

The year 1981 saw the announcement and introduction of a variety of new television systems and techniques. Many of the topics reported here were current topics during the 1981 SMPTE Television Conference, held in February, 1981, in San Francisco. That meeting, one of the most successful of the 15 annual TV Conferences held so far, is to be followed by the 1982 Conference in February, in Nashville, Tennessee. It is clear that the SMPTE Television Conference has international status and that the newest developments in the technology are discussed in depth.

### Self-Contained Camera-VTR Systems

Several manufacturers, including RCA in this country and Matsushita, Sony, and Ikegami in Japan, have demonstrated self-contained camera-VTR systems for ENG/EFP. RCA has joined with Matsushita in system development, with RCA providing many of the electronic portions of a system that will utilize a Matsushita-designed videorecorder mechanism. Prototype systems were objects of great attention during the 1981 NAB Equipment Exhibition in Las Vegas. Most of the prototype systems utilized new 1/2-in video recording formats and demonstrated improved picture quality when compared to the nearly universal 3/4-in U-format mostly used with existing ENG/EFP systems. Wider luminance and chrominance bandwidths, improved signal-to-noise ratio and less chrominance delay error combine to provide significant quality improvements.

It is evident, however, that these developments are viewed by many broadcasters with somewhat mixed emotions. While the small size and the convenience of self-contained systems will be welcomed by most, concerns continue to be expressed about the added weight of the handheld combination and, even more importantly, the cost and operational problems inherent in the introduction of yet another video recording format into television studios.

The exhibition of several different formats at NAB does not necessarily indicate that a multitude of new formats will reach the market in production equipment. At midyear, ABC, CBS and NBC requested that the SMPTE commence the standardization process to develop a single ENG/EFP videotape format specification. It should be noted, however, that CBC did not encourage such SMPTE efforts, fearing that standardization at this time may not be in the users' best interests. At its meeting in mid-September, the SMPTE Video Recording and Reproduction

Technology Committee received this subject as an agenda item and, with the cooperation of the manufacturer proponents of the technology, have agreed to review technical parameters, the potential standardization prospects and stated user needs. By year's end, two meetings on the subject had been held. There is a possibility, then, for a unified video recording system as a result of the assessments of the subject going on both in North America and Japan. Such an outcome is far from certain; the manufacturers state that their engineering and manufacturing plans are completed and a compromise for the sake of standardization is not possible. Only time will reveal the final outcome of the discussions.

### High-Definition Television Systems

One of the highlights of the 1981 SMPTE Television Conference, held in February in San Francisco, was an elaborate and impressive demonstration by NHK of the present state of high-definition television research in Japan. Special camera systems, wide-bandwidth monitors, video projection systems and other apparatus were transported from Japan and installed at the St. Francis Hotel. Demonstrations of wide aspect-ratio 5:3 pictures showed excellent quality. The scanning specifications used were 60 fields/sec with 1125 scanning lines interlaced 2:1. Overall analog system bandwidth was nearly 30 MHz, with 20 MHz assigned to the luminance channel and 6.5 MHz assigned to the line-alternating R-Y and B-Y separate chrominance channel. Special camera pickup tubes and newly developed display devices were necessary to take advantage of the system capabilities. The chroma signals were not inserted on a subcarrier within the luminance signal band but were handled separately. Complete freedom from dot-crawl, cross-color and color-moiré resulted in exceptionally clean-looking picture reproduction.

Certainly all who had an opportunity of viewing the NHK demonstrations were suitably impressed. Inevitably, questions were put to the experts in attendance about the future of high definition television systems. How and when would they be introduced? How could 20 and 30 MHz bandwidths be accommodated in practical transmission systems into the homes of viewers?

