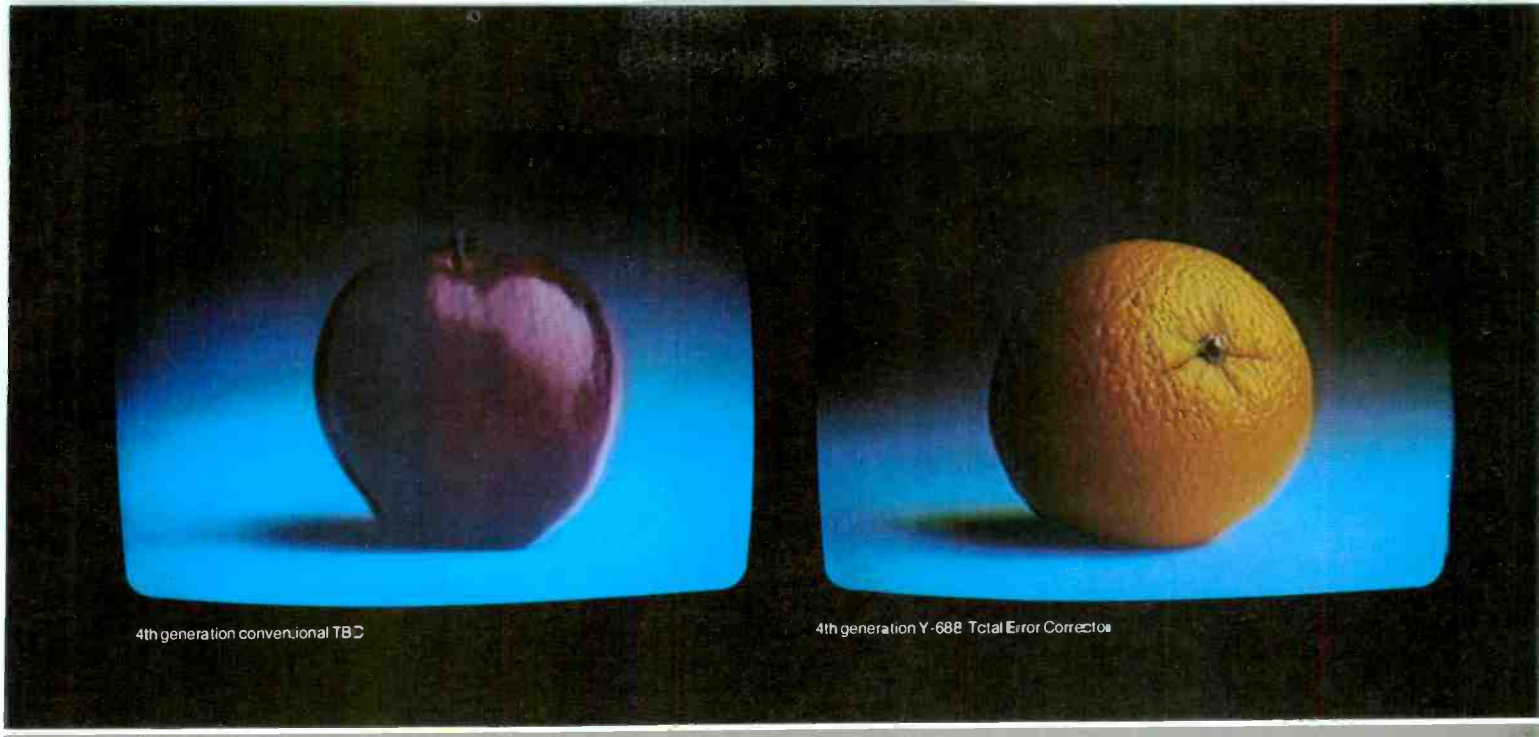
The development of digital, solid-state frame-store equipment in the '70s heralded a radical change in the approach to the use of special effects and graphic arts in broadcasting, as well as in commercial production.



In the KRON-TV 4 newsroom, artist Warren Lamm creates digital videographics on an Aurora system.



The top graphic illustrates infiltration of DBCP into the community water supply. The lower graphic displays local temperatures around the Bay area. The Aurora system is connected with local and national earth stations to provide local viewers with a complete weather picture.



NO COMPARISON

Comparing video from a conventional TBC to video from a Y-688[32] Total Error Corrector is like comparing apples to oranges. A time base corrector, as the name implies, corrects timing errors. The Y-688[32] Total Error Corrector corrects timing errors and virtually all VTR induced errors.

The major cause of video quality loss in 3/4 VTR's is inherent in the color under process. This process separates the input color video signal into its luma and chroma components, converts the chroma frequency for recording and playback and recombines the luma and chroma for color video output. The worst part is that this quality loss is cumulative, in that it is compounded with each pass through a VTR or conventional TBC.

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The improved quality of Y-688[32] TEC video can be seen in first generation playback. It becomes more obvious in successive generations. It is particularly noticeable in third and fourth generations because conventional TBC video has gotten worse with each pass, while fourth generation Y-683[32] TEC video approximates original quality.

The Y-688[32] TEC is simply the most powerful tool available for extending multi-generation quality from color under VTR's.

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Y-688[32]
Total Error Corrector

Evolution of digital video effects

Digital video techniques found their first use in broadcasting for frame storage in *Digital Noise Reducers* (DNRs), standards converters and frame synchronizers. The possibility of using the frame store for video effects was realized by CBS' development of its Action Track special effects gimmickry, using techniques employed in its DNR. The Action Track was first used for the Super Bowl pro football game and the Masters Golf Tournament in 1978 to provide a still-frame trace of a football and a golf-ball trajectory. (See **BE,** April 1979, pp. 54-55.)

This was followed by a broader application of frame stores for modification of picture size and shape, and movement of matted picture material to different positions at varying rates, in a TV raster. The first of these devices was introduced by Vital Industries in 1977. Shortly thereafter, MCI/Quantel extended the capability of its standards converter to provide, first, a limited degree of picture size change, and, subsequently, a complete gamut of picture-manipulation effects. Concurrently, Quantel, using its basic standards converter design, and NEC began marketing similar equipment in the United States.

Because of the high cost (approximately $200,000), the first new digital effects devices were acquired only by broadcasters, such as networks and their flagship stations in the nation's major population centers where the cost of the facility per viewer was low enough to warrant the expense. On the other hand, post-production companies were normally not prepared to commit for high capital expenditures. However, by virtue of efficient around-the-clock scheduling of the new digital facilities, they were able to realize an early return on the large investment entailed.

Video effects supplant film opticals

The digital special effects generation and processing equipment provided a variety of picture manipula-

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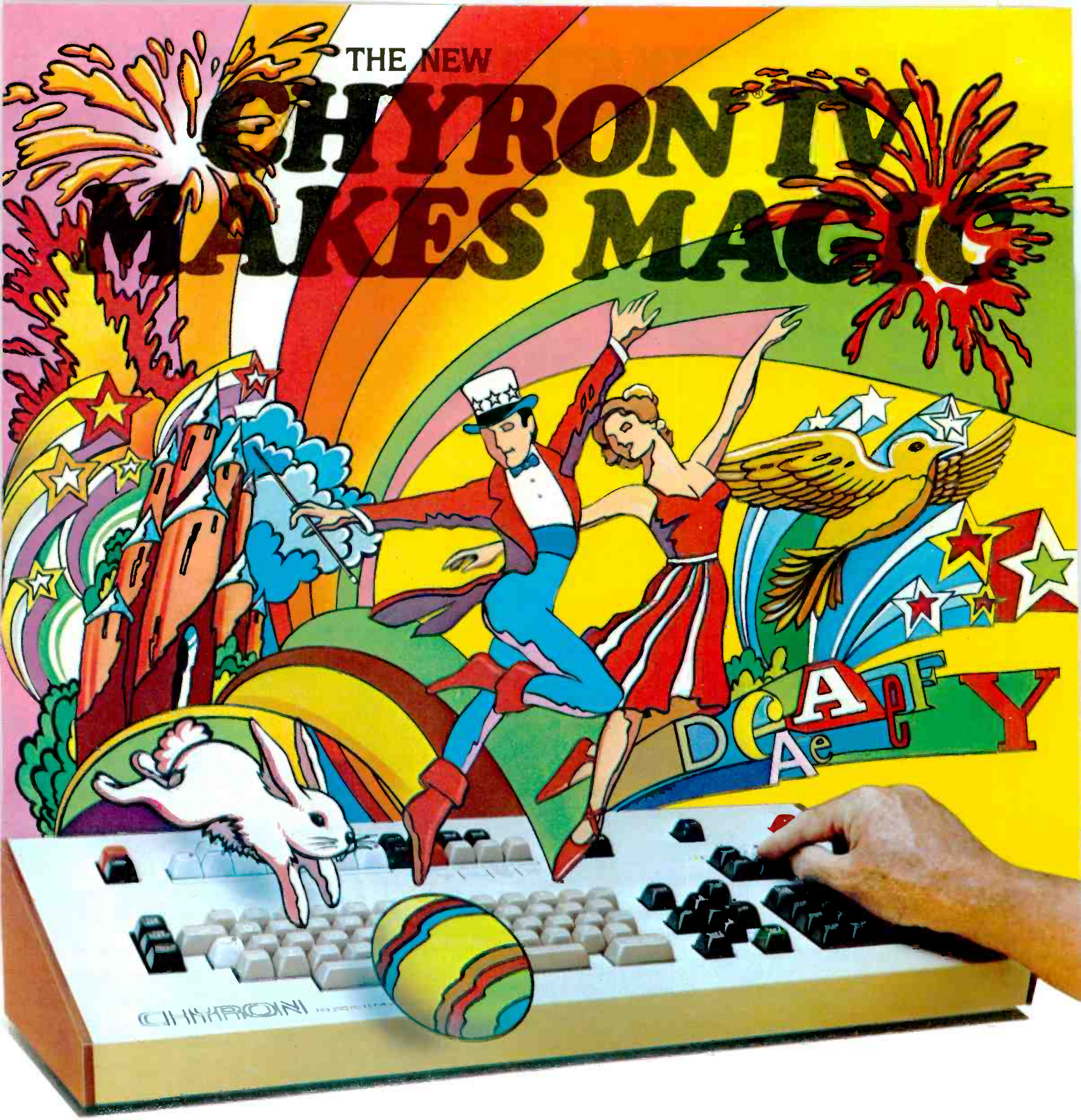

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tions that heretofore had been possible only by traditional film animation techniques. The availability of these new electronic facilities to the electronic editor drastically shortened the time, compared to film optics with the attendant film processing, from the creative conception of a video effect to the completion in the electronic medium on videotape. This has resulted in the emergence of videographics as the dominant creative medium for special effects in TV productions.

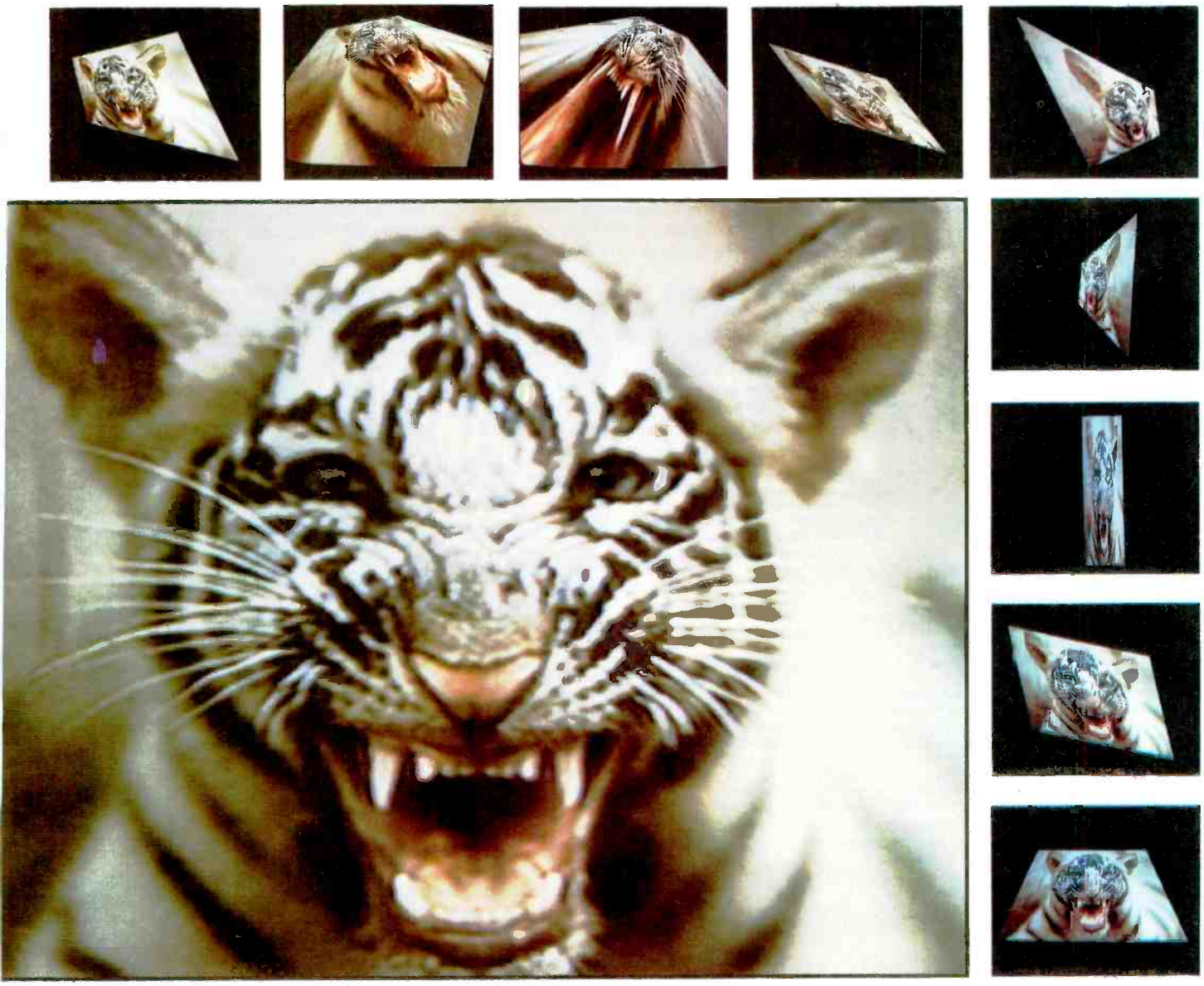
It is of interest to note that in theatrical productions video effects are being used to an increasing degree, although at a slower rate than for television. Evidence of this is in recent features such as Disney's *TRON*, which, although not a box-office triumph, serves as an extensive catalog of the range of computer-processed and generated graphics and effects available to the creative director.

Nevertheless, even though there has been relatively no limitation on the range of graphics and x-y-z manipulation possible in video, the medium was not freed completely from its dependence upon artists' drawings as an important input to the TV system until the emergence of the electronic equivalent of the artists' tools, and an interface with the already available digital effects systems. Subsequently, with the development of video paint systems in the late 1970s, electronic graphics progressed from an adjunct or supplementary tool to motion picture animation production to a new art form that can completely supplant the time-consuming sketch preparation by *in-betweeners*, and the inking and painting of *cells*, followed by complicated film shooting and optical special effects production.

Thus, by means of the electronic equivalent of the artist's sketch pad and brush, the creative person is divorced from any requirements for manipulation of electronic controls and the accompanying need for interpretation relative to artistic effects. Furthermore, the system flexibility can be enhanced by means of video input for integration of artwork or live material from a camera, and selected still frames from videotape.

Videographics development

Experimental computerized video-



The Ampex ADO (Ampex Digital Optics) system uses advanced digital techniques and computer graphic principles to achieve true image perspective in 3-D. The rotating knob on the joystick controls the depth of perspective, transforming a square image into a parallelogram. Horizontal and vertical deflection of the joystick alters the horizontal and vertical aspect ratios of the video picture, respectively. All size, position and expansion controls are at the operator's fingertips.

Live-action animation is illustrated by the Via Video System One. This system consists of an electronic easel and pen, a 13-inch-high resolution monitor, dual 8-inch floppy disc drives, high definition camera input source and master control keyboard – all for approximately $35,000. The heart of this system is its S-100 color graphic encoder board that minimizes RF noise, color crawl and chroma-smearing, while reducing interference between chrominance and luminance signals.

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The HM-100 VCR captures the image intact with a very respectable luminance/chrominance S/N ratio of better than 47/48 dB. Audio is better than 50 dB. This flexible, lightweight recorder (9.0 lbs) can be carried on a shoulder strap or mounted on-board for use as a one-piece system.

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graphics systems were demonstrated by a number of research organizations, and in fact, were used in the mid-70s for a number of non-broadcast applications. However, much of the pioneer work for application to TV broadcasting was conducted by the New York Institute of Technology on Long Island, with the encouragement and cooperation of CBS. Their developments were further refined by Ampex with guidance as to users' requirements by CBS, which ultimately resulted in the Ampex Digital Optics (ADO) system.

This was followed by a proliferation of graphic arts animation systems to the extent that their ever-increasing use by the networks for sports and news pressed stations to follow suit on their local news originations and locally produced commercials. Surprisingly, the high cost of the digital equipment proved to be no deterrent to its use by individual stations because of the salability of the facilities to local spot commercial producers. The financial burden on the station was further reduced by the reduction in the cost of frame stores which, in turn, was reflected in the system cost.

Thus, a full complement of digital *black boxes* has become a part of the normal inventory of equipment for the

Bosch-Fernseh graphics system

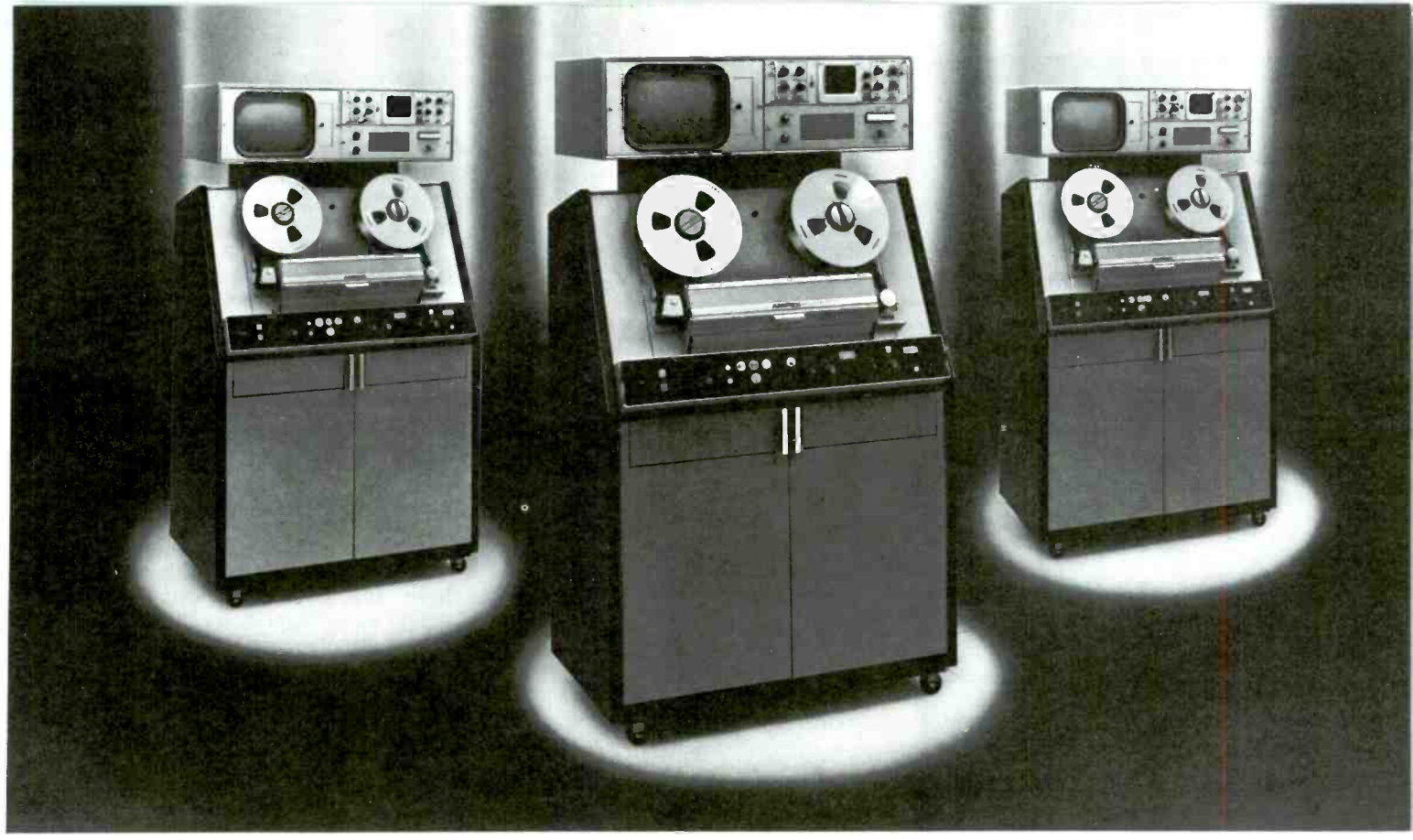
At SMPTE-'82/New York, Bosch-Fernseh demonstrated its new FPS-1000 digital art/graphics system, a low cost system that can be used as a stand-alone graphics station or be connected to an existing character generator.

It includes a special-purpose color graphics computer and a 10Mbyte disc drive with a removable cartridge, and will accept any standard electronic tablet/stylus, including the Graphics Compose digitizer tablet for the Bosch Compositor I character generator.

The artist has access to:

- a master palette of 65,000 colors, of which any 16 can be displayed;
- five brush sizes and styles;
- coloring by manual painting or automatic filling; and
- automatic graphics routines, including dots, lines, circles, diamonds and rectangles.

The system's operating modes are displayed as a menu on a monitor. Up to 64 full frames of video can be stored on each of the system's disc cartridges. Transferring or recalling pictures to and from the disc requires a simple stylus depression. Screen resolution of the system is 640x480.



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networks, local stations and production companies.

Video paint systems

One of the several companies experimenting with the use of computer-generated graphics for industrial and educational applications not directly related to broadcasting, the Xerox Research Center in Palo Alto, CA, was called upon to provide graphics for NASA's use in press briefings and coverage of space exploration.

The Xerox SuperPaint videographics system, designed and built in 1977 under the direction of Dr. Richard Shoup, was first used on network and local television during the Pioneer Venus and Saturn Fly-bys in 1978 to display in animation the onboard scientific experiments and findings. The inputs were from computer-generated graphics and alphanumerics, and artwork scanned by a color TV camera.

As a result of the success of the NASA project, Shoup and several colleagues formed their own company, Aurora Imaging Systems, in 1980, to apply the new technology to the TV field. Aurora's first Digital Videographics System was installed at KRON-TV and used with great success on local TV news shows and program originations.

The drawing, editing and all commands in the Aurora system are inputed to the system by lightly pressing a stylus on an artist's tablet, or *canvas*. The artist's drawing efforts from manipulation of the stylus appear on a video monitor in front of the artist. An adjacent monitor provides a selection of colors, brush sizes and shapes, and editing functions for selection by the artist.

The artwork is stored on a digital videodisc where it can be recalled for display of selected still frames or animation sequences. Area coloring, picture manipulation and zoom, and other ancillory functions can be selected and controlled by the artist. The zoom can be used for operation on fine detail, thus providing a high precision of line structure. A variety of lettering fonts with drop shadow and proportional spacing are available for editing and overlay with other graphic material.

The video paint system introduced by Aurora was followed by systems based upon the same design concepts and operating features. The first of these were the Quantel/Micro Associates DFA-7000 and the Ampex Video Art (AVA), followed by several other companies, also using the artist's tablet as the creative format for the origination of digital videographics. All of the systems, in addition to the *paint pad* or artist's tablet, use microprocessors and computers to transform the artist's conceptions from analog visual information to digital video signals. By the use of a *menu* display on a companion monitor to the graphics presentation or on the same monitor, the artist, with his stylus, can select the mode of operation. This can include many such sophisticated details as the size and shape of brushes, the texture of paint or water color, and the generation of geometric patterns of a wide variety stored in the computer program.

