TELEVISION

The major impact upon both broadcast and nonbroadcast television in 1972 has been the introduction of cassette and cartridge videotape equipment. The increased use of quadruplex videotape for commercials and spot announcements in broadcasting has resulted in a demand for tape playback equipment that is difficult, if not impossible, to meet with existing reel-to-reel plant facilities. Consequently, automated quadruplex cassette equipment promises to be the broadcaster's alternate to substantial expenditures for additional reel-to-reel equipment facilities and the accompanying increased operating costs. Furthermore, by means of time-base stabilization equipment[138–140] the lower-cost helical-scan players, both cassette and reel-to-reel, may be a significant competitor to the quadruplex VTR — the standard in broadcasting operations since its introduction in 1956.

Similarly, in cable television and hotel-motel entertainment programing the cassette has provided a means for automatic operation of origination equipment and maintenance of a uniform and relatively high degree of picture quality without the need for continuing operator attention.

To meet the demand for multiple copies of commercials and spots, as well as programs, several tape duplication centers have been set up throughout the United States. Recognizing that an increasing share of the market for recorded material is being captured by videotape, several major film laboratories have installed duplication facilities for quadruplex and helical formats. While most laboratories employ banks of recorders operating simultaneously in real time, some of them now have high-speed contact duplication equipment employing magnetic-field and thermal transfer techniques.

Although 1972 saw a phenomenal growth in the use of helical videotape equipment, primarily the cassette type, for nonbroadcast applications, progress toward an industry standard has been minimal. Several Japanese manufacturers are producing the proposed EIA-J 12.7-mm ($\frac{1}{2}$-in) format[141] and the Sony 19.05-mm ($\frac{3}{4}$-in) format.[142] In the United States, North American Philips has started deliveries of its different 12.7-mm ($\frac{1}{2}$-in) format; RCA is readying production of its 19.05-mm ($\frac{3}{4}$-in) format; and still another format is being produced by Cartrivision. Thus, there is little likelihood of full interchangeability for some time to come.

As for nonbroadcast use of videotape cassettes, except for Cartrivision, which is directing its efforts toward the home, the market is, for the most part, the educational, industrial and pay-TV fields. The future for the consumer product would appear to lie with the several disc systems demonstrated in Europe and in the United States, mainly because of the anticipated very low cost of the duplication medium, relative to that of videotape cassettes. At this time, among the major contenders — RCA, MCA, Zenith, Sydnor-Berent, Philips, and Telefunken-Decca — there is no standardization, although the matter has been the subject of discussions between MCA and Philips.

The electronic production, heralded in the Progress Report for 1971 in the May 1972 *Journal*, has developed at a slower rate than anticipated. Nevertheless, with the availability of more sophisticated editing techniques, and alternatively by the ingenious use of less complex and costly helical equipment for editing decision-making, there is little question that a marriage of film and electronic techniques is here to stay. Furthermore, a sleeper in this technical field has been the successful use of portable television cameras and tape recorders for electronic journalism. With this technique, one broadcast network has been able to reduce substantially the time from shooting a news event to airtime as compared with the time-lag with 16mm film; and this has been accomplished with comparable operating cost and flexibility.

In the field of television news, the use of satellites to avoid the time-consuming air shipment of filmed events from all parts of the world has become commonplace. For example, films shot in Viet Nam can be processed in Hong Kong, transmitted from telecine facilities there via satellite to the United States, and tape recorded for presentation over evening news programs.

The use of electronic production was not limited to programs intended for television broadcast. Using vastly improved techniques for transfer from videotape to color film, several features were produced in the United States and Canada for theatrical release; these were comparable in quality to direct color film photography. One of the systems[10] uses a slightly higher scanning-line rate and a different frame-rate than those authorized for broadcasting in order to obtain greater compatibility with the motion-picture standard of 24 frames/s. The outgrowth of this approach may be the development of a new industry standard for these and similar applications.

It is worthy of note that the image-enhancement and noise-reduction techniques developed for one of the tape-to-film production processes were used successfully to improve the quality of color television signals transmitted from the space vehicle and from the moon during the last two Apollo missions. Also contributing to the high quality of the color television pictures transmitted on recent Apollo missions has been the field-sequential camera employing a newly-developed silicon intensifier-target (SIT) pickup tube and highly sophisticated ground-command equipment.[109]

Developments in color camera design resulted in a new generation of more compact, low-cost equipments which, while not equipped with all of the features required for complex production work, are capable of providing a degree of picture quality comparable to the more expensive broadcast equipment. For closed-circuit, nonbroadcast applications the single-tube camera promises to be a strong contender and may portend the future camera for broadcasting. The obvious advantages are the extreme simplicity of design and alignment. Developments on this front are progressing both in Japan and in the United States.