A variety of possibilities emerged from these discussions. For example, even today such wide-bandwidth systems seem well suited to all-electronic production of films for television release, as supplements or replacements for today's photographic

systems. Indeed, one prominent Hollywood director, Francis Ford Coppola, is extremely enthusiastic about the possibilities of using such a system in the near future for reducing pre-production and editing costs. In addition, in the summer of 1981, CBS proposed to the Federal Communications Commission that one of the important possibilities offered by direct satellite broadcasting is that of distributing to home viewers an improved high definition television service, and their petition claimed that no other distribution means will be as universally available. Other suggestions have been made that cable television systems may ultimately offer high definition channels, either as special attractions or as extra-cost optional channels. Of course, new designs for home television receivers will be necessary, for either cable or satellite signals, in order for the viewer to take advantage of the high picture quality. This requirement for special receiver design will be somewhat affected by the choices made in the specification of the system. For example, Compact Video demonstrated, during the November SMPTE Conference in Los Angeles, a system of their design which, they claim, provides improved quality while maintaining a high degree of compatibility with standard television transmissions. The Compact Video system uses extended bandwidth cameras, monitors and recorders, together with specially designed camera lenses, and a scanning standard of 655 lines/24 frames/sec with the color subcarrier transmitted outside of the luminance band in a PAL-like manner. The results are impressive, but there is not universal agreement that such an approach, which is basically an optimization of existing systems, is really suited to the next generation of television systems.

In mid-1981 the SMPTE reactivated its Study Group on High Definition Television Systems. This group, relatively dormant for 12 months or so, had prepared in 1979 and 1980 a detailed report on future options for high definition television systems. Their important report was published in the March 1980 issue of the *SMPTE JOURNAL*, and the author of the report, Donald G. Fink, continues as chairman of the Study Group. Current interest and discussion indicate that more and more will be heard about this topic in the near future. For example, the New York Section of SMPTE devoted its September meeting to a repeat of a successful 1981 Montreux Broadcast Symposium half-day session. The topic was "High-Definition Television: How, Why and When."

A panel of seven experts from Europe, Japan and the United States were put on the spot and asked for their prognostications. The general conclusions were that high-definition television is the "next big

thing in television." However, individual expert opinion on many specific details differed markedly. One individual expressed concern about the problems of making a high-definition system compatible, to a greater or lesser degree, with present-day broadcast television. Another felt that cable television would be the first and most logical means of distribution. As noted before, the use of direct satellite broadcasting for high-definition signals has been suggested as an important national service. There was some agreement that television program production centers will put high-definition equipment to work as quickly as it becomes available, partly to provide ease of international television program distribution. There seems to be universal agreement that the standards chosen for this new service must be standards good enough to endure for two generations, i.e. 50 to 70 years. This requirement dictates a broadly-based wide-ranging examination by all segments of the television industry. In fact, one can envision work in the USA requiring NTSC III before much progress in standards writing is possible. It is interesting to note that an FCC spokesman has postulated the desirability of the private sector's developing and proposing specifications for this service, because of the very limited capabilities of the FCC, at present, to develop such standards.

In the interim, there is some expectation that industry interest in improved picture quality will accelerate application of various methods of improving the quality of the present broadcast service. Primary emphasis in this area is on the picture quality displayed by the home receiver and recent receiver designs do, in fact, reveal improved overall performance. It is expected that more progress in this area will soon be made. Increased use of videodisc equipment, which is capable of good quality video performance, will also tend to accelerate improvements in receiver design.

### Teletext and Videotex

Many developments were apparent during the year in teletext and videotex proposals. By common usage, the term "teletext" refers to broadcast text and graphic transmission systems which transmit binary data during part of the vertical blanking interval. The term "videotex" refers to comparable systems making use of telephone lines for distribution of the encoded data to the user. Both types of transmission require the use of a decoder before the text and graphics material can be viewed in the home. The matter of choosing a broadcast teletext system is, at this time, under consideration by the Federal Communications Commission, and several videotex experiments are under way.