The development and application of digital video processing and computer technology in the fields of special effects and creation of graphics has resulted in the means for bypassing or eliminating the traditional motion picture film optical procedures. Consequently, the time necessary for production of graphics in broadcasting, as well as for theatrical films, can be reduced drastically. And of equal importance, the inherent ease in which the video images can be created, modified and edited has provided the artistic talent with an unparalleled freedom from the restrictions of conventional animation and graphics arts generation.

Videographics/video effects

Since 1978 there has been a rapid proliferation of electronic videographic systems specifically designed for TV usage. In our February issue last year, we reported on the major systems of interest to broadcasters and covered in depth the ABC specialized system for which Dubner won an Emmy award.

This year we have discussed some of the changing requirements of broadcasters in the areas of videographics and video effects, both in features and in equipment. But, we have not reviewed all the current equipment available. If you would like to receive literature on specific equipment, you may do so by using the Reader Service Card and data in our September 1982 *Buyers' Guide*. In more restricted categories, you may use Table I (page 50) and the Reader Service Card in the current issue.

Model 5104 16 in/4/2/1

Model 5104 24 in/4/2/1

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Max Berry (left), director of Audio Visual Systems Engineering, ABC, New York; and Harvey Dubner, receiving the 1982 Emmy Award for Engineering Development, for the Dubner CBG-2. The CBG-2 has established itself as a prominent character generator/graphic animation system. By incorporating a character generator, a digital painting system and 3-dimensional image creation and rotation software into one system, the CBG-2 enables the creation of complex animation sequences that can be played back, in real time, at 60f/s.

Table I.
Equipment sources

Animation equipment

Animation Video, Div. Of Convergence 335
Aurora Systems 336
Computer Operations 337
Convergence 338
Cromenco 406
Forox 407
Grove Video 339
Interand, Telestrator Div. 340
International Video 341
Kavouras 342
Lyon Lamb Video Animation System 343
MPB Technologies 344
Precision Echo 345
Warren R. Smith 346
Symtec 347
Texscan 348
Texscan/MSI 349
UMC Electronics, Broadcast Products Div. 350
Via Video 351
Zei-Mark 352

Digital video effects

ADDA 353
Ampex 354
All Mobile Video 355
Robert Bosch GmbH 356
Central Dynamics 357
Computer Operations 358
Dubner Computer Systems 359
Fernseh 360
Grass Valley Group 361
Grove Video 362
Industrial Sciences Inc. (ISI) 363
Interand, Telestrator Div. 364
Lang Video Systems 365
MCI/Quantel 366
MPB Technologies 367
NEC America, Broadcast Equip. Div. 368
Texscan/MSI 369
Vital Industries 370

Electronic graphics systems

All Mobile Video 371
Aurora Systems 372
Robert Bosch GmbH 373
British Videotex & Teletext 374
Colorgraphics Weather Systems 375
Comprehensive Video Supply 376
Computer Graphics Lab 409
Computer Operations 377
Dubner Computer Systems 378
Interand Telestrator Div. 379
Kavouras 380
L. Matthew MillerAssociates 381
Logica 382
Lyon Lamb Video Animation System 383
MCI/Quantel 384
MPB Technologies 385
McInnis, Skinner & Associates 386
Quanta 387
Soll 388
Spectra Computer Systems 389
Symtec 390
Texscan/MSI 391
Thomson-CSF 408
Video Associates Labs 392

Weather display systems

Colorgraphics Weather Systems 393
Computer Video Systems 394
Denrad Technical Group 395
Dubner Computer Systems 396
Information Processing Systems Of California 397
Interand Telestrator Div. 398
Kavouras 399
McInnis, Skinner & Associates 400
Satellite Broadcast Network/ Weathermation 401
Sperry Weather Systems 402
Technology Service, Commercial Operations 403
Texas Electronics 404
Weather Services 405

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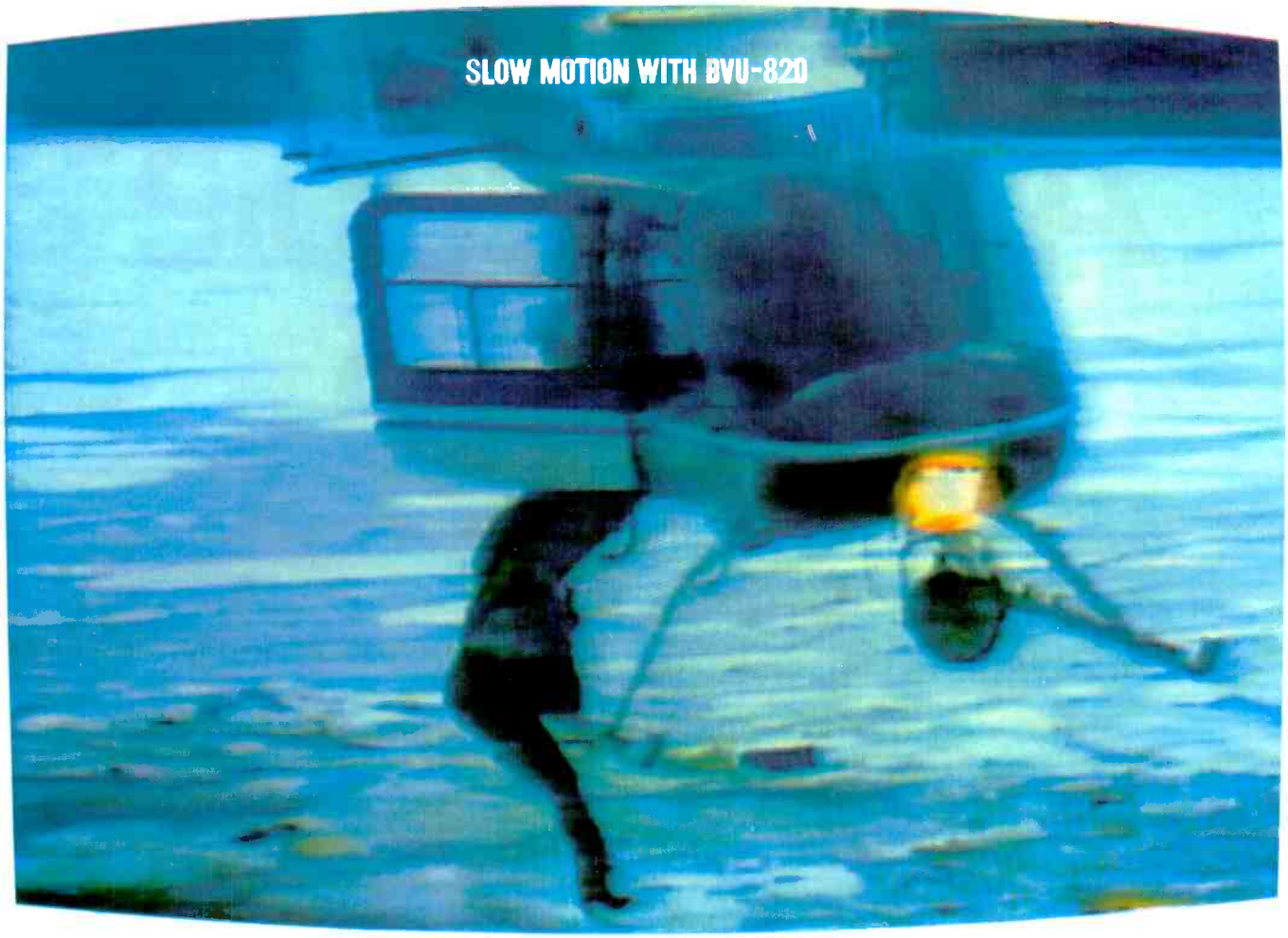

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Now, for the first time ever, you can make instant broadcast-quality edits of those dramatic events which call for freeze frame, slow motion, fast forward or reverse, without transferring to 1".

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Without it, the BVU-820 is capable of up to 10x play speed—fully viewable.

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SONY®
Broadcast

A turntable update

By Bill Rhodes, editorial director; and Carl Bentz, technical editor

The **BE** Septembers *Buyers' Guide* and our product files list a number of companies manufacturing turntables applicable to the broadcast industry. A mailing was made to these companies requesting the latest product data and photos for this update. Not all of these sources responded, due to pressures of getting ready for the upcoming NAB-'83 convention.

Table I is a listing of sources for turntables of interest to broadcasters and professionals in audio. Tables IIA, IIB, IIC and IID summarize key specifications for selected turntables.

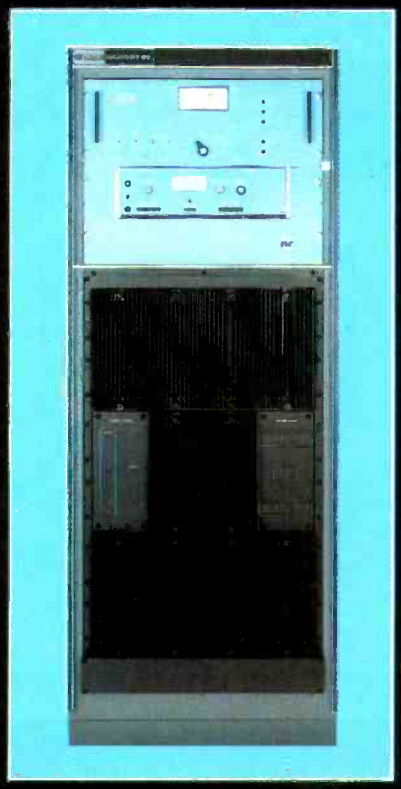
Table I.
Turntable sources

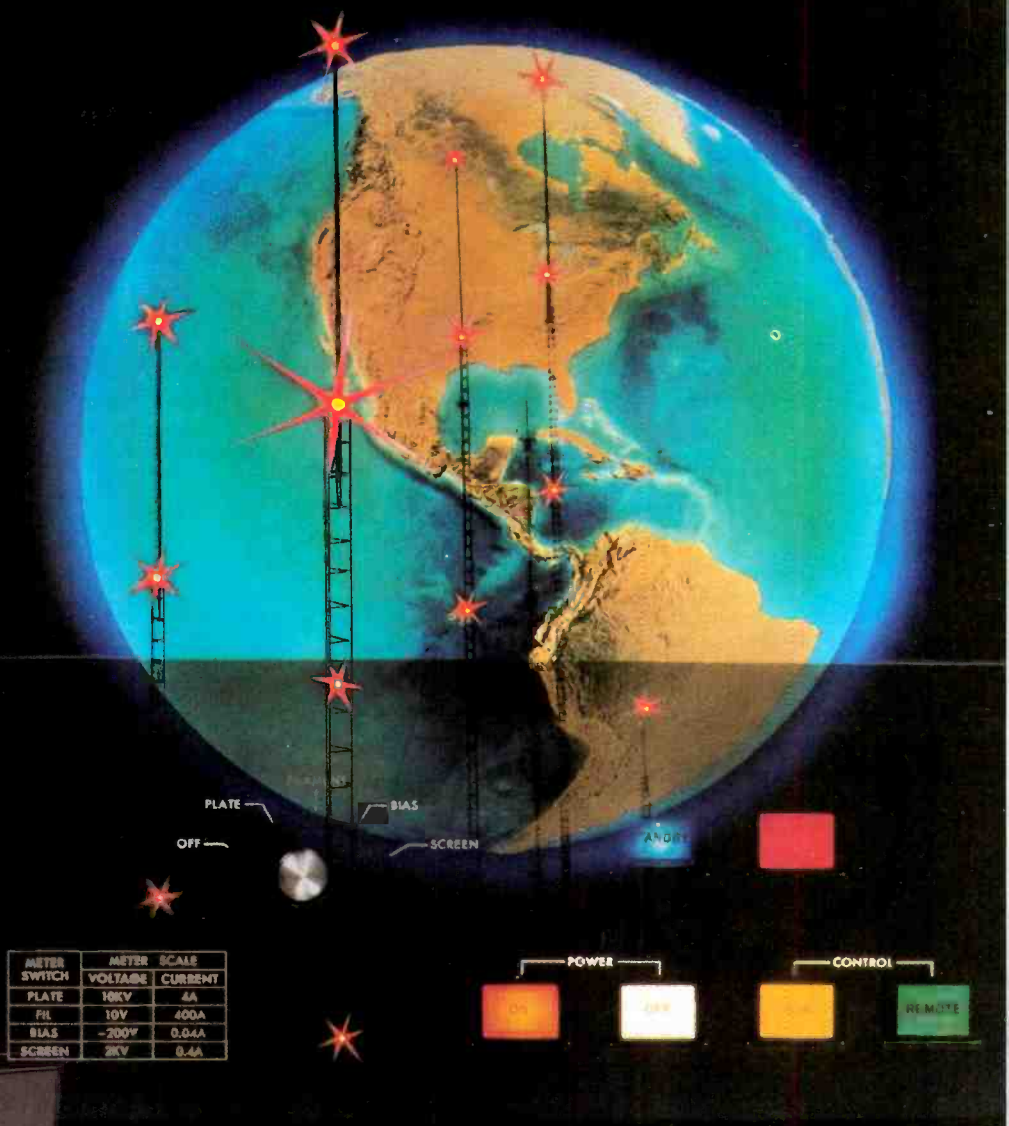
Table IIA.
Phonograph turntables

Manufacturer	Broadcast Electronics				EMT-Franz
Model Number	QRK Galaxy	QRK 12C	QRK 16SA	QRK Custom 2	EMT 950(1)
Drive System	Rim idler	Rim idler	Rim idler	Rim idler	Direct
Motor Type	dc Hall effect	ac synchronous	ac synchronous	ac synchronous	dc servo
Speeds(rpm):	Variable(15-85)	3(78,45,33⅓)	2(45,33⅓)	2(45,33⅓)	3(78,45,33⅓)
Speed Display	LED	Lever position	Indicator lamps	Indicator lamp	Lighted push-button
Speed Accuracy	.....	99.5%	99.5%	99.5%	±0.1%
Pitch Control	±10% of speed	No	No	No	Limited
Start Time(33⅓rpm)	1/16rev.	1/16rev.	1/16rev.	1/16rev.	0.2s
Rumble	−55dB per NAB	−48dB per NAB	−48dB per NAB	−52dB per NAB	70dB, weighted
Wow/Flutter	0.06%/0.08%	0.1%	0.1%	0.1%	0.05%, DIN 45507
Platter Diameter	12"	12"	16"	12"	13"
Platter Weight	5 lb	5.5 lb	8.5 lb	5.5 lb	.....
Speed Change Control	Electronic	Mechanical lever	Mechanical lever	Mechanical lever	Push-button
Start/Stop Control	Push-button	Switch or lever	Switch or lever	Switch or lever	Push-button
Base Size	16⅜"Wx17 7/16"D	15"Wx15.5"D	20"Wx18.75"D	15"Wx15.75"D	27.6"Wx18.4"Dx13.2"H
Clearance	2.5" below tabletop	5" below frame	6.25" below frame	5" below frame	.....
Tonearm Recommended	Any	Any	Any	Any	EMT 929
Dust Cover	No	No	No	No	Yes

(1) EMT systems include preamp electronics.

ACRODYNE '83





METER SWITCH	METER SCALE	
	VOLTAGE	CURRENT
PLATE	10KV	4A
FIL	10V	400A
BIAS	-200V	0.04A
SCREEN	2KV	0.4A

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The Broadcast Electronics 12C turntable features three standard speeds, instant start (full speed in less than ⅛-revolution), rugged construction with only three moving parts, and rim drive to assure minimum rumble and maximum starting torque. Newly styled, the 12C is finished in gray with a black felt pad and a durable polycarbonate overlay on the shift plate, which is a satin-finished extrusion.

Table IIB.
Phonograph turntables

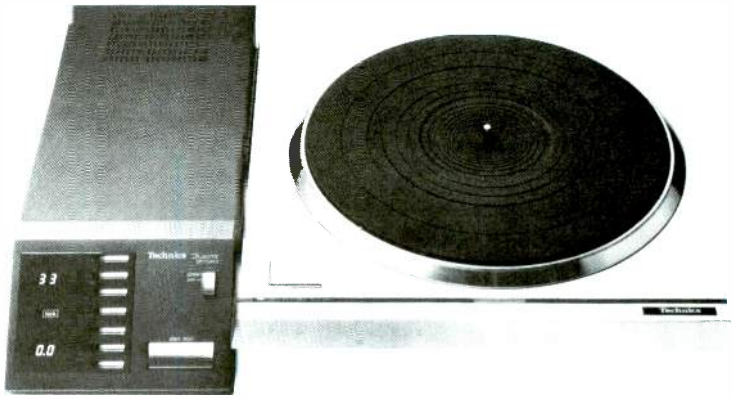
Manufacturer	EMT-Franz	Harris Broadcast	LPB	McMartin Industries	Micro-Trak
Model Number	EMT 948(1)	CB 1201	S-7A	TT-12C	740
Drive System	Direct	Rim idler	Rim idler	Rim idler	Rim idler
Motor Type	dc servo	Hysteresis sychronous	ac synchronous	ac synchronous	ac synchronous
Speeds(rpm)	Variable & 3 fixed	3(78,45,33⅓)	3(78,45,33⅓)	3(78,45,33⅓)	3(78,45,33⅓)
Speed Display	Switch position	Position of lever	Position of lever	Position of lever	Position of lever
Speed Accuracy	±0.1% of fixed	±0.3%	.....	99.5%	.....
Pitch Control	Possible	No	No	No	No
Start Time(33⅓rpm)	0.5s	1/16rev.	1/16rev.	1/16rev.	1/16rev.
Rumble	70dB, DIN 45539	−45dB per NAB	−48dB per NAB	−48dB per NAB	−36dB per NAB
Wow/Flutter	±0.075%, DIN 45507	0.1%	0.1%	0.1%	0.3%
Platter Diameter	12.9"	12"	12"	12"	12"
Platter Weight	.....	6.9 lb	5.5 lb	5.5 lb	6.5 lb
Speed Change Control	Electronic	Mechanical lever	Mechanical lever	Mechanical lever	Mechanical lever
Start/Stop Control	Push-button	Switch or lever	Switch or lever	Switch or lever	Switch or lever
Base Size	18.3"Wx18.9"Dx9.4"H	16"Wx16"D	15.5"Wx15.5"D	15"Wx15.5"D	15.5"Wx15.5"D
Clearance	6.2" below panel	5.5" below chassis	5" below chassis	.....	7.5" below chassis
Tonearm Recommended	Included	Any	Any	Any	Micro-Trak 303
Dust Cover	Yes	No	No	No	No

Gotham Audio provides the EMT 938 turntable system broadcast disc reproducer and the EMT 948 broadcast turntable. The 938 features three speeds, quick start without auxiliary platter, and built-in equalizer amplifiers with balanced studio outputs. It is for use with magnetic pickup cartridges with standard mounting, or is optionally equipped with the EMT TSD 15 dynamic pickup cartridge. The 948 is designed to accommodate the limited space available in many broadcast studios. The 948 platter is driven directly, with the platter shaft rigidly connected to the motor rotor, so that quick-starting is assured. Three fixed speeds or variable speeds are possible, depending on options selected. Remote control is also possible.

Table IIC.
Phonograph turntables

		Ramko Research		Russco	
Manufacturer	Micro-Trak				
Model Number	720	SL-1500MK2/Technics	SP-10MKII/Technics	Mark V Broadcast	Studio-Pro
Drive System	Rim idler	Direct	Direct	Belt-isolated rim	Rim idler
Motor Type	ac sychronous	dc servo	dc servo	dc Hall effect	ac synchronous
Speeds(rpm)	3(78,45,33⅓)	2(45,33⅓)	3(78,45,33⅓)	2(45,33⅓)	2(45,33⅓)
Speed Display	Position of lever	LED	.....	LED	Indicator lamps
Speed Accuracy	.....	0.002% error	0.002% error	.....	.....
Pitch Control	No	±9.9%, 0.1% steps	.....	±10%	No
Start Time(33⅓rpm)	1/16rev.	0.7s	1/12rev.	1/36rev.	1/16rev.
Rumble	−36dB per NAB	−73dB per DIN B	−70dB per DIN B	−68dB per DIN B	−38dB per NAB
Wow/Flutter	0.3%	0.02%	0.025%	0.075%	0.2%
Platter Diameter	12"	.....	.....	12"	12"
Platter Weight	5.5 lb	.....	.....	6.5 lb	6.5 lb
Speed Change Control	Mechanical lever	Electronic	Electronic	Electronic	Mechanical lever
Start/Stop Control	Switch or lever	Push-button	Push-button	Push-button	Switch or lever
Base Size	15.5"Wx15.5"D	.....	.....	15.5"Wx15.5"D	15.5"Wx15.5"D
Clearance	6.5" below chassis	.....	.....	4" below tabletop	7.5" below chassis
Tonearm Recommended	Micro-Trak 303	Included	Any	Any	Any
Dust Cover	No	Yes	Optional	No	No

Technics SP-10MKIII



SP-10MKIII

The Technics SP-10MKII turntable is well-known. Many manufacturers of turntable systems have modeled their products after the Technics system, adding their own enhancements and features. The newest model from Technics, however, is the SP-10MKIII.

Many of the features of the earlier model are retained, but the SP-10MKIII adds a variety of new ones. For 33⅓ rpm operation, a starting torque of 16kg-cm achieves its proper speed within 0.25s, or 30° rotation. The quartz-controlled direct-drive system allows ±9.9% pitch shift in 0.1% increments. Wow and flutter is rated 0.015% with rumble at −92dB (DIN-B). For older records, 78 rpm is available.

The control unit and power supply offer a new approach to turntable control. Soft-touch switches for speed selection and pitch control combine with LED displays on the front panel. By housing all control circuitry in the remote unit, reliable low noise operation is possible. Parallel operational switches are available on the turntable itself, for those who need them.

The quartz-synthesized speed control system allows up to 199 discrete speeds for each of the 33⅓ rpm, 45 rpm and 78.26 rpm settings, a total of 597. Speed drift remains within ±0.001%. To aid in speed setting, a strobe system includes yellow-green indications at standard speeds, with red-orange flashing at others.

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Table IID.
Phonograph turntables

Manufacturer	Technics/Panasonic		Thorens/Gertatewerk
Model Number	SL-1015	SL-1025	TD126 Mk III
Drive System	Direct	Direct	Belt
Motor Type	dc heteropole	dc brushless	dc servo
Speeds(rpm)	3(78,45,33⅓)	2(45,33⅓)	3(78.45,33⅓)
Speed Display	LED	Strobe indicator	.....
Speed Accuracy	Quartz control	Quartz control	.....
Pitch Control	±9.9%	±6%	.....
Start Time(33⅓rpm)	0.4s	0.7s	.....
Rumble	−78dB per DIN B	−78dB per DIN B	−72dB per DIN
Wow/Flutter	0.008%	0.01%	0.04%
Platter Diameter	13-11/32"	13-11/32"	12"
Platter Weight	5.9 lb	4.4 lb	4.73 b
Speed Change Control	Electronic	Electronic	Push-button
Start/Stop Control	Push-button	Push-button	Push-button
Base Size	22"Wx18"D	20.7"Wx16.5"D	.....
Clearance	.....	.....	.....
Tonearm Recommended	EPA-A501H included	EPA-A250 included	TP16 MkIII
Dust Cover	Optional	Optional	Available

The European Lenco L75S is one of a line of continuously variable transcription turntables. The heart of the system is a conical drive system powered by a heavy-duty 4-pole constant velocity motor. The system is continuously variable from 30-86 rpm, with detents at 33⅓ rpm, 45 rpm and 78 rpm. An easy-to-read stroboscope disc is supplied for precise speed adjustment. (Imported through Benjamin Electroproducts, Commack, NY.)

Personal tastes may lead some engineering and production personnel to consider purchasing turntable systems from the higher grade professional audio and high fidelity lines. We have included several manufacturers of such systems. (See Table I.)