Concurrent with the development of equipment for improved picture quality, and new techniques for production and distribution, efforts to improve system performance and the resultant picture and sound presented to the home viewer have been an ongoing all-industry activity. The Ad Hoc Color Television Study Committee,[143] formed in 1968 by the Joint Committee on Inter-Society Coordination, has continued its many investigations of causes of color variability and made many recommendations for corrective industry action. One of the more significant conclusions of the committee in 1972 was the recommendation to the United States CCIR Study Groups that the FCC/NTSC color primaries not be modified, as proposed by the European Broadcasting Union. Instead, it was recommended that corrections for the differences between present-day and hypothetical FCC/NTSC phosphors be accommodated by matrix modifications in receivers and monitors. Other activities initiated by the JCIC in 1972 were the organization of two more Ad Hoc committees: one to study and determine the appropriate use of ancillary signals in television broadcasting, and a second to investigate causes of deficiencies in television sound.

Attention to improvements in quality of television transmission in 1972 was not limited to broadcasters and the home receiver. The Federal Communications Committee formed the Cable Technical Advisory Committee[144] for the purpose of formulating standards for present-day cable television systems and for new systems and services as they are developed. Furthermore, the potentialities for the

use of television, particularly by cable, to meet the requirements of our changing and expanding society have resulted in the initiation of several in-depth studies and field experiments. For example, the proposal for the establishment of a new rural society,[145] based upon the use of available communication techniques and equipment, has given considerable impetus to study of new and improved television techniques. One of the several related activities was a grant of $2.5 million to the Urban Institute to establish a cable television information service over the next four years. Thus, in the years to come the industry may expect a greater and more varied use of television techniques, resulting in a greater impact upon the nation's changing society.—*K. Blair Benson*, Vice-President for Television Affairs

Broadcast Television

Videotape

In 1972 close to 100 cartridge/cassette quadruplex videotape units were delivered to broadcast stations in the United States by RCA and Ampex. This equipment permits the broadcaster to automate completely the station-break or often-called "panic period," on a single playback unit. Through the use of editing and program identification accessories, changes in recorded material can be accommodated and the commercial or program segment transmitted can be logged and verified. Thus, the reel-to-reel equipment facilities need not be expanded to cover the trend toward increasing use of videotape for commercials.

Production of multiple copies for playback on the cartridge/cassette equipment, in addition to the conventional reel-to-reel types, is no longer limited to re-recording in real time on expensive quadruplex equipment. Transfer from a master tape simultaneously to several tapes now can be accomplished at substantially greater speed by the Ampex contact duplicator, with negligible loss in quality. Another contact duplication system using the thermal, rather than magnetic, principle was introduced by Consolidated Video Systems. The CVS equipment will accept 12.7-, 19.05- and 25.4-m ($\frac{1}{2}$-, $\frac{3}{4}$-, and 1-in) helical formats.

The Fernseh Division of Robert Bosch Corp. demonstrated a prototype helical design using one-inch tape which provides quality of performance suitable for all broadcasting applications presently filled by quadruplex equipment. Production of the 625-line PAL version is scheduled for early 1973. In the United States Ampex introduced a time-base corrector for its VPR-7900 helical equipment which meets broadcast requirements.[139] Thus, Ampex and IVC[140] now produce helical equipment suitable for color broadcasting applications on 525- and 625-line standards, and in addition to the Fernseh 625-lines PAL version. In addition, Television Microtime Inc.[140] announced a line of time-base accessories intended for use with a variety of helical equipment.

An Electronic Program Identification System (EPIS) which permits a 16-character alphanumerical code to be recorded on the RCA TCR-100 videotape cartridges was developed. It can be used with special program identification codes, such as ISCI (Industrial Standard Commercial Identification) for program material verification. Coding may be done by the user by way of a manually operated keyboard entry unit and the code can be observed visually on the TV monitor during cue-up. The EPIS and similar systems may eventually be used for automated program verification and control.

An automatic tracking system for quadruplex videotape recorders was developed. The system automatically seeks out the maximum FM output from a quadruplex tape recorder by scanning the recorded tracks in a controlled fashion. The system can be installed on all RCA videotape recorders using the new servo system, i.e., TR-70C and TCR-100.

Color Television Cameras

Developments in conventional studio and field cameras were limited for the most part to improvements in existing basic designs. On the other hand, efforts toward new camera design were directed toward moderately priced equipment which, while providing fewer of the features required for full-scale network-type productions, would not suffer any significant sacrifice in picture quality.