During the past two years, extensive field tests of the several teletext systems

now proposed were held in Los Angeles, Salt Lake City, New York, St. Louis, Chicago, and elsewhere. Valuable technical data were gathered for submission, ultimately, to the FCC. In addition, an important meeting in Toronto in May 1981 resulted in a proposal's being accepted by several of the organizations now petitioning the FCC for establishment of technical standards. At that meeting the American Telephone and Telegraph Company (AT&T), the Canadian Department of Communications (developers of the Telidon system), the proponents of the French Antiope system and the Columbia Broadcasting System (CBS) reached agreement on a unified approach to text system protocols. Earlier work by the EIA Broadcast Television Systems Committee (EIA/BTS) had been abandoned by CBS in July 1980, because, it was claimed, of a lack of committee progress. CBS subsequently filed a petition with the FCC to adopt the French-developed Antiope system modified for 525-line use. After that Toronto meeting, CBS modified its petition and joined the other proponents of the Toronto Presentation Level Protocol (PLP) as noted below. Joseph Roizen, SMPTE representative to the EIA/BTS committee, summarizes the situation in an article in the July 1981 issue of the *SMPTE JOURNAL*.

In July 1981, CBS and Telidon Videotex Systems (TVS) a U.S. company promoting the Canadian Telidon system, submitted identical technical proposals to the FCC incorporating the substance of the Toronto Agreement. (Because videotex services are not broadcast, it is not necessary for AT&T to file their proposals with the FCC.) However, other viewpoints on teletext are evident. The United Kingdom Teletext Industry Group has submitted to the FCC a different set of technical specifications based on the Ceefax/Oracle system now in full use in the United Kingdom. This system is used by both the BCC and the IBA. The British claims are for lower costs and a fully developed operational technology.

From an engineering point of view, the fundamental difference between the two camps is that of data format. The British Ceefax/Oracle system uses a fixed data format which is claimed to result in simpler hardware in the decoding apparatus. On the other hand, the CBS/TVS approach uses a variable data format which is claimed to offer advantages in achieving sophisticated graphics displays. Both kinds of systems are broadcast by means of encoded data transmitted during a portion of the television vertical blanking interval, and the CBS/TVS proposal is for use of lines 15 and 16 at present with possible use of lines 10 to 14 in the future.

Because of the complex technical questions raised by these submissions on the national level, because no proposal from EIA has yet been submitted to the FCC, and also because of international ramifi-

cations, the SMPTE Vice-President for Engineering is keeping a watchful eye on developments in this area.

At year's end, the United States Department of State called together the proponents of the several systems for discussions in Washington aimed at reaching a national consensus. However, such a consensus has not yet been achieved. The CEPT specification, developed by the Conference of European Posts & Telecommunications Administrations, has now been agreed to by 26 nations plus Hong Kong. In addition, CEPT has indicated that they will accept the AT&T alpha-geometric coding scheme if AT&T will accept a compatible CEPT alpha-mosaic coding proposal. At this date AT&T has not accepted the data coding proposal and has refused to accept another CEPT proposal for a 40-character by 24-line text page.

There is no SMPTE standards activity in the teletext field presently under way, but the Society stands ready to offer its expertise and the membership of its television-related engineering committees to perform necessary investigations as the future dictates, especially insofar as recording systems are affected by teletext specifications.

### Digital Video Standards

From the very beginning of the year, 1981 has been seen as a year of decision by the proponents of digital video systems. Following several years of discussion and the putting forth of a wide range of ideas for digital standards, there has been a focusing of world technical opinion on a final choice. In January 1981, in Winchester, England, the European Broadcasting Union (EBU) held a series of subjective picture quality test demonstrations of several proposed 625-line digital encoding specifications. Shortly thereafter, at the February 1981 Television Conference, the SMPTE Task Force on Digital Video Standards conducted an elaborate set of picture quality tests using parameters suitable for both 525- and 625-line television systems. A large amount of experience and much statistical information were gained from these tests and from other digital video demonstrations held during 1980. In all cases, intrinsic picture quality was very high. In one area only did the basic performance of some digital systems come into real question. That area is the process of chromakeying. It appeared that, as a practical matter, the quality obtainable with this useful production tool was a vital factor in the choice of the minimum digital bit-rate that is satisfactory for television studio applications. Significant improvements in chromakey techniques have been evident in the past year as a result of the work done for the subjective testing, and the essential parameters nec-

essary to achieve good chromakeying now seem well agreed. Accordingly, the broadcasters of the world are in the process of formalizing final choices of the digital encoding specifications that will serve the next generation of television facilities all over the world.