Because some of these manufacturers are not in the United States and Canada, their products may be available only regionally. For the non-US and Canadian companies, the country of manufacture is indicated for interested individuals. If US distributors are known, they are given.

Several of the systems from various manufacturers are based upon the turntable mechanics of the Technics SP10MKII equipment. An asterisk (*) has been used to reflect those situations.

Reader Service Numbers have been provided in Table I for your convenience. Data for models not described in Tables IIA, IIB, IIC and IID are available free from the manufacturers. Reader Service Numbers in Table I and our Reader Service Card provide you an easy means of obtaining appropriate data.

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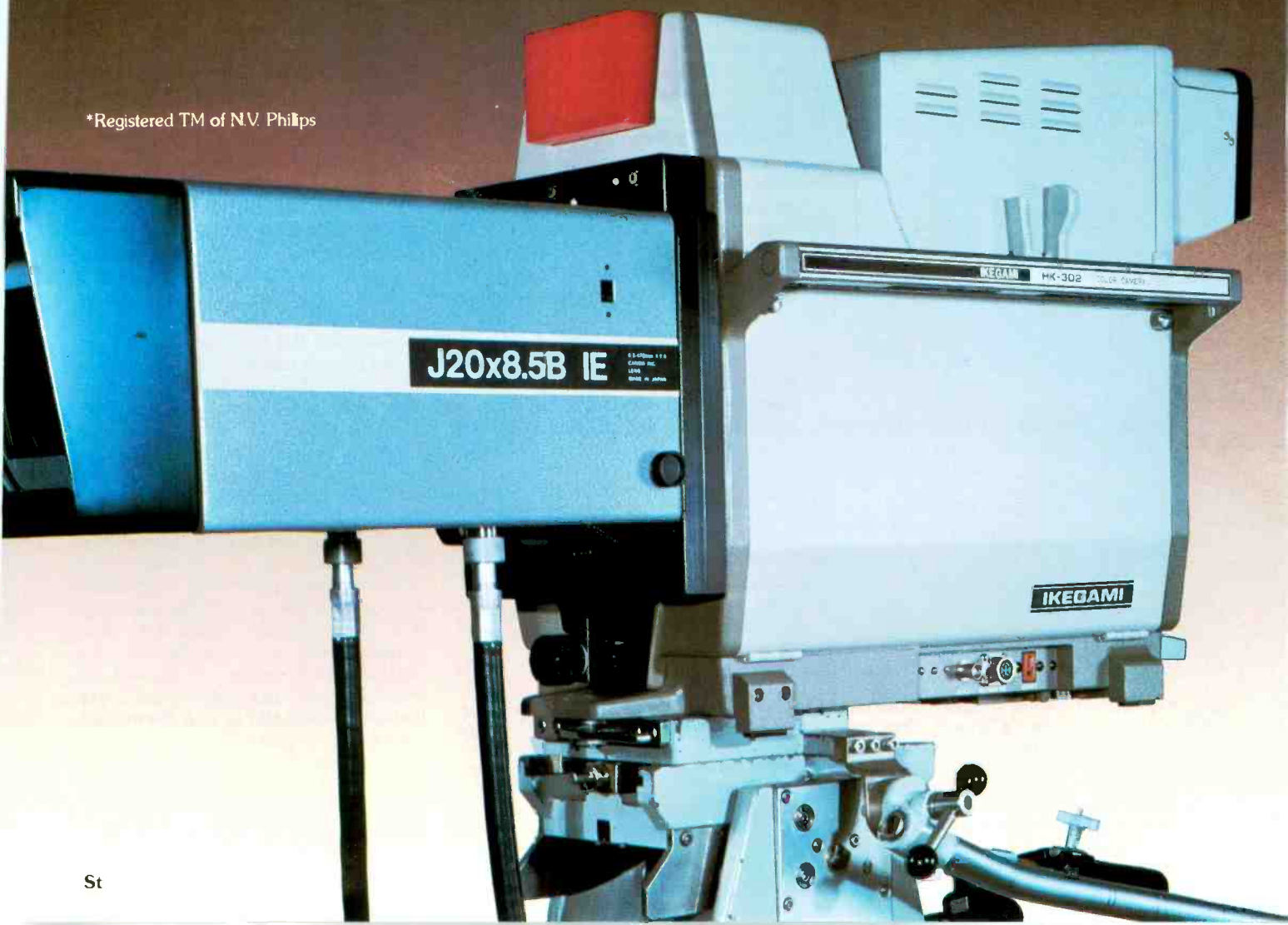

St

Optimizing the broadcast phono system

By Roger Karwoski, operations manager/chief engineer, KBIA, Columbia, MO

Have you checked your station's phono systems lately? These devices are generally reliable enough that many of us probably forget to properly maintain them, and, thus, there may be a tendency for performance to go downhill over time. Let's review some major points on the *care and feeding* of the broadcast phono system.

Lubrication and cleaning

If you haven't established a regular lubrication routine for your station's turntables, it's time to do so. Dig out those instruction sheets on your equipment and follow the manufacturer's directions.

If your turntables are the rim-drive type, you'll probably need to lubricate the main turntable shaft and the drive motor every one to three months. The idler should be inspected at these times to see if it moves freely on its shaft. If not, it should be removed, cleaned and relubricated. It is important not to overlubricate any of these parts, because oil will probably overflow and contaminate the idler and/or turntable rim.

Cleaning of the idler driving surface and inside rim of the table should be done every week or two, depending on use.

Direct-drive turntable systems require little in the way of lubrication. Usually they come with their own oil that needs to be applied to the motor every six to eight months.

No matter what type of turntable drive you use, it is a wise move to clean up the outside of the system: Carefully dust off the tonearm assembly with a fine brush and clean the platter surface.

While you're performing a regular cleaning routine, it is wise also to check the condition of the stylus. If it is bent or otherwise damaged, replace it. Otherwise, continued operation will probably damage your records. Despite the fact that it is a "diamond," the stylus does wear out. It is difficult to say how often a stylus should be replaced; factors such as vertical tracking force and quality of the stylus affect life. However, a worn stylus will easily become audible. Keep a use *history* of stylus life at your station, just as you do for your transmitter tubes. Then replace the stylus *well* before it affects the playback quality.

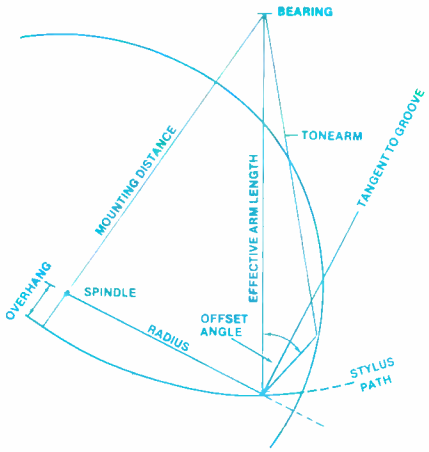

Figure 1. Geometry of a pivoted tonearm.

Alignment crucial

In order for a phono cartridge to do its job properly, it must sit in the same relationship to the record surface as did the cutting stylus when the record master was made. Proper alignment of the cartridge is important in order to minimize distortion. The alignment accuracy needed for optimal performance is precise. A British author[1], J. K. Stevens, has calculated that a 2° error in mounting position will double the harmonic distortion to almost 2%! Let us review the important aspects of the necessary alignment.

Lateral Tracking Angle (LTA)

The movement of a playback stylus in a pivoted tonearm is only an approximation of the movement of the cutting stylus. The cutting stylus moves tangentially to the record groove. The playback stylus and tonearm must have the proper geometric setup to approximate this movement. The *Lateral Tracking Angle* (LTA) references this relationship. A good setup will have minimum LTA error. Factors such as *stylus overhang* and *offset angle* play key factors in this alignment. (See Figure 1.)

When aligning a tonearm/cartridge setup, it is always best to start with the suggested setup instructions from the tonearm manufacturer concerning the mounting position of the arm pivot and stylus overhang. If these prove inadequate, then it is time to review your geometry.

Perhaps the earliest mathematical treatment of tonearm geometry was done by H. G. Baerwald in 1941. Subsequent studies have essentially concurred with his study. One of the most interesting findings to note is that a pivoted tonearm should be set up so that the LTA error is zero (the stylus should be tangent to the groove) at two positions on a phonograph record. These *null points* vary depending on the size of the record. For a 12-inch LP, these *null radii* are at 2.6-inch and 4.76-inch.

Assuming the tonearm is mounted in the proper relationship to the turntable, then the use of a simple template will aid in proper alignment. Figure 2 shows how to make one for yourself, or you can buy any of a number of different alignment aids available commercially. (See Table I.) The design of any template or alignment device is based on certain assumptions, most notably the minimum and maximum modulated groove radii. Thus, tonearm geometry will vary slightly based on what assumptions were made by the designer. Fortunately, errors in LTA result in generating mainly even-order distortion—something that the human ear readily forgives.

Formulas for determining the geometry of the tonearm setup, as well as tables for setting of overhang and offset angles, have been written about

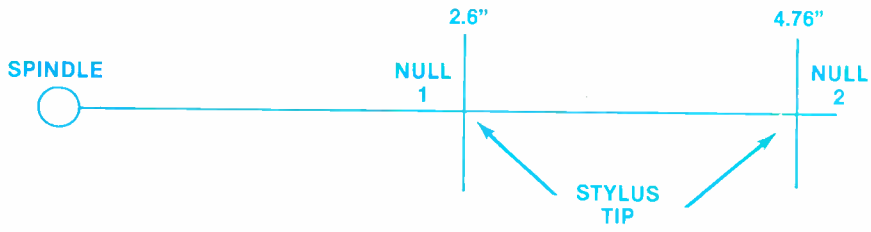

Figure 2. Dual-null template. Bond a piece of graph paper to a stiff piece of cardboard and mark as shown, then carefully punch the spindle hole. To use, put template over turntable spindle and rotate turntable to place the stylus tip at null point one. Adjust the offset angle and overhang of the cartridge so that the front and sides of the cartridge are squared with the graph lines. Rotate turntable to place the stylus at null point two and again adjust the alignment of the cartridge. Continue back and forth between the null points until the cartridge is aligned at both points.

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for many years. One of the most comprehensive articles in recent years that readers may want to consult was written by Martin Kessler and B. Pisha[2].

Vertical Tracking Angle (VTA)

Vertical Tracking Angle (VTA), the angle between the direction of stylus vibration and true vertical (See Figure 3), has been the subject of much discussion in recent years. Ideally the VTA of a playback stylus should match the VTA of the cutting stylus. The major problem in this regard has been in accurately measuring that angle. The test methods available for measuring VTA have, in the past, given results differing by as much as 10°! In 1979, James White and Authur Gust[3,4] of the CBS Technology Center devised a more precise method of VTA measurement based on the FM distortion that VTA errors produce. The procedure can be used with existing test records and is reported to be consistent within ± 5%.

Although playback VTA is predominantly fixed by the design of the cartridge, the height of the tonearm pivot will have some effect on this alignment. The *correct* VTA of a record is determined by the cutting lathe used. One survey measured recording angles that varied from 15° to 22°. Hi-fi enthusiasts correct this problem of VTA discrepancies by shimming a record with cardboard discs in a trial-and-error process to optimize the playback sound of each disc.

So what is a broadcaster to do? With elliptical and Shibata-type styli, another parameter enters into play: Stylus Rake Angle (SRA). SRA is the angle that the vertical center line of the stylus footprint, or contact area, makes with the groove ridges. With conical styli that make circular footprints, this parameter is not pertinent. (See Figure 4.) Recent tests done by Jon Risch and Bruce Maier of Discwasher Laboratories suggest that SRA is a much more critical alignment than VTA. The Discwasher staff surveyed a number of cutting lathes for their SRAs and found them to vary between 91° and 95°. This forward tilt is done to facilitate *chip* (cutaway strand) removal. The Discwasher report suggests proper tonearm cartridge setup with a SRA of 92° as a compromise alignment.

In light of this, then, it would seem that the proper *compromise* adjustment of a cartridge's VTA/SRA would be to first align the pivot height so that the top of the cartridge is level (90° SRA), then raise the pivot an additional amount that would increase the SRA an additional 2°. Thus a tonearm with an effective length of 240mm would be raised an additional 8.38mm

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(amount to raise = Sin (2°) x effective length).

Vertical Tracking Force (VTF)

Vertical Tracking Force (VTF), the downward force a cartridge exerts on a record, is generally specified in a range of values. Many people tend to adjust the VTF to its minimum value with the thought that this will minimize record wear. This may not be the case. If the cartridge *mistracks* during heavily modulated passages on a record (loses contact with the walls of the record groove), then the damage done to the record while the stylus bangs around inside the record groove will be far greater than any wear from normal stylus motion. Usually it is best to err on the high side when it comes to VTF (staying within manufacturer's specifications, of course).

One additional item concerning VTF: The *V* stands for *vertical*. This will be so only if the turntable base has been leveled. The periodic use of a bubble level is recommended to maintain a level turntable.

Test records

Now that your turntable system is aligned mechanically, it is time to make electrical adjustments. These necessitate the use of a good test record. Two of my favorites are the CBS Laboratories STR 151, *Broadcast Test Record* and the STR 112, *Square Wave, Tracking, and Intermodulation Tests*. These records offer all the major test signals needed for routine adjustments such as:

- **Wow-and-flutter measurements.** Used with a wow-and-flutter meter, or even used just by ear, this frequency band will confirm the soundness of your turntable's mechanical rotation system. Problems in this area usually result from defective or dirty drive shafts or idler wheels.
- **Rumble and hum measurements.** The first time I made this measurement, early in my broadcast career, I was shocked at how high it was compared to most specifications provided by turntable manufacturers. The rumble figures quoted are usually *weighted* measurements. For instance, the DIN A-weighting standard calls for a 12dB/octave roll-off above and below 315Hz. (Weighting is used to approximate the characteristics of the ear at low levels.) Any excessive hum or hiss in the phono system is indicative of something gone awry. Loose or broken cables or connectors or broken ground leads are usually first suspects.
- **Reference level adjustment.** This provides a reference level or "0 VU" level at which the majority of records are cut. Channel gain, phase and balance can be easily checked and set.
- **Frequency response measure-**

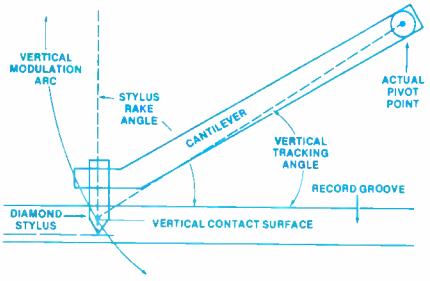


Figure 3. Relationship of stylus Vertical Tracking Angle (VTA) and Stylus Rake Angle (SRA).

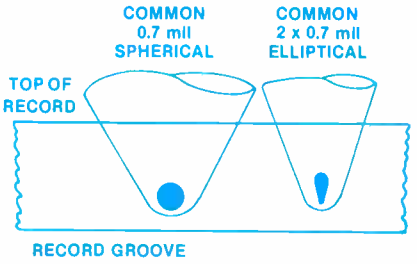
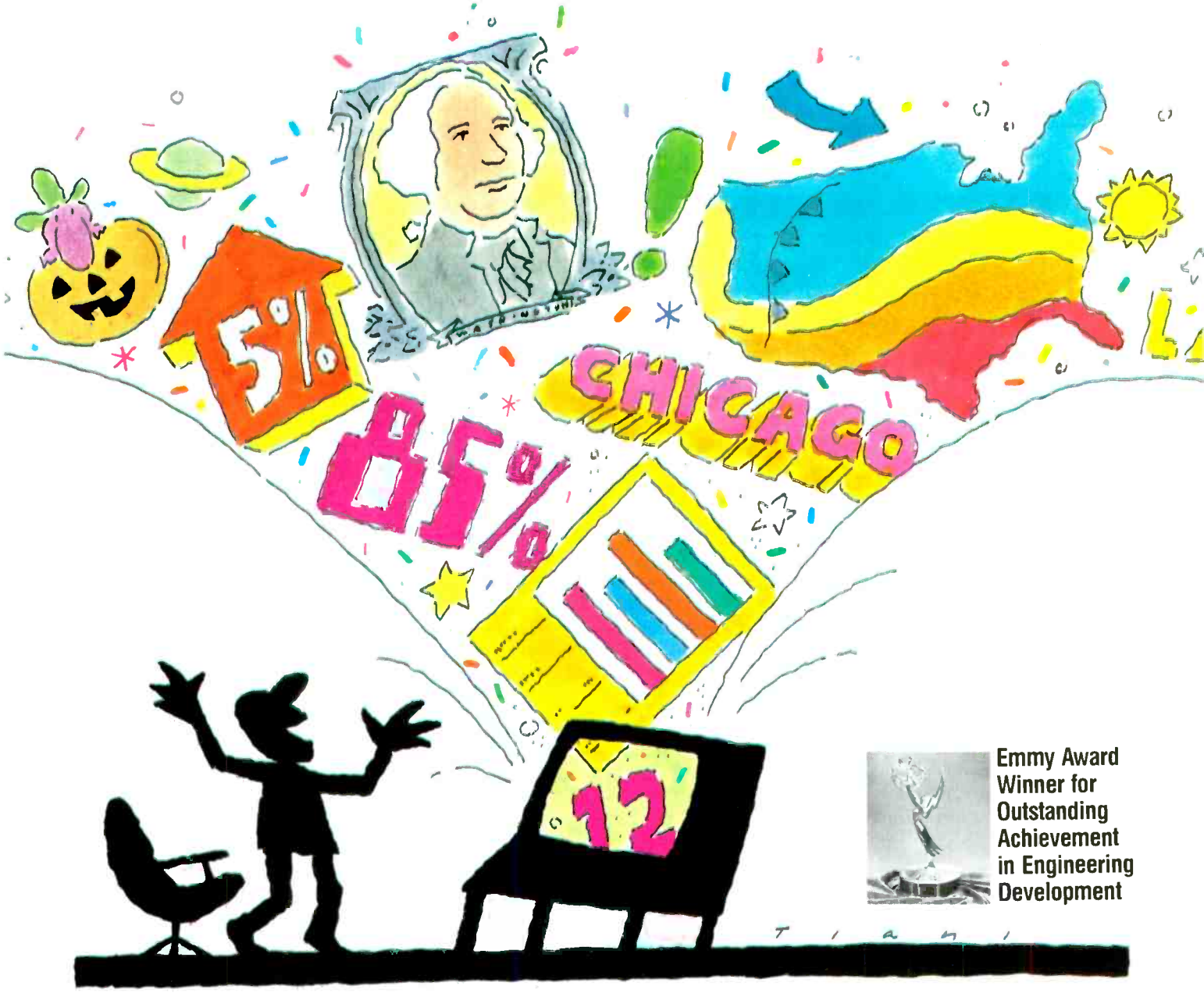


Figure 4. *Footprints* (contact areas) of conical (left) and elliptical (right) styli.

Ultranimation

Ordinary words can't describe the Dubner CBG-2 Video Graphics Generator



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Every now and then a product comes along that so outclasses existing products, claims like "revolutionary" and "breakthrough" seem inadequate.

Such is the case with the Dubner CBG-2 Video Graphics Generator, a *computerized character generator* that's also a painting system, frame storage device and video effects generator.

But the real miracle of the Dubner CBG-2 is more than just versatility. It's the ease, sophistication and speed with which it can create everything from a weather map to a tricky network logo animation sequence.

In fact, the Dubner CBG-2 Character/Graphics/Weather/Animation Generator offers such diversification, it's impossible to describe in just one word. And the amazing price is indescribable too.

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DUBNER COMPUTER SYSTEMS INC.

Dubner Computer Systems, Inc., 158 Linwood Plaza, Fort Lee, New Jersey 07024

Circle (53) on Reply Card

Table I.
Phono-alignment-tool manufacturers

Company name	Reader Service Number
Geo-Disc, Mobile Fidelity Sound Lab	330
Cart-a-lign, Spencer Broadcast	331
Geometric Soundtracker, Dennesen	332
Omnidisc, Telarc	333

ments. Spot frequencies are provided that give an indication of the overall response of your cartridge and preamp. Poor frequency response may indicate electrical problems within the preamp or a poor *interface* between the cartridge and preamp. Magnetic phono cartridges are designed to work into a particular capacitive load, generally 250-300pF. This capacitance is made up of the wiring capacitance of the tonearm, connecting cables and the preamp's circuitry. If the total capacitance is greatly less or more than the cartridge's specified load, poor frequency response will likely result.

- **Tracking.** High level modulated bands that can be used to test the tracking capabilities of your cartridge and for anti-skate adjustments. It is also useful to compare tracking capabilities as you evaluate other cartridges.
- **Intermodulation measurements.** Variable amplitude bands consisting of two tone SMPTE-type intermodulation test signals. This is also useful in cartridge comparisons as well as system checkouts.
- **Peak capability testing.** This consists of pulsed 3kHz tone bursts recorded 10dB above standard reference level. Any clipping of this signal is a good indication of insufficient headroom in the system.

And finally: clean, clean, clean

So here we are with a wonderfully aligned machine—in excellent mechanical and electrical condition. *Don't blow it now!* Perhaps the most common form of distortion in a phono system is caused by dirt, dust, fingerprints, hair, etc., caught in the stylus, preventing it from accurately following the record groove's track. Don't underestimate the need for record *and* stylus cleaning. Many good products are available on the market. Our favorite is the Discwasher D4 system. The system is effective and is sold to radio stations and libraries at 50% of the retail price.

This past summer, we ran out of D4 solution and, because of some internal ordering problems of our own, we went without the solution for a couple of months. In the interim, I substituted distilled water mixed with a little alcohol. When the new solution came in, the difference was quite noticeable: A record that had excessive surface noise was cleaned with the water/alcohol mix to no avail. The D4 did the trick; the record was substantially quieter. The folks in the record cleaning accessory business know what they are talking about.

References and bibliography

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[2]Martin D. Kessler and B.V. Pisha, "Tonearm Geometry Demystified," *Audio*, March 1980.
[3]James V. White and Authur J. Gust, "Measurement of FM Distortion in Phonographs," *Audio Engineering Society*, March 1979.
[4]James V. White and Authur J. Gust, "Three FM Methods for Measuring Tracking Angles of Phono Pickups," *Audio Engineering Society*, April 1979.
S.K. Pramanik, "Understanding Tonearms," *Audio*, June 1980.
Jon M. Risch and Bruce R. Maier, "More Than One Vertical Tracking Angle," *Audio*, March 1981.

Digital Test Generator

Price/Performance at its Peak

If cost effectiveness of your equipment dollar is as important to you as state-of-the-art technology, then you cannot afford to ignore the DTG-1100N.

In just one rack unit you get 35 computer generated, precision video test signals and microprocessor controlled signal selection.

The user-friendly front panel menu and status indicators let you look and select... easy as 1-2-3!

Full remote control is also available.

NEW FOR NAB '83

The VIP-1101N Vertical Interval Processor is a sophisticated, versatile companion for the DTG-1100N Digital Test Generator. It is a stand-alone unit featuring a digital sync generator which always maintains RS170A in the digitally generated black output. Microprocessor control with digital read-out allows insertion/deletion of VIT signals or data in lines 10 to 21 of either field. The unit is scheduled to be shown at NAB '83. Don't miss it!