RCA Corp. updated the TK-44 with an automatic iris for exposure control and automatic black-and-white level balance. For the lower-priced market RCA introduced the TK-630 camera with the features of image enhancement and automatic color correction.[27]

Another moderately-priced camera was brought out by General Electric. This camera uses YRB, rather than the RBG, taking characteristics for the three 25-mm Plumbicon ™ tubes.

The Fernseh Division of Robert Bosch added the feature of automatic color balance and registration to their KCU40 camera. A new lower-cost camera was introduced by Fernseh which uses 25-mm Plumbicons. ™ In addition, a lightweight camera with the same tubes and suitable for handheld operation was introduced by Fernseh.

IVC updated their Plumbicon ™ silicon-diode camera for improved gamma-correction and dynamic range capability.

Telecine

A new telecine camera, the TK-28[27] featuring automatic level control by means of a neutral-density filter, automatic color correction, and preset chromacomp settings was introduced by RCA. Either vidicons or lead-oxide pick-up tubes may be used in the camera. RCA also introduced the three-vidicon PK-610 camera intended for both the closed-circuit and broadcasting markets.

GE brought out the PE-245 telecine camera, essentially an updated PE-240, with FET preamplifiers, masking, and new closer-tolerance optics. For the lower-cost market, GE released the TE-201, a telecine version of their 8 line camera.

A telecine version of their lower-cost LDH live camera was introduced by Norelco.

Eastman Kodak brought out several projectors for television covering a wide range of pricing. For the more sophisticated broadcasting operation their CT100 16mm unit provides features of slot-threading, automatic lamp change, automatic cuing, reverse operation, and both magnetic and optical sound. Also lower-cost 16mm and super-8 projectors for broadcast were brought out.

In the interest of improving film picture quality over television Eastman's Video Van, with a variety of telecine equipment, started a continuing tour of stations, labs and technical societies throughout the United States to demonstrate proper film transmission techniques and the resultant improvement in picture quality.

Electronic Production

Electronic production for television programing generally has used two or more cameras, shooting simultaneously. Using this technique, frequently before an audience, there has developed a trend to record on more than one videotape unit and thus relegate a large portion of the editing to post-production rather than in real-time during the shooting sequence. In 1972, however, the first motion picture intended specifically for network television release, recorded on videotape using a single-camera technique, was produced in conjunction with CBS by Metromedia Producers, Inc., in Hollywood. *Sandcastles*[17] was shot with a Norelco PCP-70 camera and recorded on videotape using an Ampex VR-3000, the latter along with an audio recorder mounted in a vehicle specially constructed for the purpose. Editing of the tapes into the finished release tape was accomplished by means of the CMX electronic editing system.

A new mixing amplifier, TA-70, and a special-effects generator, TF-70, were introduced by RCA. The units serve as versatile production controls for program assembly systems.

Video Signal Transmission

Progress was made by the Electronics Industry Assn. towards development of a

vertical interval reference signal (VIR) intended to provide a means for certification and readjustment, when necessary, of luminance and chrominance parameters in the video signal and for certification. Concurrently, equipment for automatic correction utilizing the VIR was introduced by several manufacturers. A signal similar to the VIR was adopted by the FCC for use on unattended transmitters.

Because of the demands for use of portions of the vertical interval, as well as the picture and sound channels for many diverse services, the Joint Committee on Inter-Society Coordination (JCIC) set up an Ad Hoc Committee under the auspices of the National Association of Broadcasters (NAB) to sort out the requirements and recommend appropriate allocations.

Space Technology

The dramatic uses of television in moon and space explorations and in satellite technology have extended the horizons of all sit-at-home viewers. A broad survey of satellite technology was given in seven papers presented at the Society's 110th Technical Conference in Montreal. The papers were published in 1972 in the February and March issues of the *Journal*.[146–151]

Action by the FCC to authorize domestic satellite service in the United States will result in the availability of these transmission facilities for a wide variety of television applications starting in mid-1973 from several commercial communication organizations.

Nonbroadcast Television

In the nonbroadcast television field, activity continued at a very moderate rate. It appeared to be a year of consolidation and adaptation of many of the technological advances that had occurred during the previous years. We did see new adaptations of videotape in hotels for private viewing as well as a continued increase in the number of small tapes submitted for various uses.