Final international decisions on digital video parameters were made in October at a meeting of the CCIR in Geneva. In preparation for this meeting, many nations had submitted position papers concerning digital video standards. A very significant contribution came from the EBU, suggesting that a luminance sampling rate of 13.5 MHz should be optimum for the entire world, since such a rate permits a commonality of equipment design for both 625- and 525-line countries. Other contributions supported this stance, including one from the U.S. Some nations had reservations, however, and concern was especially evident in Japan, where the feeling was that a sampling rate of four times the NTSC subcarrier frequency might prove to be the optimum choice for 525-line countries. This opinion was also held by some North American experts. The discussions in Geneva were complex and detailed. A variety of viewpoints was considered and an agreeable compromise reached. The final choice of basic luminance sample rate is 13.5 MHz and a variety of other specifications are now spelled out. These results are considered to be suitable for the world to live with for as long as 50 years. This is a significant technical achievement, and it is one in which the SMPTE as an organization and especially the SMPTE engineering committees and their expert members have played a very important role.

## Digital Audio

Even though digital video discussions are on the road toward final agreement, the same cannot be said, at least with equal

assurance at the end of 1981, about digital audio specifications. The key to a choice of digital audio parameters is a choice of digital audio recording data-rate specifications. It is well understood and agreed throughout the world that professional digital audio recording systems must not only meet the needs of the traditional sound recording industry, but must also be directly applicable to the needs of television, video recording, and motion picture production. Indeed, a variety of "magic numbers" which suggest certain common factors between the picture display rates of these visual media have been proposed and claim to serve the needs of professional users of the digital audio recording processes that will dominate in just a few years. Unfortunately, the authors of each of these magic numbers have given the various operational factors differing weights in devising their proposals and thus the "magic" seems to fade into a complex variety of different choices, with the basic sampling rate in the various schemes ranging from 44 kHz to 60 kHz. In the U.S. most of the discussion of digital audio recording parameters is taking place within AES, the Audio Engineering Society. Progress is evident, but in the meantime equipment is being delivered with different, non-interchangeable formats. Time is running out on a single choice, and some frustration has been evident in North America, Europe and Japan. In particular, the Japanese have reached an industry agreement on 44 kHz sampling, and their decision is being implemented in hardware which is being placed into service in many audio recording studios. Most North American and many European experts are not satisfied with this choice and have urged adoption of higher sampling rates in the 48 to 60 kHz range. Most American equipment delivered by the end of 1981 must be considered prototype, but it does, in general, use 50 kHz sampling.

The SMPTE Vice-President for Engineering, R. J. Zavada, has been following the progress of digital audio standards

proposals for several years. He has assigned the representation of SMPTE concerns to a few well-informed sound and video experts who are now taking part in the AES discussions. In November, the AES made an apparently final choice of 48 kHz as the preferred professional sampling rate. If the balloting on this proposal is favorable, it is probable that the discussions of digital audio standards will have reached a successful conclusion. This situation should become clear during the first part of 1982.

## Network Facilities

### *Electronic Library Systems*

During 1981 ABC added five of the MCI/Quantel DLS-6000 Digital Library Systems to its electronic still store facilities. In New York, two of the 6000 systems were centralized with an Ampex ESS, for use by all production studios on a delegated basis, at the 66th Street TV Center.

A 6000 uses a Winchester-type disc with a capacity of 400 pictures per disc. More discs are added as needed for greater capacity. The Quantel DLS-6000 represents a new generation of still store devices which uses a computer disc rather than 35-mm slides for picture storage.