LEITCH

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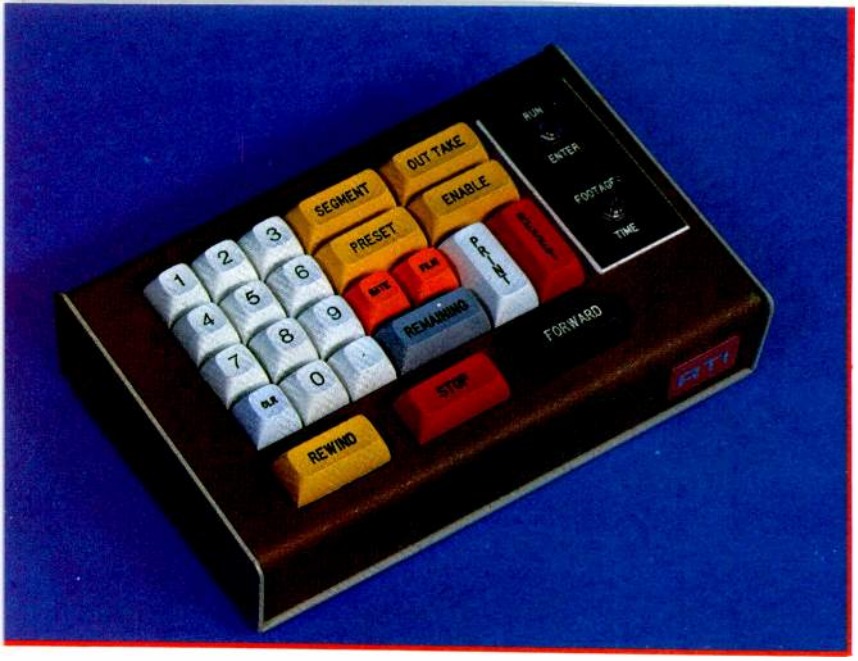
Tel: (416) 445-9640
Telex: 06 986 241



The Data-Film keyboard provides human interface to the system.

Field report:

TV-120 for quality film maintenance

By William Rapp, film director, WLS-TV 7, Chicago, IL

It is recognized that videotape has made rapid advances to become the primary recording media for television. Nevertheless, there is still a place for film because of its inherent advantages and because of the bulk of programming still available on film.

However, stations still using film must be certain that their material is in top condition in order to deliver the quality signal expected by today's viewers. At WLS-TV we still use a lot of film for programs and commercials, and we have established procedures to ensure that our film is in top quality for broadcasting. Our purchase of a RTI TV-120 film care system has greatly simplified our work.

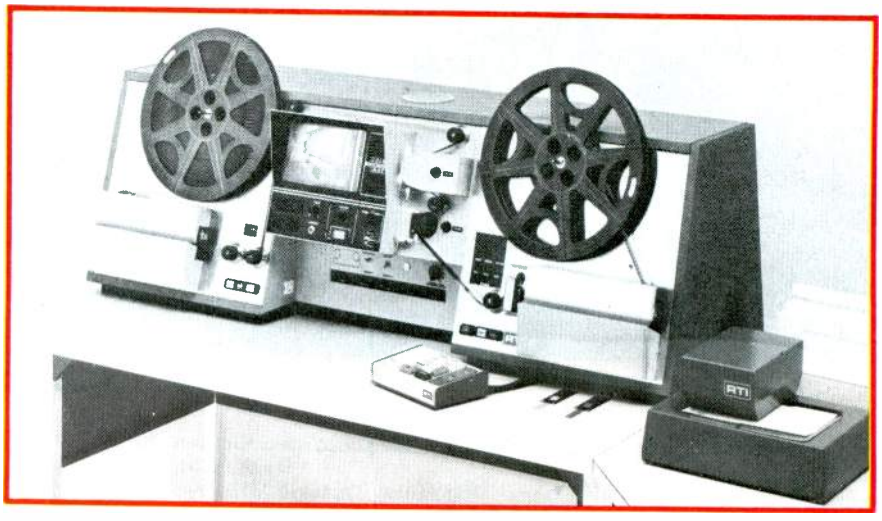
Quality control and reliability are paramount in film usage, as it is in every area of the broadcast industry. That's where the TV-120 film editing/maintenance system comes into play. For us, a well-planned quality control program based on the TV-120 provides a high degree of reliability to film usage and reduces much of the tedium of film preparation for the station film editor. Besides the ability to improve film library maintenance by reducing some of the stress placed on film editors, the TV-120 offers other error-reducing advantages such as timing verification, increased productivity and proper film material maintenance on a routine basis. Now inspection, cleaning and evaluation of filmed materials can proceed four times faster than with manual rewinds.

Program and commercial maintenance

WLS-TV currently holds approximately 1200 feature titles under contract. Whenever a feature film comes into the station, it is generally run through the TV-120 system first. The film is screened for technical quality, cleaned and its total length determined. Even if the program is screened initially on a projector, it will be processed by the TV-120 before decisions are made in regard to keeping the print or returning it for a replacement.

The cleaning function of the machine would justify the investment in the system, because on-air quality is important to WLS-TV. Yet, while cleaning occurs, the evaluation process, under control of the Data Film Computer in the TV-120, detects and totals various faults—such as splices, sprocket defects, tape defects and sound track physical defects. The time in terms of total frames is also calculated. When the evaluation test is completed, the computer prints out a report card. This card provides a hard copy for the film library records and information that can be used to determine whether the film is accepted or returned to the distributor for a replacement copy. At WLS-TV, if the feature is not yet scheduled, the newly cleaned print is stored in a dustproof cabinet in the film storage vault until it is needed for airing.

A scheduled feature will be screened by the film editor for placement of commercials and bumpers. During the screening, the TV-120 gives the editor exact frame times for each segment, and cleans the material again. Once the editor is completed with his work, the program is placed on the *ready* rack for on-air use. After airing, another pass on the TV-120 to remove any inserted segments produces a final condition report and ensures that the film is returned to the film vault in a clean and ready state for its next scheduled use.



The RTI TV-120 film care system with Data-Film computer. The card printer is at right.

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At last, a practical solution to the age-old problem of color balancing your picture monitors—the PM5539 color analyzer.

Working directly off the screen with three color-sensitive photodiodes, the PM5539 gives you quick and easy readings of the three primary colors—separately or simultaneously—referred to a previously-set white standard.

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For nationwide sales and service information call 800-631-7172, except in Hawaii, Alaska and New Jersey. In New Jersey call collect (201) 529-3800, or write Philips Test & Measuring Instruments, Inc., 85 McKee Drive, Mahwah, NJ 07430.

Color temperature should normally be adjusted at both high and low light levels. Balance of the three primary colors should track at the "grey" levels in between. To facilitate "grey scale tracking," the PM5539 has a wide sensitivity range (1 to 300 NIT's full scale).

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PHILIPS

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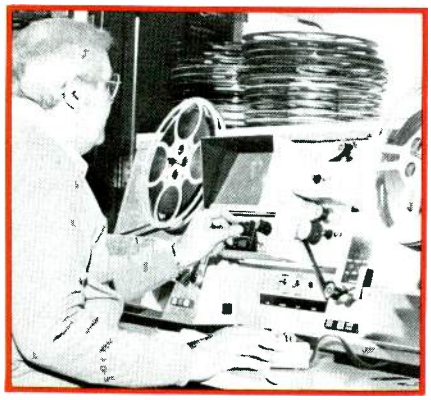
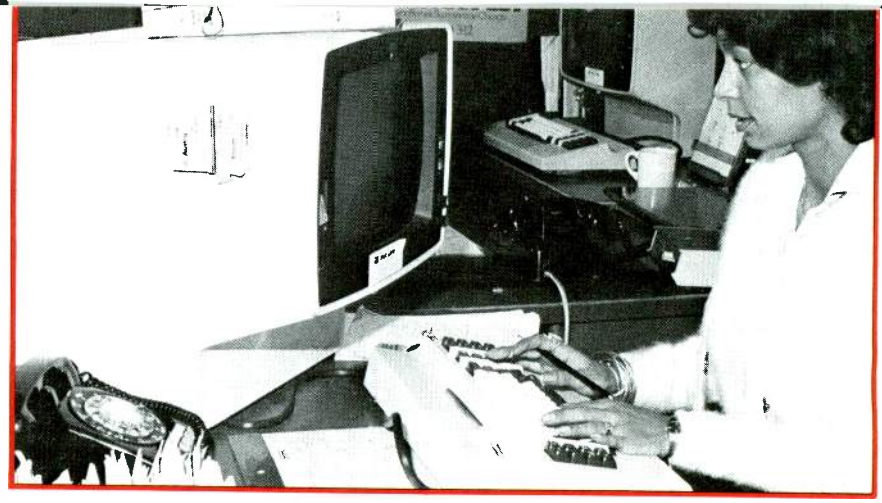


Sol Gelfond, WLS-TV film editor, uses the TV-120 for inspecting film and printing a film condition report.



Lori King, WLS-TV, puts overnight ratings into the MIS computer.

In the case of commercials, the TV-120 is used heavily in the screening process. Content, physical defects and SMPTE variations can all be considered at once. Once an item has been approved by WLS-TV's Broadcast Standards and Practices Group, the individual commercial pieces are then prepared for use in Telecine in the RCA 1624 film cartridge playback system. Just as with feature-length materials, the commercial films have been subjected to more than one cleaning pass before they move into telecine for on-air use. (In fact, no film goes into the telecine department without having been cleaned.)

At WLS-TV our RTI system has become invaluable. An incident, occurring around the time we purchased our TV-120 equipment, points out one of the helpful features of the system. A feature-length film, received in seemingly good condition before our TV-120 acquisition, aired with a motorboating sound. The defect had not been detected during viewing on a normal projector. When we used the TV-120 and its overscanned viewer screen to evaluate the audio track and sprockets along with the visual frames, we found that the audio track contained an audio pulse printed in. Because of this confirmation, we were able to get a replacement print for our library.

Routine reporting

The report-generating Data Film Computer system is an option, and a valuable one. Although several reports may be generated at WLS-TV,

The Harris TC-85...when you want more from your cameras than just pretty pictures.

You naturally expect excellent picture performance from a studio camera...and the TC-85 delivers. So do some others.

But you need more than high picture quality for truly cost effective broadcasting. And here the TC-85 is way out in front.

Cuts valuable setup time. Each TC-85 has a built-in independent computer that allows simultaneous multi-camera setup at the touch of a button *...in just 45 seconds!*

Extra operational safety. If one computer should fault, only one camera is affected, not all cameras.

Easy operation. At the touch of a button you get consistent quality setups of all your cameras. A complete tube change can be made in less than 5 minutes.

Great flexibility. Preset color balance for several scenes, then as you move from set to set just push a button to recall the settings. And add-on Triax makes "on-location" shooting a cinch.

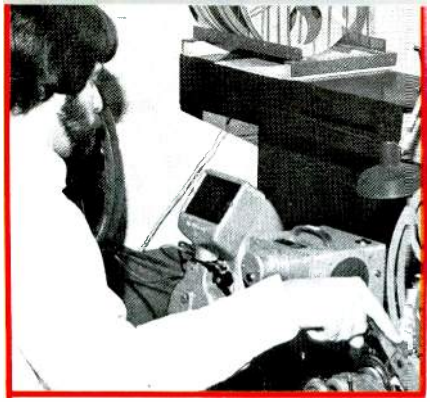
Priced well below competitive models. Let us give you a quote, and you'll see what we mean.

There's more, and it's all backed by Harris' unique *manned* 24-hour-a-day service. For full details contact Harris, P.O. Box 4290, Quincy, Illinois 62305-4290. 217/222-8200.

HARRIS

Visit Harris at the 1983 NAB, Las Vegas, in the North Hall.

Circle (59) on Reply Card



Jan Gilbert, WLS-TV film editor, picks spots for bumpers in a feature film on Moviola equipment.

we want to know information such as the following:

- date of the evaluation (month, day and year);
- total length of the film (hours, minutes and seconds);
- total number of tape defects:
- total number of sprocket hole defects;
- total number of sound track physical defects;
- total number of splices; and
- total number of all defects.

This one report, done on a regular basis including each airing and regular maintenance, provides the manager and editor with a system to detect potential problems before they occur. Checking through the report cards indicates when a new print is needed, and whether a complete program or only certain reels need replacement.

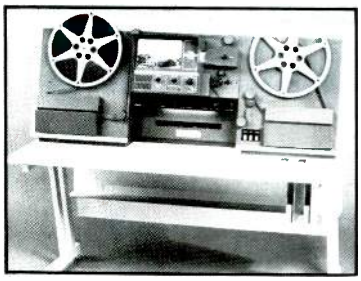
However, the fault-sensing systems of the TV-120 do not replace the practiced eye of an experienced film editor. His eye may be as critical as the most sensitive equipment, and his knowledge and comments valuable. For these reasons, the printed cards provided from the microprocessor-controlled system include a space for the editor to note other information. The comments can be crucial in rejecting or accepting a print at WLS-TV.

Saving time

Another valuable option is the *Quick-Trac* speech processor in the audio monitor system. The processor allows the film to be viewed at twice sound speed, yet the audio has no loss of clarity. Thus, any screening task may be done in half the usual time. A much more productive atmosphere is created by use of the TV-120 even if it were only used for the tedious job of searching for audio cues.

Two questions come to mind regarding the use of film in the TV facility. First, how can film compete with the constant influx of videotape into the TV industry? The answer is that it should not compete with tape. Film may be easily edited into any format

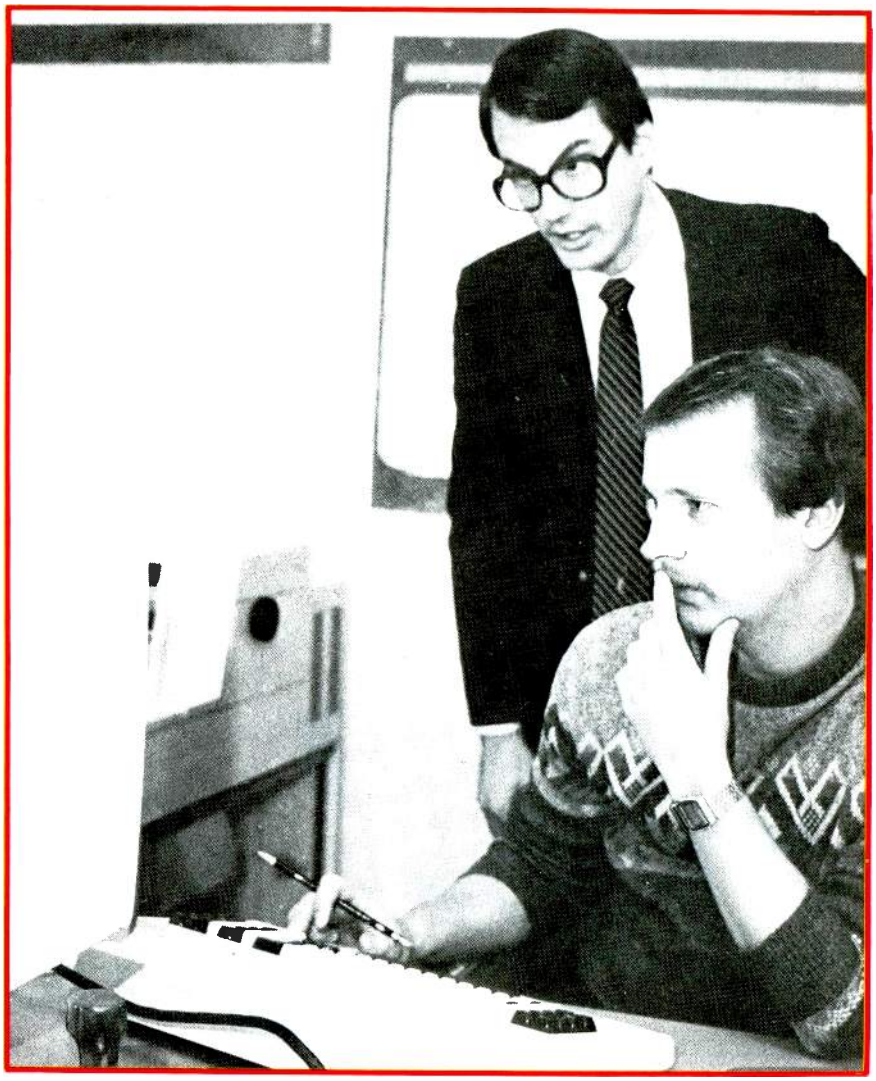
TV-120 improved



The TV-2000 film editing system. The Data-Film 820 equipment is not shown.

The many features of the TV-120 that made it desirable for TV film departments have been retained in the TV-2000 film editing system. The TV-2000, just introduced, works hand-in-hand with the Data-film 820 microcomputer film condition analysis system, to provide the operator with a printed record of the film condition. The FCD-560 digital defect evaluation unit finds poor splices, cue tabs and film defects at speeds up to 1600 feet per second. Quik-Trac is available to allow monitoring at twice sound speed with intelligible audio.

The major changes incorporated into the TV-2000 involve operator conveniences. The Digital Segment Time Display allows the operator to advance to a preset point, for example, the location where a commercial is to be inserted, with the machine automatically stopping at the desired frame. In conjunction with the Data-Film 820 unit, a hard copy of film timings, outtakes and other valuable information is provided. Also, soft touch push-buttons have been added, as well as an LED Cue Tab counter, stop-on-splice and defect-bypass controls. An optional fluid cleaner attachment is available.



The author (standing) and Michael Ozog use the MIS computer to search for feature film ratings.

The new Saticon II camera tube. Clearly superior to lead oxide.

Compare the unretouched photos below and see for yourself how the new RCA Saticon* II camera tube reduces specular highlight memory, without red trail.

You no longer have to choose between lead oxide's good handling of highlights and Saticon's well known superiority in other critical performance factors. Now it's a whole new ball game.

Computer-aided deposition and advanced material purification technologies have given Saticon II a considerably improved photoconductor. Your benefits: less highlight trail, reduced highlight memory (as much as 75% less than that experienced with earlier Saticon tubes), improved resistance to image burn.

What's more, you still get all of the recognized advantages of Saticon: high resolution, distortion-free colors, very low lag, and extremely long tube life. And Saticon II is backed by a warranty that's second to none. RCA offers full replacement for any failure in normal use for six months, compared with only two months for Plumbicon™.

Your choice is now clear. For more information on the complete Saticon line, contact your RCA distributor or write to RCA Camera Tube Marketing, New Holland Avenue, Lancaster, PA 17603. Or call (800) 233-0155. In Penna., phone collect to (717) 397-7661. Overseas, contact RCA Brussels, Belgium. Sao Paulo, Brazil. Sunbury-on-Thames, Middlesex, England. Paris, France. Munich, W. Germany. Hong Kong. Mexico 16 DF, Mexico.

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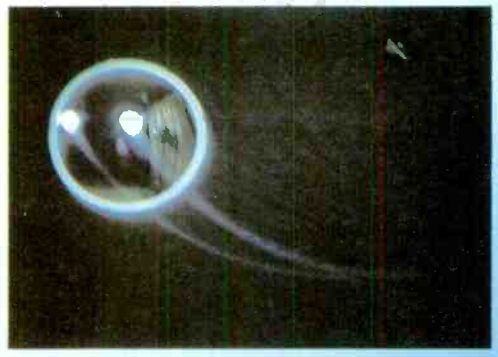
Good. Plumbicon XQ1427.
Photograph of direct reflection of flood lamps, produced by camera with CTS circuitry. Note highlight memory with red trail.



Better. Saticon II BC4390.
Same subject and conditions as in photograph at left. Note reduced highlight memory without red trail.

RCA

Manufacturer's listed features for the TV-120

The TV-120 film care system combines most of the facets of film care and programming requirements into one machine. Figure 1 illustrates the system in block form. Both film reels are under the control of the TV-120 system computer, the Data-Film unit. A capstan moves the film at a typical sound speed of 24fps for viewing on an oversized preview screen (40 square inches) or at variable editing speeds from 0 to 400fpm. The film gate uses a 16-sided crown glass prism to provide flickerless viewing. The gate and viewer are *overscanned* to allow the operator to view sprockets and sound track areas of the film in addition to the video frames.

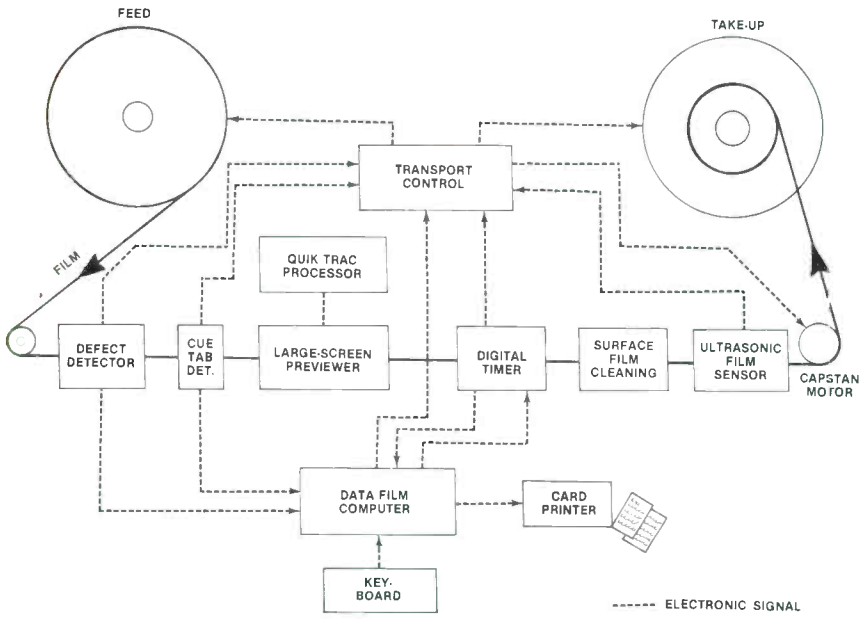
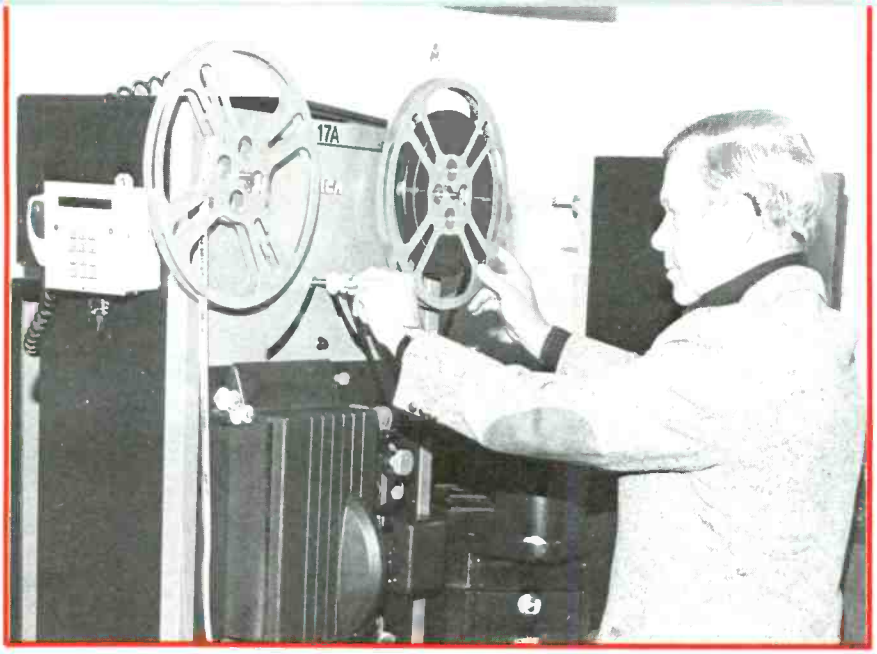


Figure 1. Block diagram showing the RTI TV-120 system with Data-Film option.

A sprocketless digital counter is used to display film lengths in *hours-minutes-seconds-frames* format. An optional digital display presents the number of tape, sprocket and sound track defects, as well as the total number of splices. With a Data-Film printer unit, the fault information is printed on cards for a permanent record, including film total time, fault times and types and estimated number of repairs. The film is cleaned at the same time as the computer condition check is made.

Film audio may be heard through a monitoring system. An optional Quik-Trac speech processor allows the film to run up to twice normal speed with a *normal* voice pitch.



Phil Carlson, WLS-TV engineer, loads a film in telecine for airing.

required. At WLS-TV, any feature could be scheduled for a time slot involving any of four different formats. By using our TV-120, we can quickly adjust to the needed formatting without having to re-edit (and re-record) an entire hour or more of videotape.