Interest continued in color and monochrome monitors. Audiotronics Corp. of North Hollywood, Calif., introduced three new monochrome monitors. They are 40-, 48- and 58-cm (16-, 19- and 23-in) and feature good resolution as well as a built-in eight-watt audio system. It also has a video drive output for other uses.[28]

Kalart Victor Corp. of Plainfield, Conn., announced a large-screen television projector capable of projecting a picture 2.74 by 3.66 m (9 by 12 ft). It is available in models for off-the-air applications as well as for closed-circuit either through VTR or other sources.[63]

With the clarification of the FCC Ruling on cable television, it was expected that there would be considerable expansion in this field. It now appears that activity was not quite as great as had been expected. Dynair Electronics Inc. of San Diego, Calif., introduced a new solid-state audio-video modulator. This unit has the necessary integral sideband response filters which allow adjacent color operation in a cable system without external filtering. The RF output is adjustable over a 20-dB range.[152]

A new NTSC color film chain for use with 16mm motion-picture film or 35mm slide transparencies was announced by Marco Video System of Philadelphia, Pa. The system uses a three-tube color pickup, a multiplexer, a 16mm projector and a 35mm slide projector.[152]

In the field of videotape recorders, there was considerable activity. There continued to be a great interest in video cassettes as well as reel-to-reel tape recorders. Standards and interchangeability continue to be one of the primary problems in the field.

The Philips Broadcast Equipment Corp. of Montvale, N. J., introduced its Model 1481 videotape recorder in a 12.7-mm ($\frac{1}{2}$-in) format using cassettes. The unit features good picture quality, signal-to-noise, and small size and weight.

Matsushita Electric Corp. of America announced two new color videotape recorders as well as a video cassette recorder. The color videotape recorder was designed to meet the specifications of EIAJ #1 Standard for recording and playback in black-and-white. It is capable of either black-and-white or color operation and features long head life, high picture quality, electronic editing, and slow motion. The video cassette recorder is a 12.7-mm ($\frac{1}{2}$-in) color recorder that can play and record. It is also a 19.05-mm ($\frac{3}{4}$-in) video cassette player. This is equipped with a RF attachment for playback through conventional television sets.[153]

Another color videotape recorder that meets the EIAJ Standard was announced by Audiotronics of North Hollywood, Calif. This is a remotely controlled unit that provides tape interchangeability and has a built-in two-input video/audio switcher for simple two-camera operation. The unit is capable of audio dubbing and editing.[81]

An editing accessory for the RCA TCR-100 was introduced. It is used for inserting or adding program material into a tape cartridge recording. Control of the insertion is on a frame-by-frame basis.

The interest in duplication continued to be high during the year. Matsushita Electric Corp. of America announced a system for duplication of 12.7-mm ($\frac{1}{2}$-in) color and black-and-white videotapes. The system consists of a VTP Printer and VTP Recorder that make the master tape and eliminate head-to-head duplication. The process involves the master and slave tapes being wound onto one reel in close contact. A magnetic field is then applied which makes duplication instantaneous. A 60-min tape can be duplicated in six minutes.[64]

For convenience, a desk-top cassette copier was designed for operation by nontechnical people. This unit — available in two configurations that can make one copy or can have add-on capabilities of a second slave — was announced by Telex of Minneapolis, Minn. The operation is essentially automatic and is started by the insertion of a cassette into the master position.[63]

Ampex Corp. of Redwood City, Calif., announced a Time Base Correction for the VPR-7900. This unit reduces the horizontal video jitter to ± 30 ns in monochrome and ± 2.5 ns in color from a machine stability of ± 250 ns. The unit will correct color phase errors as well as provide color drop-out compensation.[139]

The Sony U-Matic color video cassette system for prerecorded programs was announced by Sony Corp. of America, Long Island City, N.Y. This features a 60-min, 19.05-mm ($\frac{3}{4}$-in) magnetic tape and can be connected to a standard television set. It was also available in a player/recorder combination.[64]

As yet the video cassette equipment has not entered the home market. In fact, because of the anticipated lower cost of disc recordings versus cassettes, it is entirely possible that instead, one of the several disc systems will be the format to meet consumer product requirements. Several different systems of recording and duplication have been demonstrated and proposed for production within the next two years. The Teldec color system shown in 1971 in PAL standards uses a stylus mechanical-electrical transducer that is mechanically actuated by undulations in phonograph-like spiral grooves. Philips and MCA systems are similar in that both detect the variations in disc surface by means of a reflected laser beam. RCA and Sydnor-Berent both use optical means to detect the recorded signal; RCA uses a hologram recording, Sydnor-Berent a series of recorded lenses. In addition to the aforementioned, Zenith has demonstrated a disc system, but has not announced any production plans.