### *Electronic Graphics*

ABC continues to expand the use of Color Background Generators (CBG) in sports and news productions. The Dubner CBG, currently in use, has on-line accessibility to 250 fonts, and features complex, multi-frame animation. Art work is now being digitized directly into the background generator, and the recent addition of an electronic tablet allows the artist to create faster and more effectively than heretofore possible with the keyboard.



Figure T-1. Control room A in the ABC Washington News Bureau.



Figure T-2. Videotape editing in the ABC Washington News Bureau.



**Figure T-3.** One of 18 helical recorder editing cubicles in the ABC Washington News Bureau.

### VICR

ABC adds to the output of its major studios the Vertical Color Reference signal (VICR) as an aid for color uniformity in all in-house post-productions. Before leaving master control, having served its purpose, the VICR signal is deleted.

The VICR signal contains a chrominance, luminance and setup reference. These references can be viewed continuously together with the program signal on existing, operational waveform monitors and vectorscopes. These scopes do not have line-select capabilities thus rendering the traditional VIR signal useless. The ABC VICR installations have proved to be highly successful in controlling and maintaining good color fidelity. It is expected that in the near future outside production houses will supply ABC with VICRed shows and/or commercials.

### Washington News Bureau (Figs. T-1, T-2, T-3)

As reported last year, ABC has embarked on a program to replace the common VU meter with the peak program meter (PPM). The TV audio system of the new ABC Washington News Bureau employs PPM meters throughout. Only two VU meters are kept at the output to conform and settle Telco disputes.

Another major feature which ABC incorporated in the Washington News Bureau is the "voltage generator" principle. In short, the in-plant audio distribution is a voltage system and not the traditional power or dBm system. This means that sending end impedances are low and receiving end impedances are high. Gone are all the problems of a dBm system, e.g. match-terminations, level, impedances, power capability of amplifier output transformers, etc. The voltage system has proven itself to be very successful and it

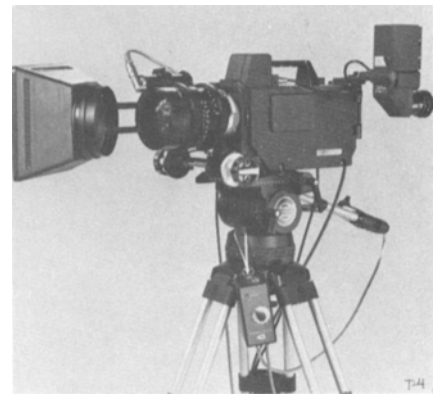
may become the standard for all future audio installations.

### Other Notable Advances

A variety of possibly less dramatic but nonetheless very important advances in television technology must be noted in this report. Not to be overlooked are the videodisc systems. Commercially available systems now number two in North America, with players available under half a dozen trademarks. The two basic systems, the Philips/Magnavox/Discovision and the RCA, are not interchangeable, as is well known. Other systems, each also incompatible with any others, are promised for introduction in the next year or so. The SMPTE has had a Study Group on Video Disc Systems for more than four years. It is now becoming much more active, since during 1981 hardware and software could be purchased with relative ease and the needs of various users and potential users became more clearly defined. The Study Group has under way an examination of the picture quality objectives that videodisc systems should be expected to meet. This study is taking an overall systems approach to the matter, including not only the disc player but also the recording specifications used to make the disc itself and the factors that must be considered in choosing the television receiver to which the disc player is attached. In addition to SMPTE efforts, IEC SC 60B-Video Recording has undertaken the first steps of a standardization process for videodisc systems. At this writing, three sets of specifications have been submitted to IEC and at least two or three others are expected during 1982. SC 60B will next meet in October 1982 in Tokyo and active discussions of international videodisc standards proposals will certainly take place at that time.

We should also note that the success of previous SMPTE standards activities continues to be evident. It is estimated that approximately 9,000 SMPTE Type C one-inch videotape recorders are now in service. This amounts to about half of the professional recording systems in use throughout the world. Most readers will remember the controversies that surrounded the development of the Type C specifications; the success of the format is a clear indication of the value of standardization.