Second, what is the future of film in television? This question is not as easily answered. Only time will tell. A recent special report in the *Wall Street Journal* indicates that a 60-minute production will cost about $500,000 if film is used, whereas videotape technology will cut about $100,000 off that price. The *Journal* further states that ABC, CBS and NBC plan to do even more of their production work on tape. Yet, some producers insist that film mediums give them visual capabilities not possible with direct-to-tape procedures. With so many program sources available on film, many smaller markets will continue to rely on film for their programming of movie and special feature presentations. With the TV-120 film editing/maintenance system available to aid in improving reliability of an extensive film library, film should continue to be a viable source of TV programming for a few more years.

Editor's note:

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

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

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

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

The TV-120 film care system covered in ths report was introduced to broadcasters early in 1978, with a major showing at NAB-'79/Dallas. For details on the system, contact Research Technology International, 4700 Chase, Lincolnwood, IL 60646.

- Nov. 12, 1982
- University of Kansas
- Lawrence, KS

KU's communications seminar

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

Leading broadcasters take time to look at the future during KU's day devoted to communications technology.

Speaking before a crowd of radio-TV students and professional broadcasters at the University of Kansas recently, Joseph Flaherty, vice president of engineering, CBS-TV, said that today's broadcasters are no longer limited in their scope of possibilities by technology, but rather by their own imaginations. "Technology limitations of the past are quickly disappearing," he said. "The question is no longer what can we do, but what should we do."

As the opening speaker at the 1982 University of Kansas *Telecommunications Day*, Flaherty said that the shift-

Joseph Flaherty

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Mr. Ralph L. Mlaska
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"We are very pleased with this quality made 9.2 meter antenna."

Mr. Ray McMillan
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"The technical quality of our antenna is excellent and has brought new flexibility and a more competitive edge to our programming."

Mr. Dave Frasier
Technical Operations Mgr.
WWBT-TV Richmond, VA

"We purchased the SatCom Technologies 7 meter antenna because it is well designed and has the advanced features we need."

Mr. Charles W. Myers
Chief Engineer
WHO-TV Des Moines, IA(Iowa)

"Our 9.2 meter antenna gives us life-like pictures from the satellite. We believe this is the technology of the future and SatCom Technologies is in the forefront."

Dr. Hugh VanEaton
President
KVHP-TV Lake Charles, LA

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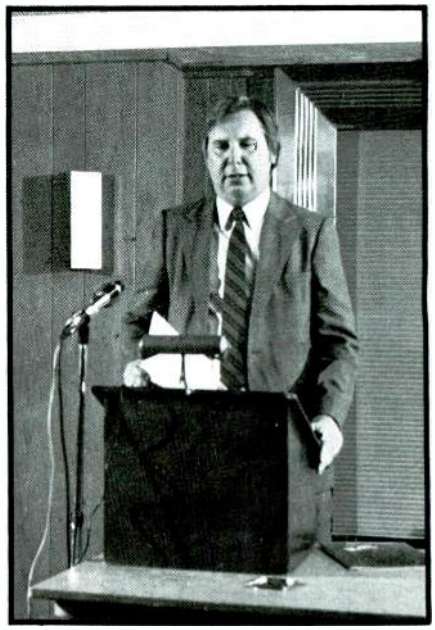
Circle (64) on Reply Card

ing direction of technology must be directed by the creative side of the industry—artists, journalists and the business community—not by the technologists. The current relationship between *technology* and the users of technology has never existed before, and it is important that the users control its direction and proportion it to the needs of society, he said. Radio used to report the news, Flaherty said, and television reported history. Since the development of modern broadcast equipment, however, he said that he saw television as the predominant medium for news coverage.

Flaherty described the changes that have taken place in the world of technology since the first TV broadcast some 20 years ago. Since that time, the TV industry has seen a black-and-white broadcast system change into a sophisticated, full-color system. He saw two primary reasons for the rapid change in our TV capabilities: solid-state electronics and rocket delivery capability for satellites.

Pointing to the similarity in cost vs. performance and size of the modern hand-held calculator and its bulky, expensive predecessor, Flaherty said that the TV industry was now experiencing similar benefits. The widespread use of the modern small, portable, high quality video camera and tape recorder is a primary reason for the change in television's ability to cover breaking news stories. Without this single product, television would still be reporting history.



Dick Smith

Flaherty pointed to the future by describing the efforts currently being undertaken to develop even more sophisticated videographic capbilities and high definition television (HDTV). He noted the use of computer graphics for recent election coverage and the use by CBS of the Ampex AVA electronic videographics system.

He also highlighted the features of HDTV as it will be demonstrated at the Montreux TV Symposium in May. This new system of television will create a totally new cinematography experience, according to Flaherty. The four major improvements of HDTV include improved color rendition, improved resolution, widescreen aspect ratios and stereophonic sound. "The wider aspect ratio, which will be more like that of movie theaters, plus the 1125-line resolution, will make HDTV the next TV production frontier," he said.

Noting that the transition from black-and-white television to color only took 20 years, Flaherty warned the students and professionals not to become complacent about technology. With the current color system now only 18 years old, one has only to realize that *that* growth took place in an era of vacuum tubes and early solid-state technology. "*There is no possibility it* can take that long today," he said.

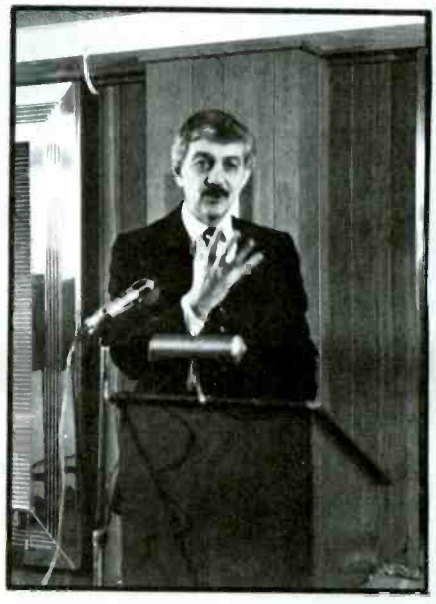
Other speakers at the program were Dick Smith, president, Satellite Programming Network (SPN); Jim

Continued on page 82

Isn't it about time?

Ampex says 'yes' with an important announcement next month.

Circle (68) on Reply Card



Jim Perkins

Perkins, Hurst/ABC Broadcasting; and Wallace Dunlap, Westinghouse. Each of the speakers provided his own unique perspectives on areas of radio and TV broadcasting. One major area of interest was that of CATV programming and delivery. Smith related his experiences in the expansion of a relatively small cable programming company to the point where, today, SPN supplies more than 5 million homes with TV programming. Calling his company a growing enterprise, he said that it was still the best kept secret in the industry. Smith's service provides a variety of programming, including foreign language programs and, most recently, data transmissions for the Keyfax system.

Perkins described the Hurst/ABC effort in expanding the Home View Network. This network would allow ABC TV affiliates to broadcast subscription programming directly to the viewers' homes during their off-air periods. This service would provide programming, on a subscription basis, which could be taped on automatic Sony videotape recorders. Users would program the recorder to select specific programs that would be broadcast on a scrambled basis during the late night hours.

Perkins described the business philosophy of Hurst/ABC by saying, "We create audiences for advertisers." He referred to present cable programming services as continuing to provide horizontal markets to horizontal advertisers. He believed that this was simply a way to get advertisers to pay a higher price for smaller audiences. Instead of paralleling other networks and current cable programmers, he said that Hurst/ABC develops vertical markets with specific demographic characteristics that advertisers can use to their best advantage.

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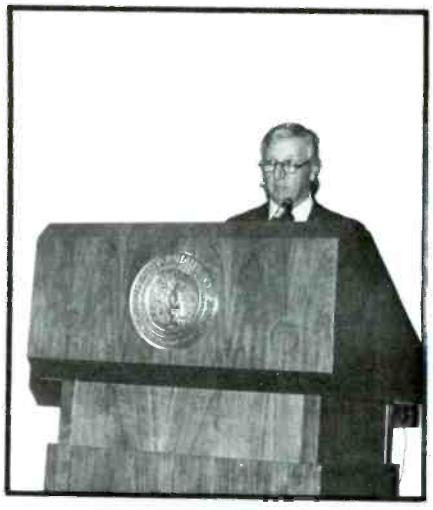

Wallace Dunlap

Hurst/ABC is now programming two services—*ARTS* and *Daytime*—to develop those vertical services. Perkins cited research showing that as much as 40% of his viewers would not be watching television if they were not able to receive the *ARTS* or *Daytime* services. "Obviously, this aspect could be good reason for a cable service to carry the companies' programming," he said.

Dunlap addressed the issues of hardware and software costs in the TV industry. He described the development of Westinghouse's cable company and why the company decided it was impossible to begin cable operations from the ground up. Rather, Westinghouse purchased Teleprompter in order to take advantage of that company's technology and hardware capabilities. He referred to cable as *narrowcasting*, as opposed to broadcasting. The audience is more fragmented than it is in broadcasting and, therefore, requires a different approach both from marketing and programming, he said.

Dunlap cautioned students to be aware of the costs involved in developing modern cable systems. Pointing out that $100,000/mile costs to install cable service in an urban environment were typical, he said that the heavy capitalization makes cable a hardware-intensive business.

The afternoon sessions were devoted to the presentation of the Grover Cobb Award for Broadcasting Service to Jerry Holley, vice-president for broadcasting, Stauffer Communications; and an address by Edward Fritts, president, National Association of Broadcasters.

After being exposed to the intensity of the full day of sessions, one student remarked that he had never learned so much from such well-known experts in such a short time.

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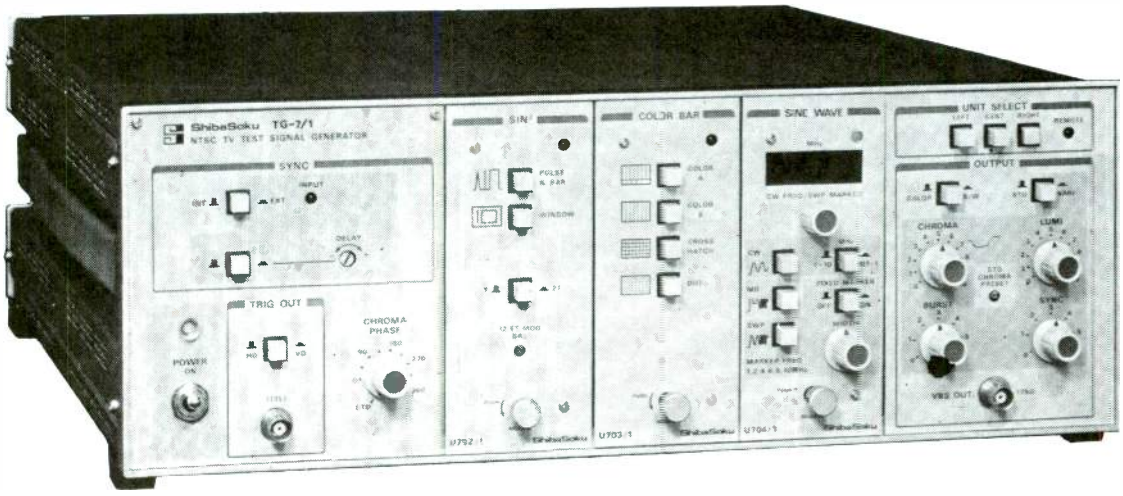

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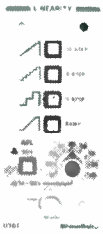
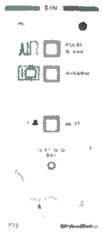
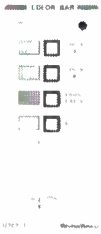


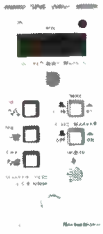
U701
LINEARITY
UNIT



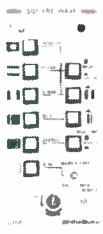
U702
SIN²
UNIT



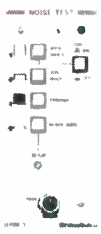
U703
COLOR BAR
UNIT



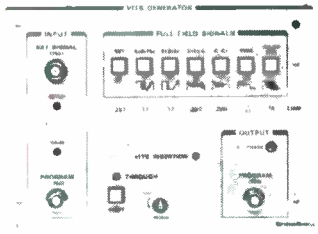
U704
SINE WAVE
UNIT



U705
SQUARE WAVE
UNIT



U706
NOISE TEST
UNIT



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- Independent output terminals provide video component, sync signal, color burst level signals to be connected to an external programmable attenuator, each output level can control with external signals independently.
- The main frame and plug-in modules are coupled with DC circuit and so there is no bounce from the signal selection.
- Switches provided on the front panel enable selection horizontal or vertical drive for a trigger pulse output.
- The maximum variety of test signals can be generated with the minimum number of modules.
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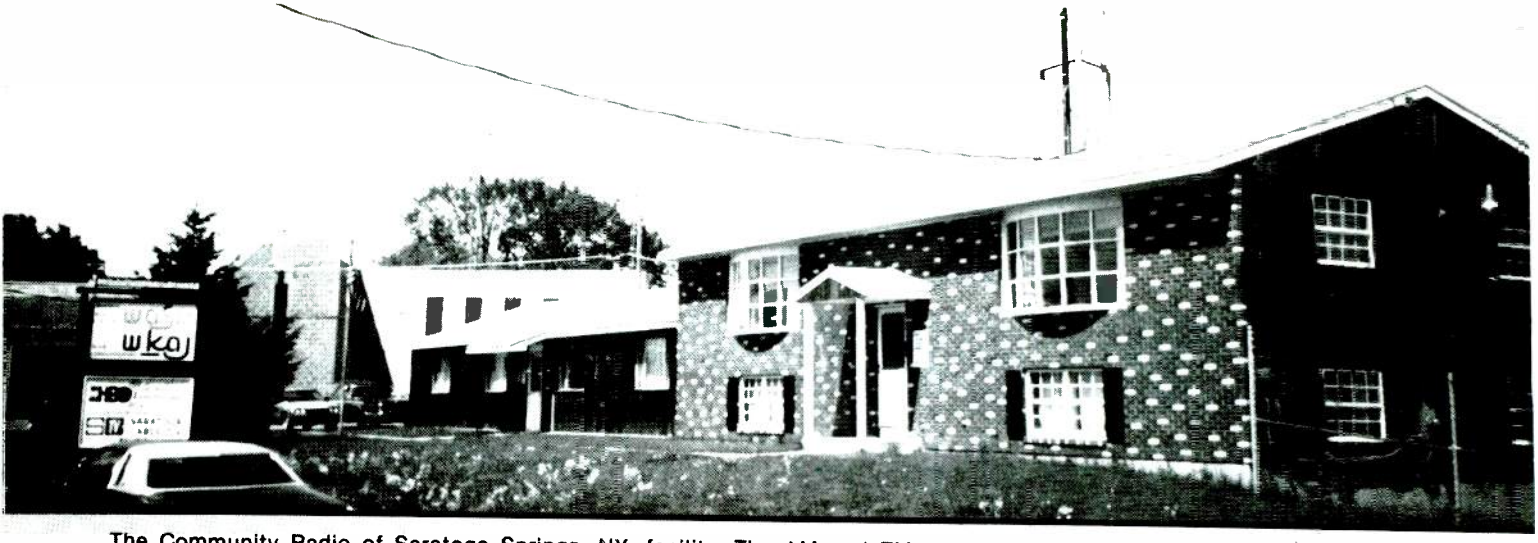

The Community Radio of Saratoga Springs, NY, facility. The AM and FM studios occupy the original 1-story building in the background. The new addition houses the cable operation.

Case study:

Automation at WKAJ-AM/WASM-FM

By Tim Lyman, general manager, WKAJ-AM/WASM-FM, Saratoga Springs, NY

WKAJ/WASM, licensed in a city of 25,000, is like other small market radio stations, except:

- It exists in the shadow of one of the country's largest metro areas (Albany, Troy, Schenectady).
- Six years ago, the FM side was billing in the low 5-digits, annually.
- It competes with 26 other radio stations, including group operators such as General Electric and the Capital Cities Group.

Some broadcasters would consider these exceptions to be liabilities. Thus, this is a story of *survival* and *innovation* through automation.

Upon joining this group, I found an AM station that lacked luster and an FM station that was in search of a format. The previous program manager, in an attempt to please everybody, designed a discordant format that combined jazz, classical, disco, etc. I believed that the station needed consistency and efficiency. The station *needed* automation, not program automation as opposed to business automation, just *automation*.

Radio has waited a long time for the two types to become one—a true interface between program and business automation. I'm talking about pushing a button, and the computer doing the following:

- scans orders entered to date and compiles a list of all spots to be broadcast for a given day;
- schedules these spots to a well-crafted log, observing all rules of product separation and station format;
- transmits this log to the program automation *(loading)*;
- makes a permanent record of each event performed by the program automation *(archiving)*;
- compiles a list of errors, including those errors that would be missed by the program automation (such as wrong cart in the specified source/tray); and
- creates a billing document for each customer that reflects exactly the spots that were successfully aired.

The beginning

I proposed this concept, in stages, to stockholders at WKAJ/WASM. My plan was to buy program automation only for the FM side and to set that system earning dollars as soon as possible for funds to automate the AM station. Finally we would acquire a business automation system that would tie it together. The multiphase approach wasn't as much due to fiscal prudity as it was to technical necessity. It seemed, in 1979, that it might take years for the interface between business and program automation to emerge from technology, and it did.

Selling stockholders on the idea of buying new equipment costing more than $50,000, considering the condition of the station's billings, proved to be much easier than one would have guessed. Automation would cost no more per year than a good employee, and would provide fewer management problems.

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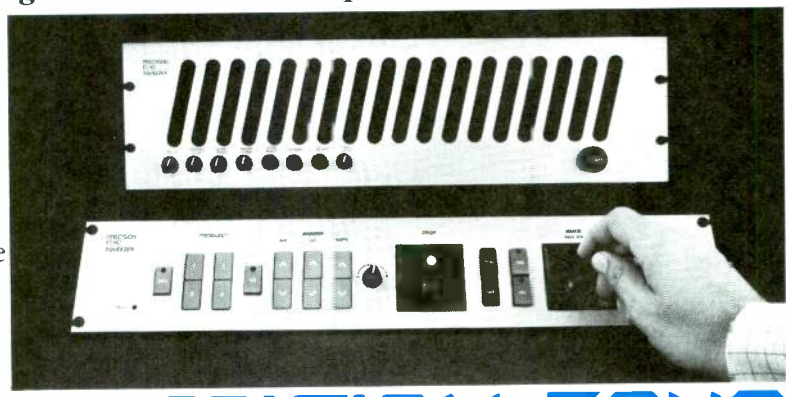
The Squeezer from Precision Echo. High on quality and cost efficiency.



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Frequency Range	1-1600 MHz	0.1-1500 MHz	.01-1800 MHz
Dispersion	20 KHz-1000 MHz	50 KHz-1000 MHz	.5 KHz-1000 MHz
Frequency Accuracy	±.005%**	20% of Dispersion ± 5 MHz	20% of Dispersion ± 5 MHz
Amplitude Dynamic Range	70 dB	70 dB	80 dB
Average Noise Level	−117 dBm (10 KHz resolution)	−107 dBm (10 KHz resolution)	−105 dBm (10 KHz resolution)
Accuracy (worst case total)	±3.5 dB	±3.5 dB	±3.5 dB
Resolution (minimum)	.3 KHz	1 KHz	.03 KHz
Short Term Stability	.2 KHz (phaselocked)	1 KHz	.01 KHz (phaselocked)
Noise Sidebands	−60 dB 10 KHz away	−65 dB 50 KHz away	−75 dB 300 KHz away (10 KHz res.)
Operating Power	115/230V AC, 12V DC	115/230V AC	115V AC
Size In³	1367	2059	Not specified
Weight Lbs	40	40	Not specified
Internal Battery	Standard	Not offered	Not offered
External 12V DC oper	Standard	Not offered	Not offered
Phaselock	Standard	Not offered	Standard
Audio	Standard	Not offered	Not offered
Frequency Markers	Standard	Not offered	Not offered
Digital Storage	Optional	Optional	Standard
Preset Frequency Bands	Standard	Not offered	Not offered
Two Log Ranges	Standard	Standard	Standard
Rugged Carrying Case w/Front Panel Cover	Standard	Optional	Standard
Camera Mount	Standard	Standard	Standard
Portability	Fully portable	Requires an inverter for field use	Requires an inverter for field use

*Information obtained from manufacturer's published specifications. **Using internal cyrstal comb markers.

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Greg Dean, Computer Concepts president (left), discusses Total Station Automation with the author. Note the Broadcast System computer and printer in the background.

Some would argue that we needed to economize, that we should not have enjoyed the extravagance of modern equipment. But, I believed strongly that compromises would not represent the commitment to success that we needed. I had my first system (a Control 16 from Broadcast Electronics) within a few weeks of that meeting. Over the subsequent three years, our ratings went up, our spot rates were adjusted upward and our billings greatly increased.

There were rough spots. For example, the brain of the FM equipment had to be programmed with about 5000 events. With each event requiring several keystrokes, programming amounted to a lot of typing. This marathon on the keyboard might have been tolerable if reserved to an occasional chore. However, when periodic maintenance was required, the automation had to be completely powered down (even the battery pack used for backup power). With power completely off, all 5000 events in memory vanished. This meant that someone had to retype several thousand keystrokes or the maintenance was not performed, with an increased risk of equipment failure.

I asked a simple question as to why we couldn't save this data in memory that was not so fragile. The people at Broadcast Electronics then introduced an innovation to the industry, and WKAJ/WASM was among the first to have it. This innovation recorded the load list magnetically on the ubiquitous cart machine found in virtually every radio station. After a power-off situation, I needed merely to feed these carts back into the system, eliminating rekeyboarding. The data could be saved and recalled from carts at the rate of 30 characters (360 words/minute, roughly).

To make the safety copy of the load list, I took over the production studio, where a cart machine had been in-

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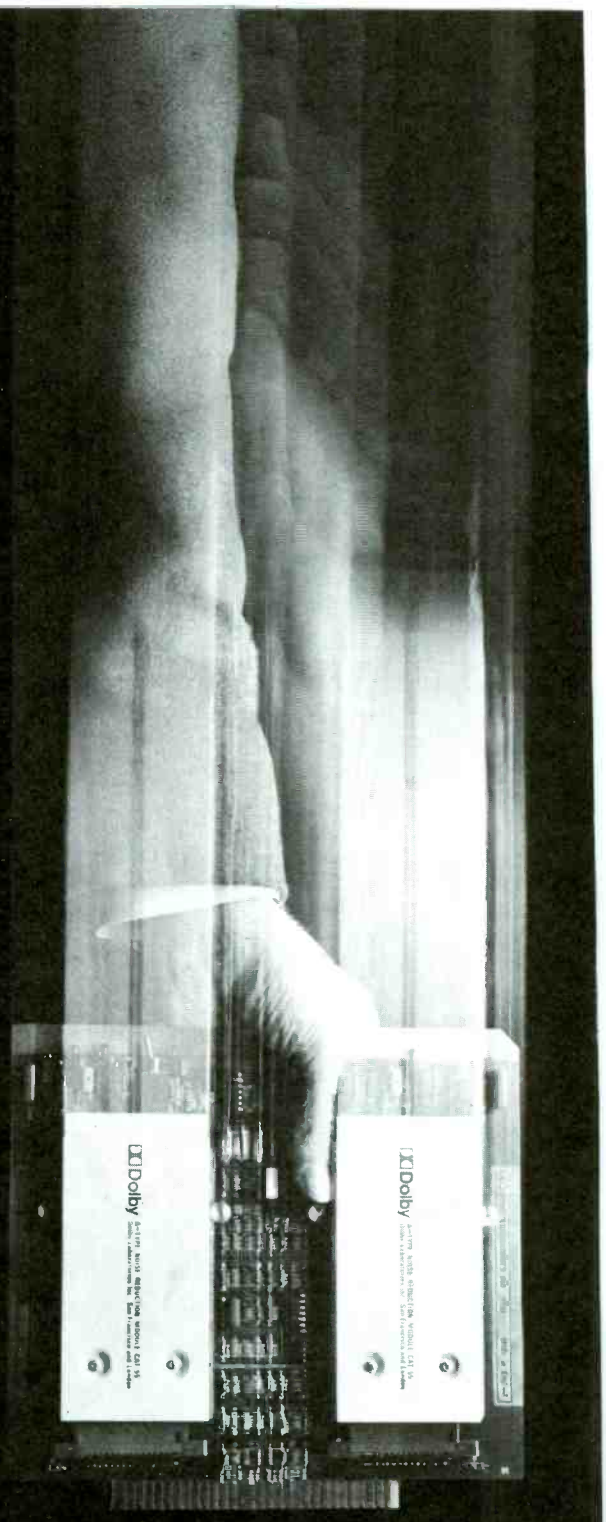

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Dolby A-type noise reduction has been accepted for years throughout the world for high-quality tape recording and other audio transmission and storage media. It provides 10 dB of noise reduction from 30 Hz upwards, increasing to 15 dB at 9 kHz and above, without the audible side effects (such as noise modulation and overshoot distortion) associated with more conventional techniques. Dolby noise reduction can also lead to lower distortion, as it permits more conservative recording levels to reduce the risk of tape saturation.

Today wide audio bandwidth and low noise are becoming commonplace in many parts of the television origination/transmission chain. Contact us to find out how Dolby noise reduction can prevent the VTR audio track from being one of the weak links.

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Kent Jones, station owner, demonstrates use of the Broadcast System terminal located in the control room. This terminal is used to place identification information on carts, as well as for other program automation functions. In all, the station uses three terminals for accounting functions and program automation control purposes.

stalled, and fed it tapes for several hours. Although recording of the event memory was at the mercy of unpredictable tape heads, and the production studio was restricted during this chore, it eliminated the typing marathons. Restoring the ephemeral event memory was merely a matter of feeding in the correct cart tapes.

More improvements

Despite our improvements, I thought that there was a better way. So I went back to my plan for *total automation:* to originate the load list using a log-scheduling business computer and to memorize this list on a faster memory, such as disc drives. The business computer would remember the details of my load list, and it would reload the system when power went down. Furthermore, the business computer would then supervise the performance of the load list and make permanent records of any errors. However, in 1980, such a system still could not be found.

In January of 1981, my plan to automate the Saratoga stations arrived at its second milestone: another automation system was purchased for the AM station. Now, whatever business computer WKAJ/WASM was to select, its task of communications with the program automation had

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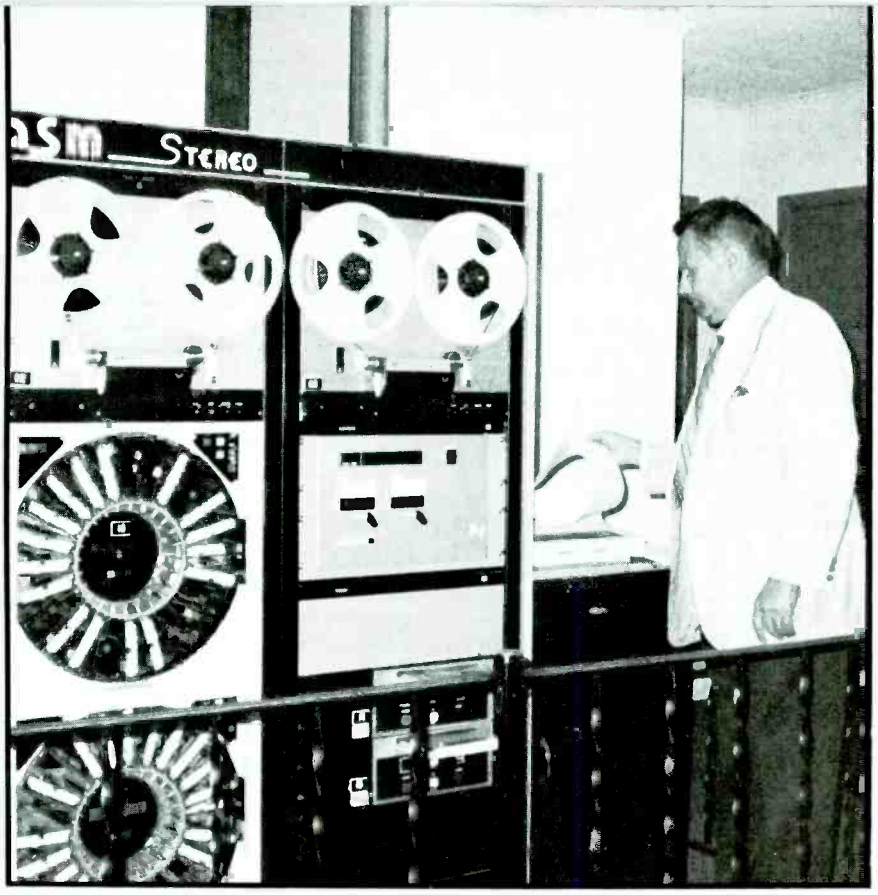


The logger output of the WASM Control 16 is a list of each event performed by the program automation, along with error and diagnostic messages. This same information is also recorded on discette by the Broadcast System for automatic examination.

doubled in complexity.

Just as soon as the FM automation system was installed, programmed and earning money, I began searching for a vender that could properly handle our needs. What I didn't realize at the time was that I should have been shopping for software instead of hardware. So I started with the big suppliers—IBM and others. When asked about their software for handling problems faced in radio, such software was still under consideration. Furthermore, their computers would need a *black box* to communicate with our automation systems. And that interface would be expensive.

It was then that we approached a Kansas City company, Computer Concepts, which specializes in business computer systems for radio stations. They seemed to have the interface already developed to link our business and program automation systems. But that alone was not sufficient. I also wanted to know about vender support, so I checked with other stations that had the Broadcast System from Computer Concepts. The responses were impressive, so, I selected the system I wanted: three terminals and software for traffic, accounting, payroll and general ledger. The problem of talking to the two automation devices was handled with an encoder

Communications in automation

By Walter Dean, production manager, Computer Concepts, Shawnee Mission, KS

The concept of interfacing business and program automation is termed Total Station Automation (TSA) by Computer Concepts. There were sound reasons for using this concept in implementing the WKAJ/WASM plans, including the avoidance of some errors. The author touches on some of the factors considered in integrating his company's Broadcast System into the station's program.

Load list entry errors. Probably the most common errors associated with automation are typos made during entry of the load list. Because the Broadcast System compiles all logs and then loads these logs into the Control 16s automatically, these load-list errors are eliminated.

Billing errors. Another problem common with automation is the large amount of uncertainty associated with billing for spots in which airing cannot be proved. This uncertainty is eliminated because the Broadcast System business computer automatically and continuously monitors log performance by the Control 16 equipment. The system will not bill a customer for any spot that fails to air and, because the system records the exact time that each spot airs, precise affidavits can be provided on demand to any customer. Furthermore, the system automatically flags any missed spots so that they can be rescheduled as make-goods. Thus, the customer is billed only when the spot is aired successfully.

Wrong cart error. Another problem common with automatic cart machines is that operators inadvertently put wrong carts into specific trays. Thus, when such trays are activated, the wrong commercial is broadcast, an error that would go undetected by the automation system. The Broadcast System, however, flags this as a *wrong customer error,* with details on which customer should have aired instead. As with any failure in getting a customer's spot on the air, the system automatically makes a note for the operator that the missed spot should be rescheduled as a make-good. The customer is not billed until that spot is finally aired.

Mechanical failures. The Broadcast System constantly monitors the Control 16s. Any mechanical failure will be reported in the following ways:

- *check diagnostic code*—A memo has been transmitted by the automation that may require attention (such as that dead air has been detected).
- *data is garbled*—Vital data (such as the customer number) has not been properly recorded on a commercial.
- *commercial was not broadcast*—For some reason, the cart refused to play...perhaps because the trip tone was recorded over the stop tone, etc.

Fast load-list dumps. A few automation devices will create a safety copy of their load list (on cartridge tapes, for example) so that the load list can be reloaded in the event of required power-down. Although this approach is better than no protection at all, it still takes several hours to create the tapes, often tying up a production room. Furthermore, in the unfortunate event that the tapes have to be used, it takes the same amount of time to load the information back into the equipment. The Broadcast System, on the other hand, performs this safety backup automatically using a fast Winchester hard disc. This means the entire load list can be reloaded into the Control 16 in a few minutes. Thus, preventive maintenance is more likely to be performed on schedule.

Easy does it.

Available in 2", 1", ¾" and ½" Beta and VHS.

FUJI

The author inspects the controller of the WKAJ Control 16. The performance of the WASM and WKAJ Control 16s is monitored simultaneously by a single Broadcast System. This monitoring is invisible to traffic and accounting users of the system.

interface, from Broadcast Electronics, for the cartridge tape load/dumps. It played traffic cop to route messages between the computer and the Control 16 system. With stockholder approval, I had the system in three months.

The working system

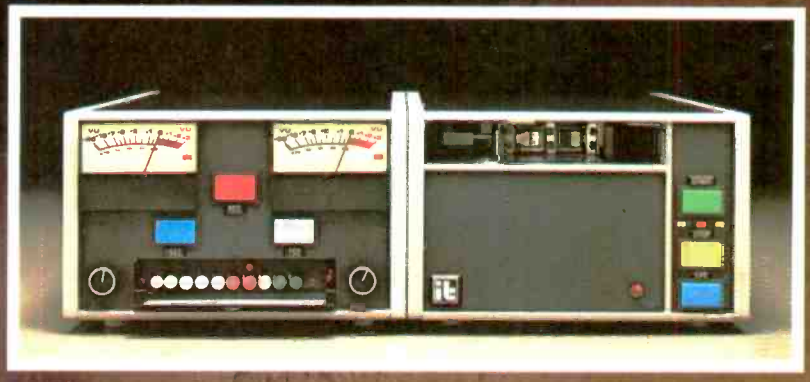
At the time of this writing, the system has been operational for several months, and working well. A recent episode illustrates how well. One evening at about 5 p.m., the close of our business day, a salesperson rushed in with an order that required early morning airing the next day and involved 60 spots of advertising over a 4-week program. For manual systems, such an order might have been impossible to handle. Our system accommodated it in four minutes: two to enter the order into the computer and two for scheduling the morning log. In another two minutes, this log could be loaded into the Control 16s. The hardest thing I did was to assign a source and tray number!

But if the particular order had required airplay right then, I would have merely entered the assigned source and tray number somewhere in the Control 16's subprogram. The computer would catch the spot and flag it for proper billing later on.

As a result of this newly found power, we are increasing our listener base; increasing our billing; and our advertisers are happier, because they are being billed accurately. And finally, our advertisers *know* that the times reflected on the invoices are exact.

Better listening through better design—Series 99B

...Crisp, Clean, Brilliant Sound



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The missing milliwatts

By Rod Wheeler, chief engineer, KSAK-FM, Walnut, CA

Any transmitter works best with a minimum SWR. But, if your power is low, SWR is critical.

Photo: KSAK staff

A Gatesway 80 console serves most needs at the control position of the on-air studio.

We so often hear about the problems of big stations. However, even the smallest, least powerful broadcast station has problems. Among the smallest, as far as I know, is KSAK in Walnut, CA.

KSAK, licensed in 1974, has grown quite a bit in its short history. The station's studios, operated by the Mount San Antonio Community College District, originally consisted of two 12' x 12' offices. One served as main studio and newsroom and the other as production room and office. Recently the facilities have been enlarged to a 30' x 40' area, with the main studio larger than the whole original station. KSAK now has a separate air studio, newsroom, office, meeting room, and production facilities.

In 1974, the station was used five days a week, 14 hours a day, serving several classes in telecommunications. Now, programming has expanded to seven days a week, 24 hours a day, serving the telecommunications department.

This employee turns on your audience *and* your coffee pot

KNEV-FM Operations Director, Steve Grelle, knows the importance of a valuable employee at his Reno, Nevada station.

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HARRIS

Visit Harris at the 1983 NAB, Las Vegas, in the North Hall.

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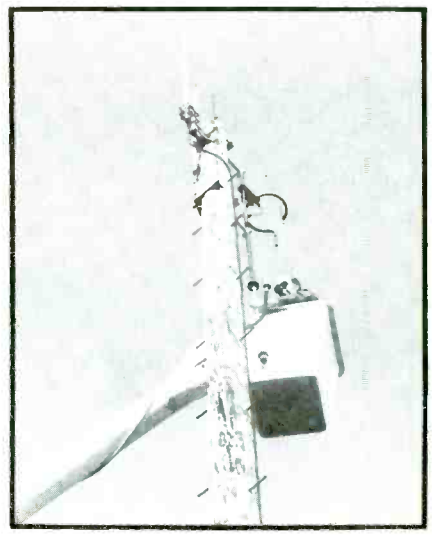
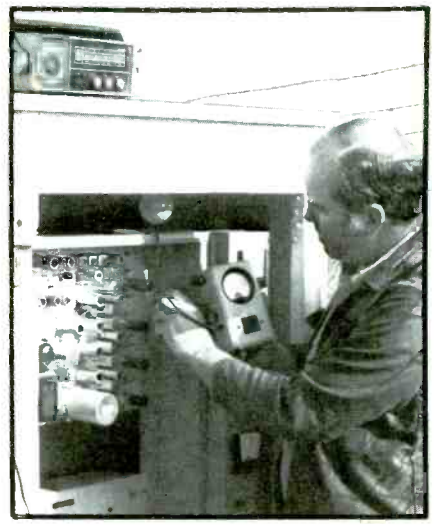
Photos: KSAK staff

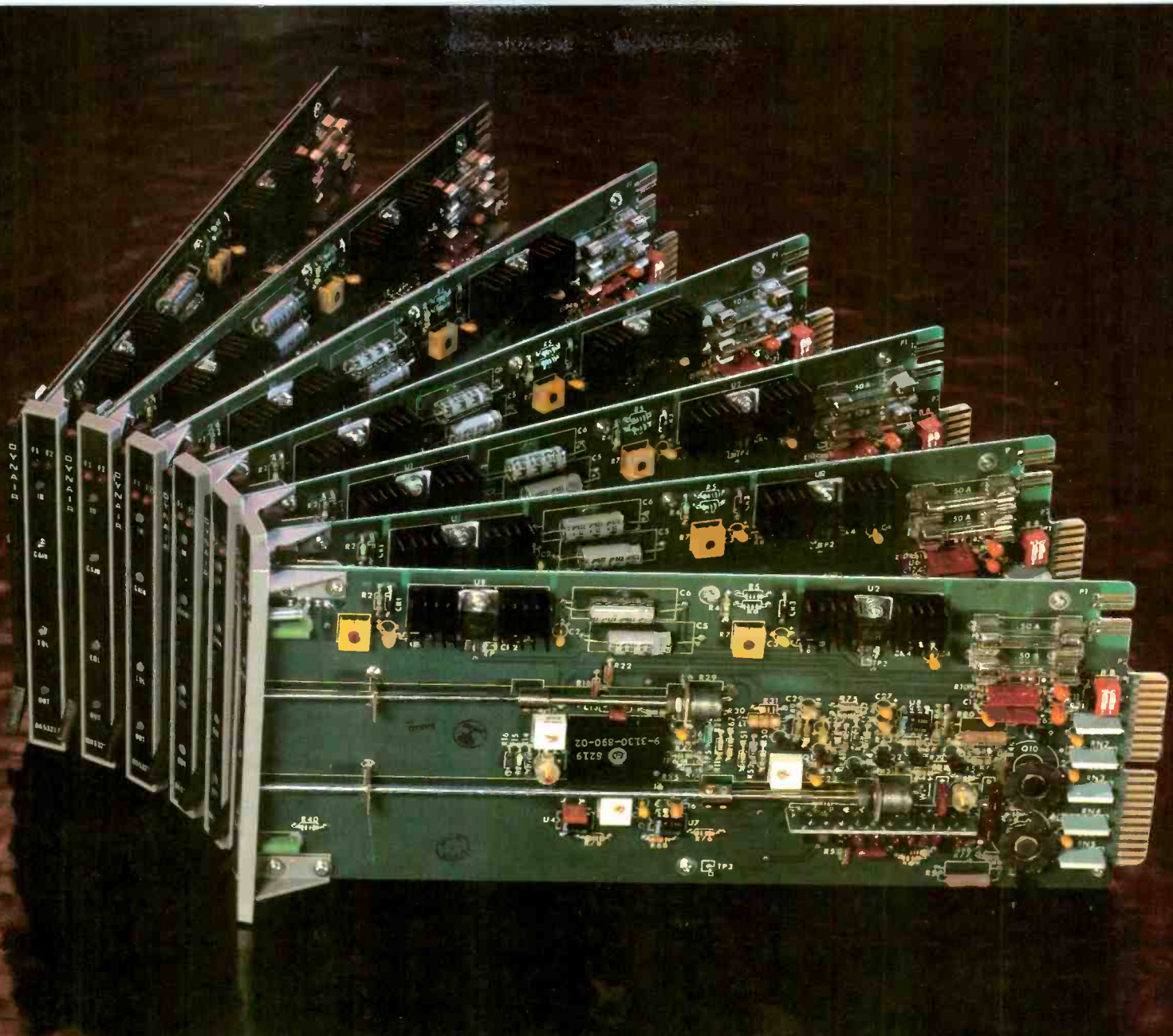
A Bird wattmeter tells the story prior to adjustments—0.6W reflected on the 10W scale.



The author adjusts the Gates FMC-1 antenna from an aerial lift device. The adjusting donut is visible above his left hand.



The author makes final adjustments at the Shadow Mountain antenna/transmitter site.



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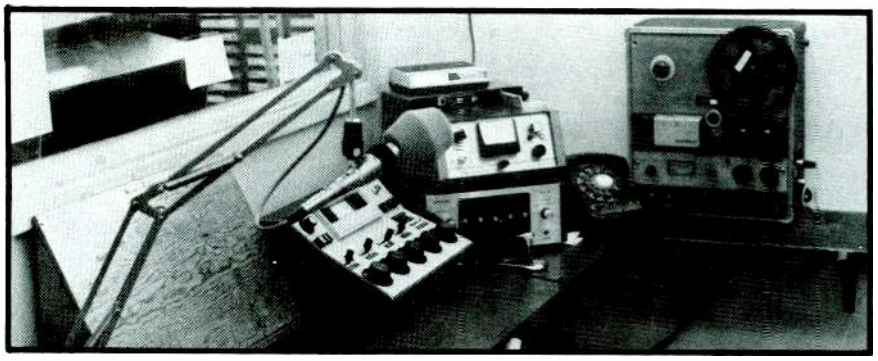
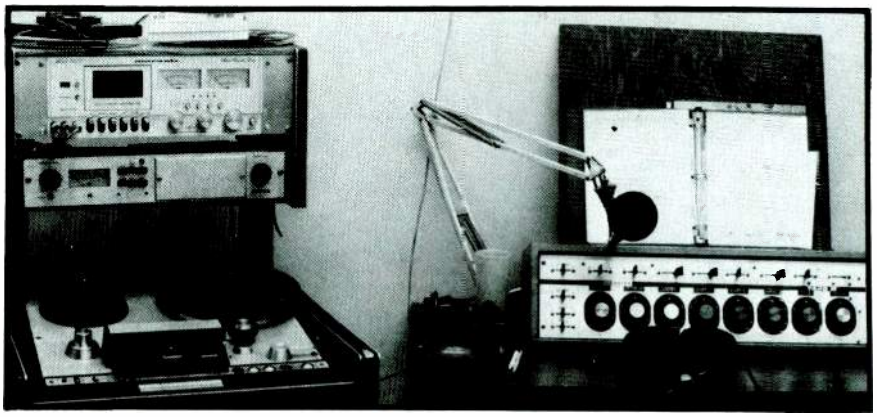
Photos: KSAK staff



A separate newsroom is visually connected with the main studio.



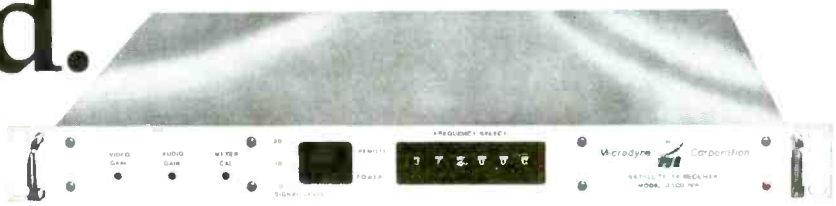
Reel-to-reel and cassette audiotape equipment interface to the production room audio board.

Recently, the power output was improved a little too. Not to say that it's more than 3.5W, but a little closer to it. A mismatch had caused us to have high reflected power. To the average engineer, a reflected power of 0.6W would bring cheers of joy. However, to us, that 0.6W represented 7% of our power. (KSAK runs 3.5W ERP; the transmitter puts out 8.3W; and it has an antenna efficiency of 42%. So, 0.6W reflected out of the 8.3W was 0.25W ERP or a 7% loss.)

The solution was simple: Adjust the Gates FMC-1 antenna for best SWR. A call to Gates obtained the needed instructions. The antenna has a matching coaxial section on its base. This coax section must be disassembled and a "donut" of what appears to be Teflon must be moved onto the center conductor to achieve best SWR. The college provided a Hi-Ranger to get me to the antenna. The coax was disconnected and the inner conductor removed. Then the tuning "donut" was moved. This was done several times until the lowest reflected power was achieved. The final figure was approximately 0.05W reflected.

Well, I could not tell it, but the station manager claims he can tell the difference. It was a good experience, but now to get rid of those 50mW!

Preferred the World Around.



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associations

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Cable copyright decision should stand, broadcasters say

The NAB opposes motions to reverse or stay the Copyright Royalty Tribunal's decision involving its new royalty rate schedule for cable systems carrying distant TV signals, which took effect Jan. 1, 1983.

Motions for stay and reversal were filed in the US District Court of Appeals for the District of Columbia Circuit by the National Cable Television Association (NCTA) and others. NAB has asked the court to deny the requests.

NAB said none of the parties made the strong showing necessary to justify the extraordinary relief they seek. It said they have not demonstrated that they or the public interest will suffer irreparable harm from the orderly implementation of the tribunal's decision, nor is there any significant likelihood that they will succeed on the merits of the petition for review.

FCC should rescind ban on cable/network common ownership

The NAB said the FCC should rescind its ban on common ownership of cable TV systems and national TV networks. In comments filed with the commission, NAB said that there is a substantial, detailed record supporting this position, which is favored by the FCC's Office of Plans and Policy, the special FCC Network Inquiry staff and the Justice Department.

NAB said this record reflects the many reasons why the present prohibition undermines the public interest and why rescinding the rule would produce important public benefits with only a remote risk of abuse. It said that as a practical matter, "the network/cable ownership ban is a solution in search of a problem."

It said that the high level of competi-

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tion that presently exists in cable television would continue after lifting the rule. If the networks are allowed to become cable system owners, they will have to propose multiple channels of diverse programming, including local access and offerings that compete with their own programming, in order to compete successfully for cable franchises, according to NAB.

International board recommends meeting with Japanese

The NAB's International Committee has recommended that the association cosponsor a high level meeting in New York this year with Japanese broadcasters. The purpose, according to Chairman Arch L. Madsen, president, Bonneville Int'l. Corporation, Salt Lake City, UT, would be to "bring together the two free nations most active in international communication."

Many topics were discussed with Kalman Schaefer, assistant to the FCC chairman for international communications, including the following: the implementation of the agreement reached in Rio de Janeiro and the problem of Cuban interference; the forthcoming DBS meeting in Geneva in 1983, which will cover the allocation of orbit locations and frequencies; and the UN Committee on the Peaceful Uses of Outer Space.

The strengthening of relationships with the Inter-American Association of Broadcasters (IAAB), the Asia-Pacific Broadcasting Union (APBU), the European Broadcasting Union (EBU) and other international organizations, was also covered.

Other matters of importance were the progress made in UNESCO's attempts to inhibit the free flow of information, and plans for a major NAB international convention session on April 13.