Television cameras and camera pickup tubes continue to improve. In addition to the new half-inch pickup tubes designed for ENG/EFP use (in both lead oxide and Saticon designs), we have witnessed improvement in the larger imaging tubes designed for the most demanding studio applications. Also evident during the year has been the greatly improved performance of stripe-filter, three-gun color pickup tubes designed for portable camera use. All in all,

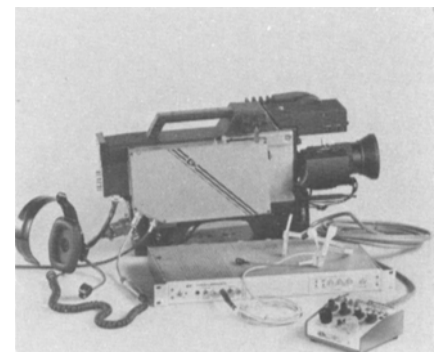


**Figure T-4.** Ikegami EC-35 Electronic Cinematography camera (Cinema Products Corp.).

the development of pickup tubes seems to be keeping pace with the evolution of camera designs; the overall situation will undoubtedly undergo great change in the next few years as high-quality solid-state sensors reach the market and totally new camera designs using these devices are proposed and implemented.

The success of the small, handheld (more accurately, shoulder supported) television camera continues undiminished. Special versions of these compact cameras have appeared, designed for the highest quality video production assignments, both inside and away from traditional television studios. For example, Cinema Products and others now supply the Ikegami EC-35 Electronic Cinematography camera (Fig. T-4). This unit is designed for television productions choosing to use traditional cinematographic, single-camera techniques and makes use of fixed focal-length prime lenses, as well as the more common zoom lenses. Matte boxes, follow-focus attachments and similar accessories usually associated with photographic motion picture cameras are also available.

Cinema Products also designed and produced coaxial remote video control systems for most of the professional portable video cameras now on the market (Fig. T-5). These systems feature digital single-cable control of the camera operating parameters and allow precise adjustment of the cameras during field produc-



**Figure T-5.** Co-Ax Digital Remote Control System (Cinema Products Corp.).

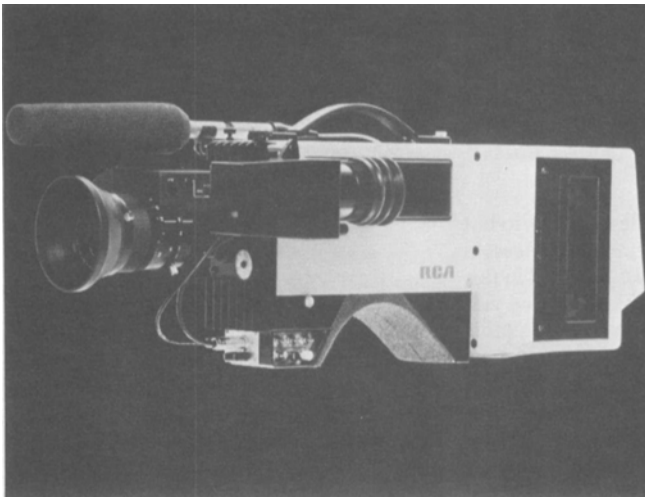


Figure T-6. Hawkeye television camera/videotape recording system.

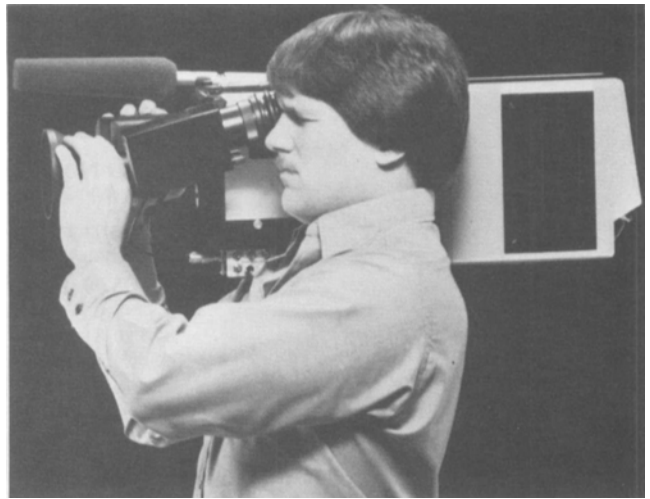


Figure T-7. Hawkeye combination camera and videotape recorder carried by cameraman.