FCC land mobile report overestimates spectrum needs

The FCC Private Radio Bureau's (PRB) interim staff report on "Future Private Land Mobile Telecommunications" overestimates future spectrum needs, according to the NAB.

In a filing with the commission, NAB said PRB has overlooked new technologies such as amplitude compandored single sideband and has based its findings on current inefficient spectrum occupancy. NAB said that no new spectrum is required to meet the estimated demand as long as new technologies and techniques are employed by land mobile services.

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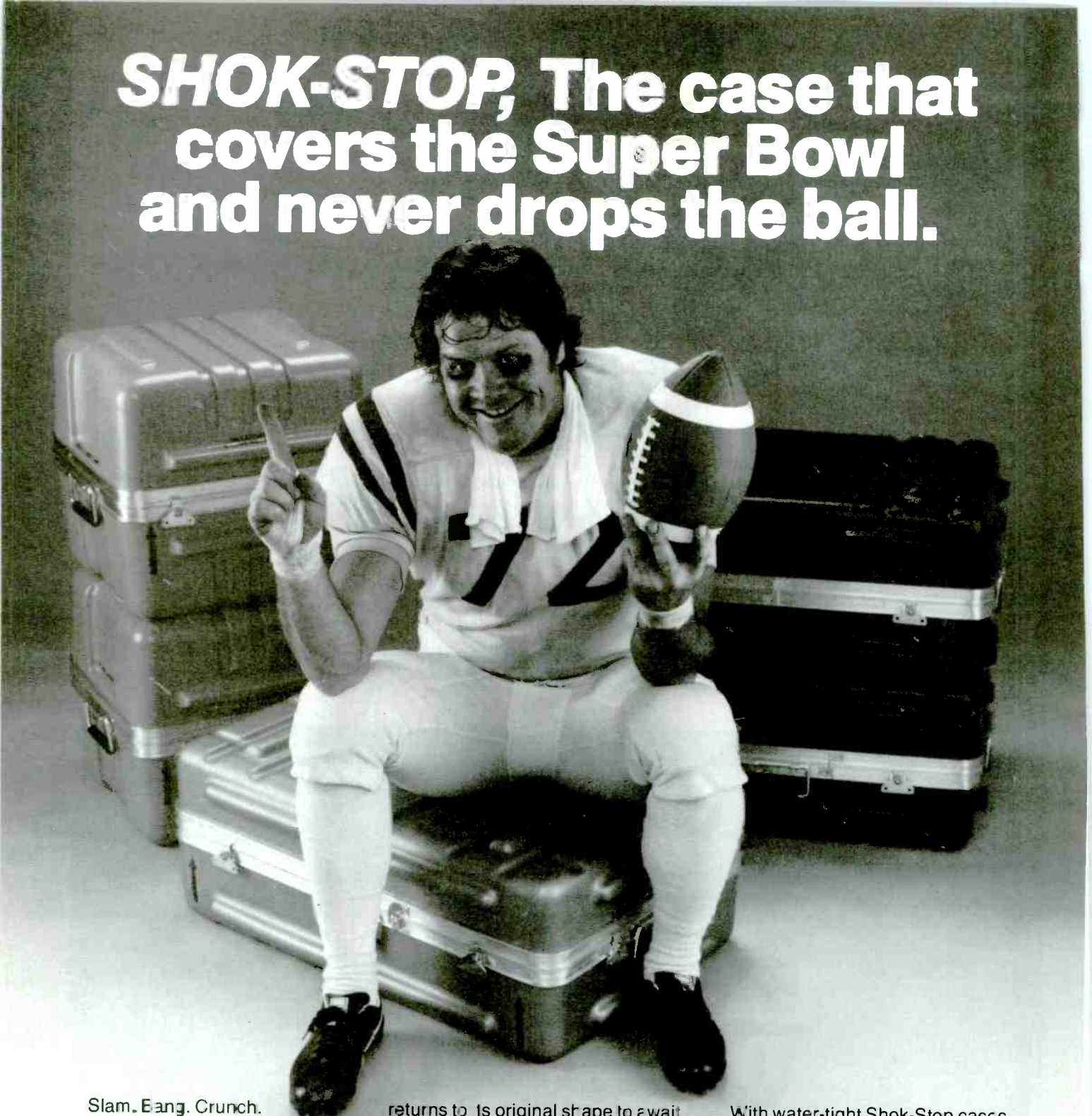

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Deregulation food for thought

Recently the FCC reminded broadcasters that they are licensed to serve the *public interest* rather than their private interests. A radio broadcaster used his station to further his non-broadcast business with a concert promotion. The broadcaster charged himself much less for the commercials promoting *his* concerts than he charged *other* concert promoters in his market when they had concerts to promote.

The commission ruled that the station owner's conduct was contrary to the public interest because he was using his broadcast license in a manner designed to gain a competitive advantage in his non-broadcast business.

According to the NRBA, the commission's deregulation order and the deregulation bills in Congress do not and will not free radio broadcasters from the all-encompassing public interest standard that the Communications Act of 1934 mandates. As long as that standard exists, NRBA said broadcasters will be subject to whatever interpretation of public interest is in vogue with three out of the five FCC commissioners and/or the courts.

Only the full and true deregulation of radio that NRBA seeks and that can only be achieved through legislation will eliminate the current constraints on radio broadcasters. Meanwhile, broadcasters should remember they still are not deregulated. The commission has shown that it is still concerned about the commercial practices followed by its licensees and will punish station owners whose policies, in its view, treat competitors "unfairly."

Accordingly, licensees engaging in non-broadcast businesses on their stations should make certain that their competitors may gain access to the station on the same terms.

Courtesy of ***NRBA Special Report,*** *Nov. 29, 1982*

The Canadian Association of Broadcasters

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CAB recommends face-lift for broadcasting system

Private broadcasters are recom-

Now your ENG units can afford the same "line" microphones bought by every major network!

You can pay as much as $1,500 or more to get a good long-reach line microphone. Or, you can put the new Audio-Technica AT815 in every production unit for under $230 each, or the phantom-powered AT815R for under $300 each.

What you'll hear is performance closely rivalling our more expensive brethren. So close, in fact, that every major network has tried and bought our line microphones. And you'll get some advantages which can be very important in the field.

For instance, the phantom-powered AT815R can interface with supply voltages from 9 to 52 volts without adapters or extra circuits. So you don't have to rebuild present equipment to put it on the air. We also have a neat 2-battery 9V power supply you can use. When one battery is in use, the other is on standby. For your peace of mind.

Our internal-battery AT815 uses a standard AA "penlite" cell available everywhere. And in intermittent use, a premium battery should last about 4,000 hours. That's over a year even if used eight hours every day! Just one less thing to worry about when time is short.

The AT815 and AT815R weigh barely over 9 ounces, to make them easy to "fishpole" or hand hold. And each comes with a foam windscreen which slips on in a second. Our optional shock mount can be added as well. And the AT815R has a bass roll-off switch if needed to control rumble.

Both models are designed to take the rough-and-tumble life of an ENG unit or remote film crew, and keep delivering excellent sound. With the narrow directivity which makes line microphones so useful in suppressing noise and "reaching out" beyond normal mike range.

If you thought line microphones were out of reach of your budget, ask your Audio-Technica sound specialist to show you the AT815 or AT815R. We think you'll agree that the networks are onto something great!

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mending fast action by the federal government to overhaul obsolete broadcasting and copyright legislation so that the whole broadcasting system can cope with the communications revolution.

The CAB made its recommendations, covering radio, television and cable, in a policy paper sent to Communications Minister Francis Fox. The timing of the CAB's release of the paper is before the communications minister's recommendations to the cabinet on broadcasting and cultural policies, and the likely emergence of a government "green paper" in the new year.

CAB Chairman Don Brinton, president of CanWest Broadcasting of Winnipeg, said that work by the association's internal committees has been under way for almost a year to prepare and refine its policy recommendations to the federal government.

With respect to television, the CAB paper recommends incentives, rather than more stringent regulations, to enhance Canadian production. It also insists that broadcasters must have exclusive rights for certain programs in their licensed service areas, if they are to generate the revenues needed to finance expensive new productions.

The CAB also recommends that the role of broadcasters and cable operators be re-aligned. The primary role of broadcasters is to produce programs, and the main role of cable is to deliver those programs, the paper points out. "We believe that cable-originated services should be licensed through a competitive hearing process, with assured access to cable channels for the successful licensees," Brinton said.

Concerning radio, the CAB paper urges early introduction of a single AM stereo transmission standard, equal access to cable for AM and FM stations, and recommends less rigid radio regulations to enable Canadian broadcasters to cope more effectively with new technologies.

The paper also states that private broadcasters favor federal jurisdiction over all forms of broadcasting and suggests that the federal cabinet should have the power to issue broad policy directives to the CRTC, providing that the public has an opportunity to comment before directives are issued.

new products

Degausser

Although the MaxERASE-16 from *Christie Electric* erases computer tapes in 30 seconds each, on a continuous basis, it serves videotape and audiotape users as well. Reels of tape from ¼ to 2½-inch widths and 16-inch diameters may be erased to a −95dB level on materials with coercivities from 300 to 750+ oersteds.

Circle (410) on Reply Card

Signal generator

The SG 505 Option 2 signal generator from *Tektronix* duplicates the standard SG 505 operation with an additional high level, fully balanced output at 50Ω, 150Ω or 600Ω. The generator continues to operate with the AA 501 distortion analyzer to extend THD measurements with minimum operator adjustments.

Circle (411) on Reply Card

Video recorder

The Frezzi On-Cam FOC-1 VTR from *Frezzolini Electronics* attaches to a variety of cameras with a standard Anton/Bauer battery bracket, providing camera operators freedom from cables. Based upon the JVC VHS C Format recorder, Frezzolini has made modifications allowing the new mounting system.

Circle (412) on Reply Card

Audio mixer

The 5990 broadcast mixer has been designed by *Integrated Sound Systems* for remote use or radio production applications. Three independent, modular input sections accept a phono and line-level input with 3-band equalization, volume control and stereo send/receive capability.

Circle (413) on Reply Card

Encoder

Associated with the model 501 Sync Proc, the new encoder from *Grumman Aerospace* provides YIQ video for direct recording of RGB graphics generators on ½-inch videotape. The encoder will also allow encoding an audio channel into video for multichannel TV sound.

Circle (415) on Reply Card

ENG battery

A replacement for the BP90 battery is available from *Portable Energy Products*. For use with Sony BVU portable VTRs and BVP portable cameras, the PEP BP90 replacement includes nicad cells and is rechargeable on existing Sony BC-210 fast chargers.

Circle (416) on Reply Card

Machine controller

Designed for broadcast, LPTV, industrial and CATV applications, the C-150 automatic VTR machine controller/commercial ad inserter from *Microtime* uses vertical interval switching. One C-150 will control up to four machines, based on manual instructions or encoded tones. A TBC interface allows TBC mode control as well.

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Power amps

The *QSC Audio Products* series one power amplifiers are for discriminating users wanting superior audio performance. Model 1400 is rated at 200W output per channel, driving 8Ω, with a 20Hz-20kHz response and 0.1% THD performance. Input impedance is 20kΩ balanced or unbalanced. Crosstalk is −75dB.

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LNBC24

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

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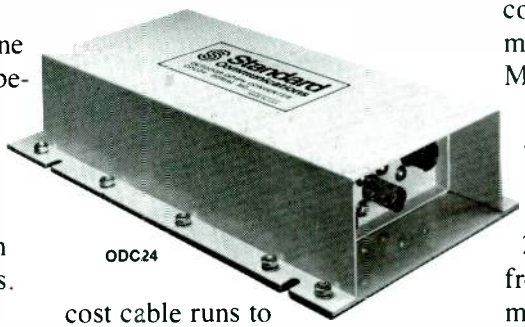

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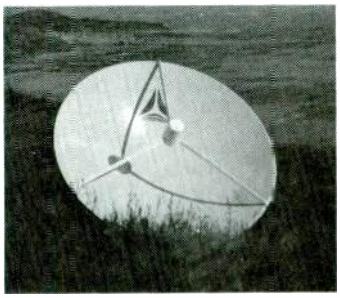
Use our ODC24 Outdoor Down Converter with our Agile 24S slave receiver to block downconvert microwave signals from 3.7 to 4.2 GHz to 760 to 1260 MHz. By mounting the ODC24 on the LNA, longer cable runs to the receiver using low cost cable are possible. The ODC24 also features 16 dB conversion gain, and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

Earth Station Antenna



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

Our MIF 24/60 and MIF 24/80 filters remove interference from telephone microwave transmissions and plug directly into the

Microwave Interference Filters

Agile 24 receiver for 60 MHz and/or 80 MHz filtration of the 70 MHz IF stream.

Standard can put you in the TVRO business or improve the quality of your service right now.

Standard Communications

P.O. Box 92151
Los Angeles, CA 90009-2151
213/532-5300

...the TVRO System people

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new literature

National Association of Broadcasters
– Industry report: "Radio Today – and Tomorrow," (75 pages), $20 for members, $60 for non-members.
Circle (430) on Reply Card

Comprehensive Video Supply
– 1982 Catalog: "The Complete Book of Professional Video Accessories," (164 pages), $5.
Circle (431) on Reply Card

Siemens Components
– Application note: "Control IC's TDA 4700/4718 for Switched-Mode Power Supplies," (35 pages), free.
Circle (432) on Reply Card

Comsearch
– Service note/data sheet: "Receive-Only Earth Station Coordination," (2 pages), free.
Circle (433) on Reply Card

National Association of Broadcasters
– Book: "Buying or Building a Broadcast Station," (78 pages), members, $10; non-members, $30.
Circle (445) on Reply Card

Beckman Electronic Technologies Group
– Catalog: "1982 Short-Form Catalog" (components), free.
Circle (438) on Reply Card

Fiberbilt
– Pamphlet: "Protective Shipping Cases, Catalog 182A," (6 pages), free.
Circle (439) on Reply Card

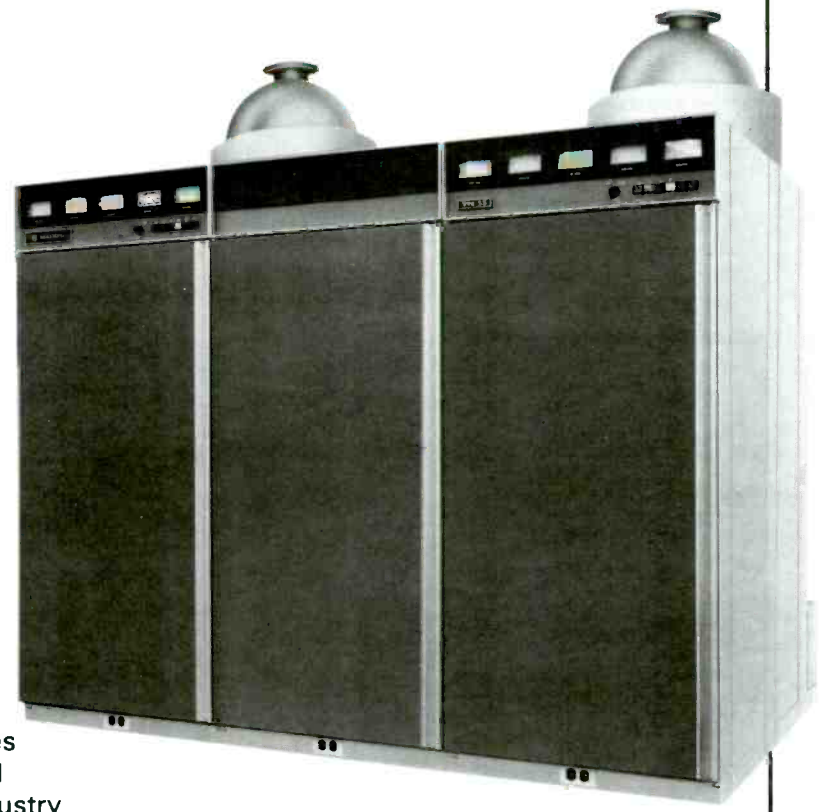
Comsearch
– Booklet: "LPTV Tier Study Booklet," $50.
Circle (440) on Reply Card

National Association of Broadcasters
– Report: "Cellular Radio: A Business Assessment for Broadcasters," (26 pages), members, $5; non-members, $15.
Circle (441) on Reply Card

Bird Electronic Corporation
– Catalog: "MobCat-82, Mobile Communications Support Test Equipment," (20 pages), free.
Circle (442) on Reply Card

New Series "E" transmitters from Harris . . .

Improved efficiency, superior performance over any previous UHF-TV transmitters!



The "E" is for efficiency in the new Harris Series "E" UHF-TV transmitter line...efficiency that can save you thousands of dollars annually in power costs (typically $10,000 per year for a 55 kW transmitter).

These features are standard in each of the new "E" models:

- Variable visual coupler for higher klystron efficiency.
- "H" type 5-cavity high efficiency klystrons.
- Mod Anode Pulser to reduce input power requirements.
- 100% waveguide diplexer to minimize high power RF losses.

The new VIDEO* SAW filter eliminates conventional receiver equalizers, and offers the best performance in the industry with absolutely no costly and time-consuming periodic realignment.

A new and unique Quadrature Corrector compensates for several types of klystron non-linearities to supply the quality of transmitter performance required by modern receivers and subscription television decoders.

Save with Series "E"...today's best value in UHF-TV transmitters. Available in 30 kW, 55 kW, 110 kW and 220 kW models.

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

*Visual IF Delay Equalized Output

Visit Harris at the 1983 NAB, Las Vegas, in the North Hall.

HARRIS

Circle (116) on Reply Card

Editorial

Continued from page 10

On the other hand, he acknowledges that traditional boundaries between printed and electronic words are becoming blurred. *The New York Times*, for instance, takes to the airwaves each night via satellite to publish in Chicago, California and Florida. Similarly the *Wall Street Journal* and Gannett's *USA Today* also use such technology.

So newspapers are already into radio and television, but thus far they have avoided the heavy hand of government. Not so with traditional broadcasters. And therein lies a considerable contradition in objectivity in this situation. As Sulzberger notes, "While most newspaper publishers believe in *fairness*, we have as yet no obligation to publish opposite sides of an issue, nor are we obliged to make space available—neither editorial nor, for that matter, advertising space—for other views. Frankly, we can be as biased or unfair as we wish."

NAB-'83/Las Vegas could become a focal point for broadcasters to marshal their forces in the battle for freedom to communicate. So be prepared to do your part. Study this situation and be ready to step forward to express your view if called upon, either at the convention or in any other directions that should arise.

Communication is not unilateral. Each month **Broadcast Engineering** strives to bring you the information you want and need. As we assemble an issue, we draw on widely varying backgrounds in the journalism and broadcast spheres. Objectivity is a key to our work, but we do have opinions, and so do you. This editorial page is our soapbox to air opinions on current issues.

But the communication loop will not be complete without your participation. Give us your comments on our opinions, as well as your thoughts on other topics. Our *Feedback* column will include some of your responses. Through this interaction we will better serve you, perhaps even solve a problem or two with the discussions. Opinions that differ from our own are welcome, and so are confirmations on key issues.

Address comments to: The Editor, **Broadcast Engineering,** P.O. Box 12901, Overland Park, KS 66212.

QUALITY STANDS OUT

In UHF-TV tetrodes, there's just one name: **THOMSON-CSF.**

- for high gain, exceptional linearity and matched coaxial-cavity circuits,
- for optimum performance in combined video-and-sound-carrier amplification,
- and for proven reliability and long operating life, it's THOMSON-CSF.

Typical of this exceptional product line, the **TH 347,** an ideal choice for 1 kW UHF-TV transmitters/translators.
In its TH 18363 circuit, it operates all the way up to 860 MHz in $\lambda/4$, with sufficient gain to allow a single-tube design.
One more excellent reason we say "THOMSON-CSF. a name to rely on!".

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CG 4988

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business

US TV to Australia

The first 24-hour-a-day international TV service via satellite was launched late last December. Programming, originating from studios in Hollywood, CA, is sent to Santa Paula, CA, where a COMSAT 13m antenna uplinks to the INTELSAT Pacific Ocean satellite. The signals are received via an 18m antenna in Sydney, Australia, for use by Channel 9 and the Nine Network of Australia.

Russell Watkins, president, Channel 9 Australia, a US-based subsidiary of Publishing and Broadcasting Ltd. in Sydney, said, "This new and innovative service marks the beginning of a valuable cultural and social link between Australia and the United States. News, entertainment and sports programming from the United States on a full-period basis will expand the viewing choices for the Australian audience. The immense physical separation of our two countries was lessened with the inaugeration of the Nine Network of Australia."

COMSAT World Systems Division, which provides the satellite facilities for this venture, is the officially designated US participant in INTELSAT.

East Coast offices opened

Via Video, Cupertino, CA, has announced a new East Coast sales and service office for its System One videographics equipment and related products. System One capabilities include real time frame animation, stop-frame animation, multiple type fonts, hard copy or transparency production and direct output to video through the NTSC-1 encoding technology.

The new offices, under the direction of Peter Clark, vice president of marketing, are located at 575 Madison Ave., New York, NY 10022.

Tektronix launches first dealer program

US customers of Tektronix are now able to purchase some of the company's leading TV test and measurement equipment through the convenience of selected professional video dealerships (PVDs). As a complement to the existing direct sales organization, the Professional Video Dealer program offers customers the benefit of buying Tektronix TV products from dealers or Tektronix sales engineers.

For now, the dealerships will concentrate their efforts on the *low technology* products that require little application support, and the sales engineers will continue to focus on the high technology products. Both organizations can and will handle all products in between.

Although the dealers will primarily handle low technology monitoring products, customers will find dealers have similar technical competence and integrity that they find in Tektronix' sales engineers. "Not just anyone gets to be a Tek PVD," Austin Basso, marketing manager for the Communications Division, said. "We've limited the number of possible dealerships, and we'd like to think we've got the top 60 or so out of the hundreds of dealers who've applied so far."

After being invited to apply for PVD by the area Tektronix sales engineer, a potential dealer must go through an extensive application and selection procedure. The dealer's type of business, territory, service policy, sales force, credit worthiness and business references—among other things—are all carefully reviewed by the area regional sales manager. Final selection and appointment to a PVD is done by a marketing selection committee in Beaverton, OR. (See Table I for list of current dealers.)

Because dealers carry a wide and varied product line,

Now, I can program, air and control station breaks, local commercials—in fact totally automate my station's scheduling needs 24 hours a day with just the touch of a finger.

Unlike costly 2" video cart machines—this automatic multi-deck random-access video cart system developed by Lake is compact, modular and has the flexibility I need. It was a turn-key system.

I had a choice of formats: U-Matic/Type M/Type C. La-Kart is expandable and capable of controlling up to 30 machines. It features automatic frame accurate switching—plus, total redundancy. Best of all, it reduces tape costs, programming time—and even cuts my overhead by freeing operators to perform other duties.

La-Kart. It's the affordable system for the cost-conscious station manager.

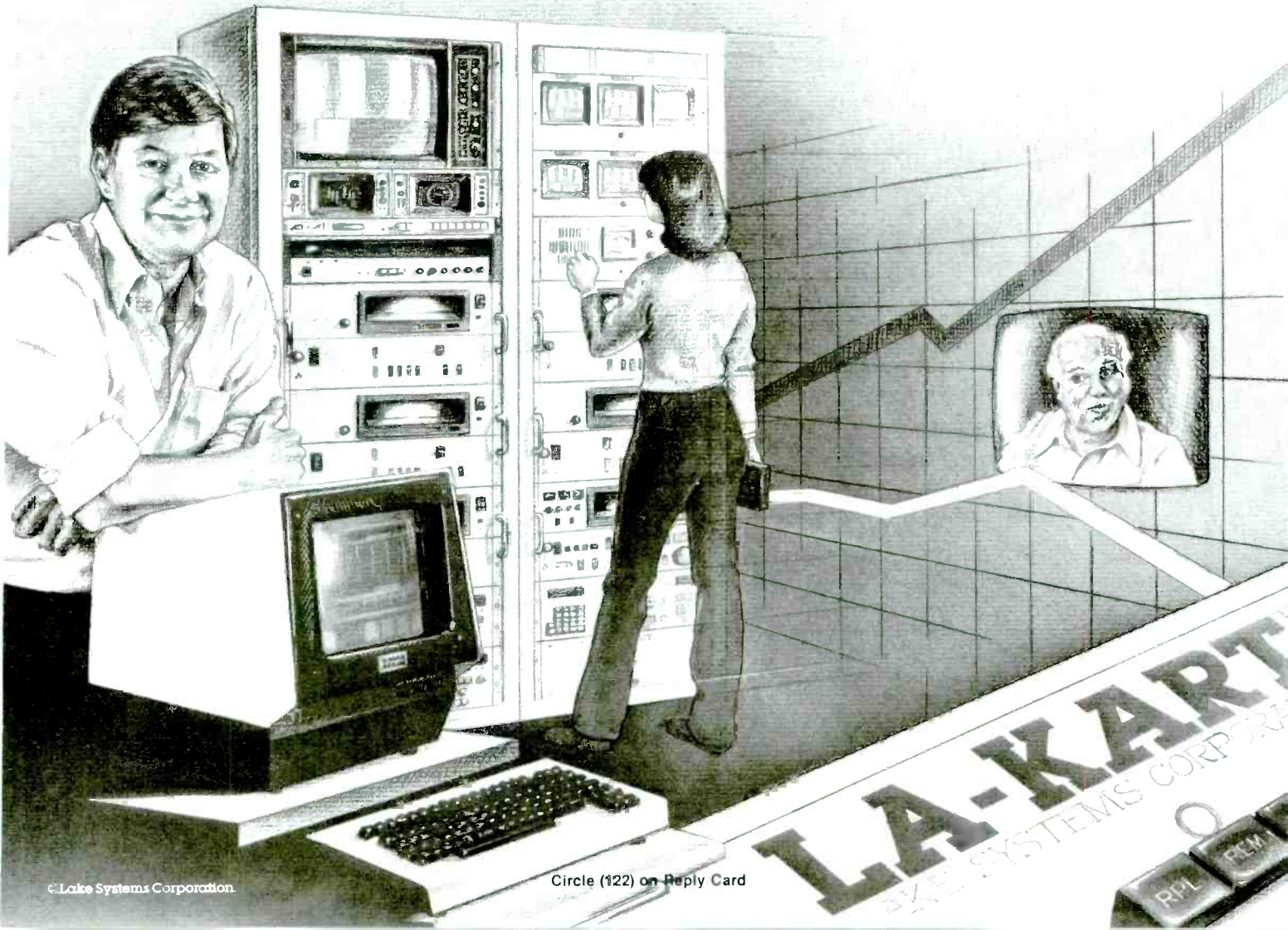
For the La-Kart representative nearest you please contact: Lake Systems Corporation, 55 Chapel Street, Newton, MA 02160 (617) 244-6881 TWX 710 335-1639. The La-Kart Series I shown is $94,500.

LAKE
LAKE SYSTEMS CORPORATION

The Systems Company

"La-Kart™ Does Everything Except Bring Me My Coffee"

Jim Boaz, Station Manager
WXXA-TV/New York



Circle (122) on Reply Card

customers who want to interface their Tek equipment with other manufacturers' equipment will be able to draw on the dealer's expertise when configuring their systems.

Dealerships will receive the latest applications and support literature. All products sold to dealerships are backed by the same warranty users would get if they bought directly through Tektronix. Because of the shift in product focus, sales engineers will now be able to spend more time with customers on site—determining the customer's needs and providing greater application support.

Because Tektronix will be able to penetrate more markets at relatively lower cost, customers can expect the benefit to be passed on in the form of increased service and sales support from their local sales engineers.

Table I.
Tektronix authorized professional video dealers

ALABAMA
Pro Video Systems

ALASKA
NVS Systems

CALIFORNIA
Broadcast Marketing
California Video Sales
General Electric Systems
Hoffman Video Systems
Merlin Engineering Works
Omega Video
Pacific Video Products
R. E. Snader & Associates
Tri-Tronics

COLORADO
Ceavco Audio-Video
Video Teknix

FLORIDA
Florida Video Systems
Hubbard Communications

GEORGIA
Gray Communications Consultants

ILLINOIS
Harris
Roscor
Swiderski Electronics

MASSACHUSETTS
Cramer Video
Lake Systems

MARYLAND
Professional Products

MICHIGAN
General Television Network
Thalner Electronic Labs

MINNESOTA
Emmons Associates
Todd Communications
Video Midwest

MISSOURI
TV Engineering
Video masters
VMI Company

NEW JERSEY
AF Associates
Central Dynamics
Landy Associates
Tele-Measurements
Turner Engineering

NEW YORK
Camera Mart
Camera Service Center
Laumic Company
MPCS Video Industries
Reeves AV Systems
Sonocraft

NORTH CAROLINA
Technical Video Systems

OHIO
Kavco
Midwest

OKLAHOMA
Diversified Electronics Communications

OREGON
Videosonics

PENNSYLVANIA
Alpha Video & Electronics
Electromedia
Lerro Electrical
Pierce-Phelps

TEXAS
Auta-Tronics
Broadcast Systems
Magnetic Media
MZB & Associates

UTAH
Skaggs Video Sales

VIRGINIA
AVEC Electronics

WASHINGTON
Bennett Engineering
Custom Video Systems
Northwest Electronics

WISCONSIN
Video Images

Viacom licenses four films to China

The licensing of four feature films to China Central Television in Beijing, Peoples Republic of China, has been announced by Robert L. Glaser, president of Viacom Enterprises.

In making the announcement, Glaser said, "We first met with Xu Chuang Cheng and the Chinese Delegation

in New York City, and further negotiations were entered into at MIFED in Milan with Madam Zheng Wei, deputy manager of China Central Television. We were pleased to find them receptive to the sensitive human interest storylines which each of these films illustrate, and feel that this agreement marks a significant cultural communications link between our two countries."

The features that China Central Television will broadcast are *Larry, Queen of the Stardust Ballroom, I Love You—Goodbye*, and *Miles To Go Before I Sleep*. There are now 10 million TV sets in China.

CBS station receives simultaneous reception

WTVH-TV 5, a Meredith Broadcasting unit, has announced plans to install a Simulsat 7m equivalent earth station for its location in Syracuse, NY. The Simulsat system, designed and manufactured by Antenna Technology Corporation, allows the CBS station to receive network programming as well as a variety of supplemental feeds from any and all satellites, simultaneously. Although the station can air live satellite feeds, it is also able to tape feeds being delivered via different satellites with one earth station.

Orrox-Satcom merger completed

Orrox Corporation (ASE-ORR) has completed the merger of its Satcom subsidiary into the parent company. Satcom now becomes a wholly owned subsidiary of Orrox, which previously held an 82.5% equity interest.

Dr. Bernard Jacobs, previously chairman of Satcom, becomes a vice president of Orrox Corporation and remains chairman of the Satcom subsidiary. Philip Arenson, previously president of Orrox, becomes president and chief executive officer of Satcom.

"This merger now allows us new opportunities to move forward with the Satcom venture," Arenson said. "DBS will be a huge market both here in the United States and abroad. With the merger, Orrox shareholders will now benefit from the whole of Satcom's expected successes. Orrox can also move forward now, knowing that the strategies and directions of Satcom will be in full accord with the objectives of Orrox shareholders."

The Satcom subsidiary of Orrox Corporation manufactures 12GHz satellite-to-home TV receivers. Through its CMX Division, Orrox also manufactures computer-assisted videotape editing systems.

Agfa Video Tape appoints Miller

Agfa-Gevaert Magnetic Tape Division has announced the appointment of L. Matthew Miller Associates Ltd. as an authorized distributor for Agfa Video Tape.

Basys moves home office

Basys has recently moved to 2685 Marine Way, Mountain View, CA 94043; 1-415-969-9810. In announcing the move, the company also introduced the opening of its London office. The new office is Basys Int'l, Inter City House, 16 Mortimer St., London W1P 4DE; 01-637-2424, Ext. 2495.

Harrison Systems available in Southern California

To better support the film and TV production industry in Southern California, Harrison Systems has announced that Everything Audio wil be exclusive representatives for the MR and TV series audio consoles. Harrison Systems of Nashville, TN, will continue to support its equipment users through its factory West Coast office, manned by Ken Fay at 1-213-622-0331 or 1-415-441-4945. Everything Audio, Encino, CA, may be contacted at 1-213-995-4175.

The most advanced editor now costs less than stripped-down units.

Mach One® Series II from Bosch-Fernseh. The fastest, easiest-to-use, and most powerful videotape editor on the market.

Now, we're making it the most affordable editor.

Less is more.

Series II is our second generation Mach One system—with a combination of advanced features no other computer-assisted editor can match. Regardless of cost.

Features like **dual-channel audio control** to give you independent control over two separate audio tracks plus the video channel.

Variable speed control to let you select any of 16 shuttle-jog speeds in either direction.

Programmable slow motion to let you program your selected speeds in the edit list—with the sequences completely repeatable.

Updated edit list formatting to give you 6-digit alphanumeric reel numbers and various other edit list features.

Cluster-event programming to let you program complicated multiple events in a "cluster" treated as a single event—and preview or record in one pass rather than event-at-a-time.

Screen highlighting to brighten the edit line you're working on while dimming the rest of the screen—so you'll never strain your eyes or your nerves, and never lose your place.

There's no comparison.

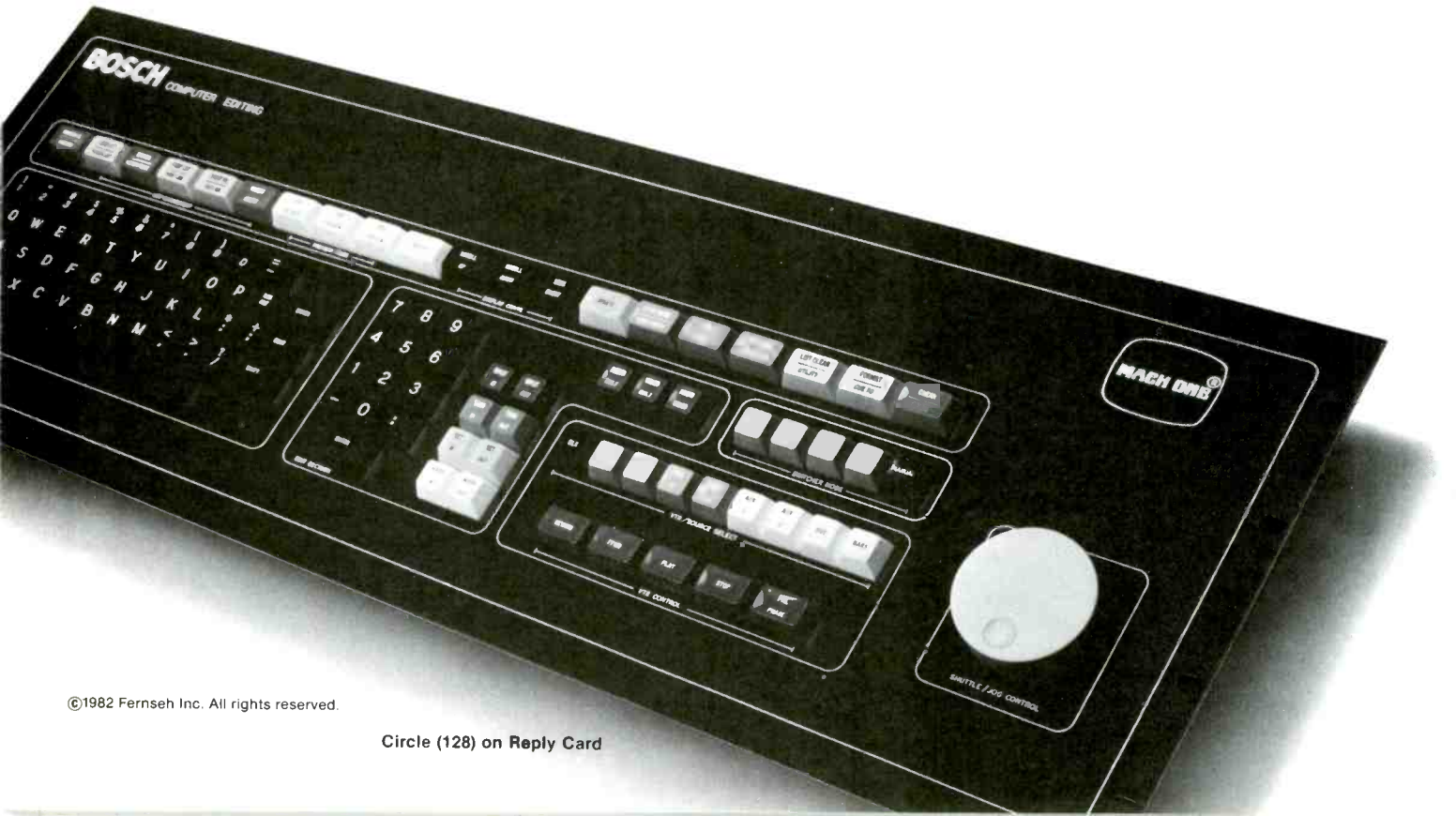
Despite all its power, all its speed, all its capability, Mach One Series II costs less than many stripped-down editors. And *far* less than any remotely comparable system.

Second best—or second generation?

Now you don't have to settle for less editing power than you need because your budget can't handle your first choice. We're making the choice easy. You can have the second generation instead of the second best.

Your local Bosch-Fernseh office has full details. Call them. Or get in touch with us directly: Fernseh Inc., P.O. Box 31816, Salt Lake City, UT 84131, (801) 972-8000.

BOSCH



Circle (128) on Reply Card

people

Ben Forrester has been appointed a vice president of Anixter Communications. Forrester comes to Anixter from Scientific-Atlanta, where he was most recently national sales manager.

Peter Kehoe has been chosen to fill the position of field service engineer at Studer Revox America's New York office. Kehoe previously served as a maintenance engineer at the Hit Factory recording studio in New York.

WFSB honorees

WFSB Channel 3 celebrated its 25th year of operation with special recognition given to 14 employees who joined the station in its first year of operation, and who also are celebrating their 25th anniversary with the company. Shown (left to right, sitting): engineers **George Dawson, Arthur Masthay, Raymond McDonald** and **Stuart Babcock;** director **Jack Guckin.** Shown (left to right, standing): engineers **Harry Levine, Bill Conticello, Ed Derry, Dick Oeser, Alastair MacDonald, Dick Heinze** and **Ed Gracyalny.** Not pictured are **Mickey Gentile** and **Ed Walsh.**

MZB & Associates has announced that **Betty Dirham** has been named marketing manager; **Rich Hajdu,** previously broadcast sales manager, has become area manager; and **Bill Ludwig,** formerly with Victor Duncan, has been named regional manager for Oklahoma.

Robert Manahan has been promoted to regional manager; **Jay Crane** has been appointed to the newly created position of manager of network accounts in the Western region; and **G. Alfred Dodds** has been appointed Midwest regional manager, Sony Broadcast Products Company. Manahan was formerly director of marketing for Compact Video and a regional manager of Amperex Electronics Corporation. Crane has spent the past 13 years with Sony Corporation of America, and is a recipient of the Sony Samurai Award for his sales achievements as Sony Broadcast's Western regional manager. Dodds will be responsible for directing sales activity in a 13-state region.

Tony Satariano has recently been appointed Eastern regional sales manager for Crown International. Satariano's experience includes service with Electro-Voice, InterAudio Systems and Koss.

More than 50 UK film industry executives attended a cocktail party in Denham, England, in October to mark the retirement of **Ron Haig** from Lipsner-Smith. Haig had been vice president of the company. |:-)))|

ad index

Coming events

March 17-22
National Association of Television Programming Executives (NATPE) 20th Annual Conference, Las Vegas Hilton, Las Vegas, NV

April 10-13
NAB 61st Annual Convention, Las Vegas Convention Center, Las Vegas, NV

April 17-21
NPR Annual Conference, Hyatt Regency, Minneapolis, MN

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

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

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

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Classified columns are not open to advertising of any products regularly produced by manufacturers unless used and no longer owned by the manufacturer or distributor.

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EARN EXTRA $75.00 PER HOUR or more. For Sale—G.E. searchlight. Very good condition, great for promotions. Al Cornella, 605-348-4684. 2-83-2t

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SONY EQUIPMENT—one VO 2600, one TT 100, two VP 1100, one SL 8200. All in excellent shape, Call 1-800-382-2723 and ask for Rosemary. 2-83-1t

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THE SOURCE FOR QUALITY CABLE AND Connectors. Video Cable, Audio Cable, BNC Adapters. EX.: Equiv. Beldon #8281, $295/M, UG-255/U BNC male—UHF Female, $1.95 ea. Call for catalog. C2 Labs, 55 Railroad Ave., Garnerville, N.Y. 10932, (914) 947-1554. 11-82-tfn

IVC 7000P CAMERA with tubes, mini-control unit, auto iris, two 200 foot cables, one 100 foot. Angenieux 15 two 1 zoom lens, body support brace. Never used on mobile. Call Bob Canaday at (515) 255-2122. 12 82-6t

HITACHI VCR, FP-1020 PORTABLE CAMERA, SV-340 VCR, OP-1020 operation panel, power belt and charger, IFS-2860 infielder. Call 714-986-6861 after 4:30 or weekends. Ontario, Calif. 2-83-1t

FOR SALE: (3) RCA TK-76B cameras, each with 15x9.5D1 Angenieux zoom lens with remote operation adaptor kits, 5" studio viewfinders, AC power supplies, and shoulder pads. $12,000 each. Call Bob Swayze, WJRT-TV, 2302 Lapeer Rd., Fling, MI., 48503, (313) 233-3130. 2-83-1t

1) **ONE HARRIS 2.5 KW** transmitter; 1975, $10,000.00. 2) One Harris MS-15 exciter, $2,000.00. 3) One Harris TE-3 exciter, $500.00. 4) One Harris 3 bay antenna. 92.1 MHZ, $1,600.00. For further information call Bill Pearl, WNGS FM, 305-844-6343. 2-83-1t

COLOR CAMERAS—2 JVC KY2700 w/10x1 lens, etc. $4750.00/obo. Panasonic series 700 ¾" editing system with two decks $12,500.00/obo. 213/639-6470. 2-83-1t

BOSCH FERNSEH KCN 40 portable broadcast camera with Canon 10:1 only $4995. Sony BVU 100 $1650. Sony VO 3800 $995. Complete Portable SEG package with triple monitors, SEG, M-67, much more only $3500. (212) 843-6839. 2-83-2t

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Individual will provide digital engineering for the STC LSI descrambler module development and function as the STC technical representative during LSI design and production. Individual will supervise the following: design and production of STC encryptors for the Broadcast Center, product improvement projects, and implementation of the STC Broadcast Center Monitor and Controls Systems.

Position requires knowledge of circuit design, D/A and A/D converters, digital telecommunications and video techniques and LSI design, plus 9-12 years of experience with design and production of digital circuits and LSI implementation.

SENIOR BROADCAST ENGINEER — BSEE

Individual will play a major part in design, specification and implementation of broadcast systems to be incorporated into STC's Broadcast Center complex. This will include extensive and advanced automated program facilities, editing facilities, and program production facilities. This individual will also be involved in equipment evaluation and selection as well as participate in industry development of emerging new technologies such as teletext and high definition television.

Position requires a minimum of 5 years of broadcast project experience. Candidate should have established familiarity with state-of-the-art broadcast video equipment and technical standards. Design, testing and implementation of complex video systems using latest construction techniques is also required.

SENIOR SYSTEM DESIGN AND DEVELOPMENT ENGINEER — BSEE, MSEE

Individual will participate in the design and development efforts at STC in the area of baseband signal processing and signal design for the video, audio, data and control information related to STC's signal format. This individual will prepare system technical requirements and specifications for the DBS Home Terminal signal processor; exercise computer and analytic models and develop various baseband signal processors for DBS Home Terminals; and develop test and evaluation plans for subjective and objective video tests of signal processing prototypes.

Position requires 5 years of video-signal processing experience. Candidate will be familiar with the state-of-the-art and be able to do independent design and development work.

SENIOR TELEVISION SYSTEM ENGINEER — BSEE, MSEE

This is a key position in the engineering group that is responsible for advanced television system technologies, including the research and development in video-signal processing and high definition television/enhanced definition television. The engineer in this position will also participate in high definition television transmission experiment through satellites. This individual should have a record of accomplishment in digital and/or analog television signal processing so as to make significant technical contributions.

Position requires 5 years of experience in television signal processing and experience in prototype development is desirable.

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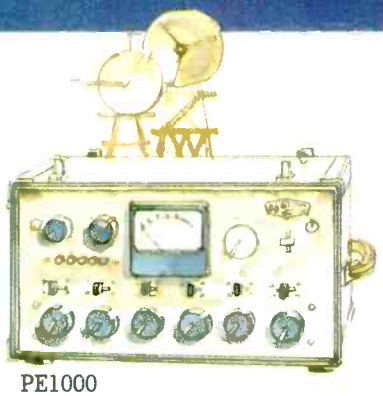

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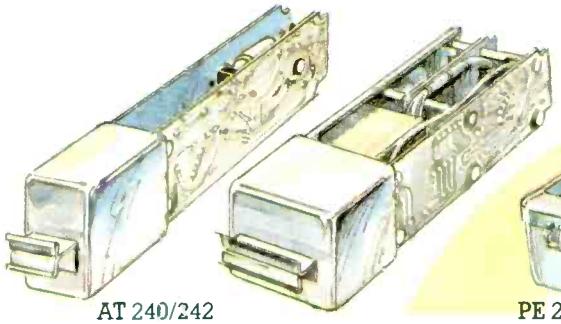

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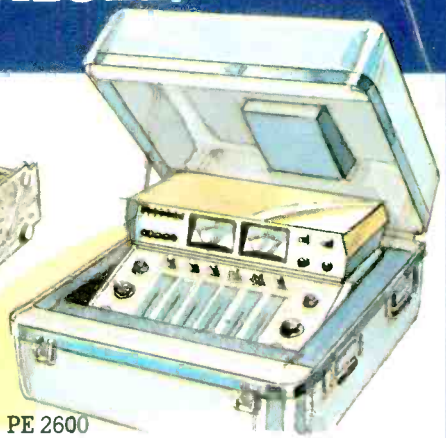

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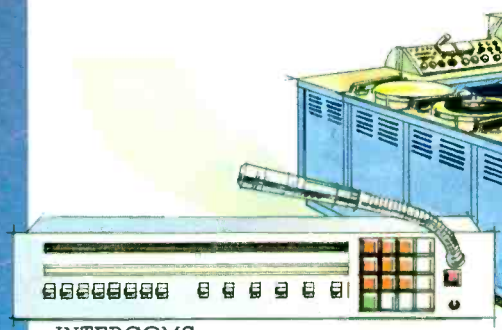

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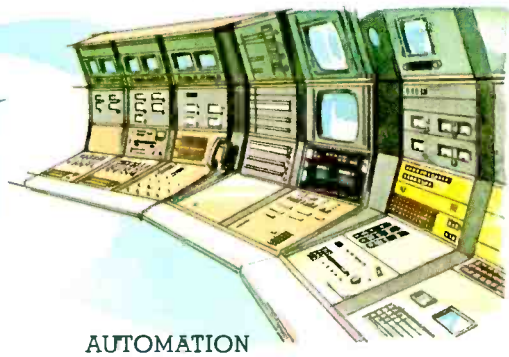

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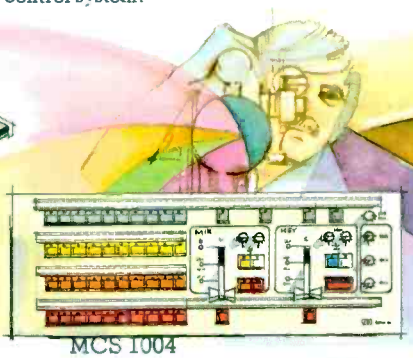

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