tion. This facility is very useful when multiple camera production techniques are used with portable equipment.

The Hawkeye TV camera/videotape recording system (RCA-Matsushita) (see section above on Self-Contained Camera-VTR Systems) combines a television camera and videotape recorder in one handheld (shoulder-supported) unit (Figs. T-6, T-7). The camera is a three-tube color camera using half-inch pickup tubes. The recorder uses new circuit technology and new head design.

A multicharger capable of charging 13 battery packs simultaneously was introduced by Frezzolini Electronics, Inc. (Fig. T-8).

Another exciting area of rapid development is that of electronic graphics generation and display. The 1981 NAB show saw the introduction of many new systems. All of the highest quality units are computer based, often making use of the most complex of high-level computer languages to achieve quite amazing visual effects. At another extreme, some systems are available which make use of small, desktop computer systems for control of the graphics generating process. Even these small systems are capable of remarkable results. It is anticipated that computer

based graphics systems will become virtually universal television post-production tools in the near future and that costs, now generally quite high, will be reduced as time passes. The placing into service of teletext systems will serve to encourage the use of computer graphics systems; teletext systems are digitally based and digitally generated graphics are natural adjuncts here. It is in this area of graphics, perhaps, that computer technology and television technology are currently most closely allied. The future will see many present-day distinctions between the two technologies become blurred and eventually disappear.

In conclusion, I would like to mention another digitally based system being specified by SMPTE, one that will be vitally important to the television industry. This is the SMPTE specification for the digital control of television studio equipment. Many television facilities have for years utilized digital control systems for applications such as transmitter remote control and master control switching. More and more equipment is being designed to perform, under the supervision of a computer, all of the complex operations of a television studio or master control operation. Heretofore there has not been an agreement for specifications for the interface between the control system and the equipment to be controlled, but the SMPTE Working Group on Digital Control of Television Equipment has nearly completed its work and a Draft Standard that defines interface parameters has been circulated and is under review. The document includes specifications for the connectors and cables to be used, and baud rate of the control signal and the protocol to be used to achieve communication between the devices involved. It is expected that almost universal application of this standard will be seen in the design of future television equipment such as telecine projectors, videotape recorders and switching systems.

It should also be noted that work continues on another computer-based technological problem affecting video recording systems, that of the protocol to be used in sophisticated VTR editing systems. A Working Group of the Video Recording and Reproducing Committee continues to work on this matter, with the ultimate goal a unified system of command terminology for use on all large-scale editing systems, regardless of manufacture. This will permit portability of original materials and allow post-production work to be accomplished without present system-specific restrictions.

## Conclusion

This review of the state of television technology is directed toward two goals. The first is to present a concise summary of the year's developments and to try to give some perspective as to their overall importance. In addition, I also have attempted to indicate the significant involvement by SMPTE in the standardization work leading to industry acceptance of these developments. Whenever standardization of new television techniques is judged to be practical and desirable, SMPTE is ready and willing to undertake standardizing efforts. This is a significant challenge under present circumstances, since we are in fact seeing a virtual explosion of television technology. Because much of the new technology involves digital techniques, some of the structure of the SMPTE standardization effort has been revised and adapted to respond effectively to the needs of the industry. Your Society and your officers are determined to continue to respond; comments and proposals for further efforts will be given full consideration by the Engineering Vice-President and his advisors. — *F. M. Remley*, Vice-President for Television Affairs.

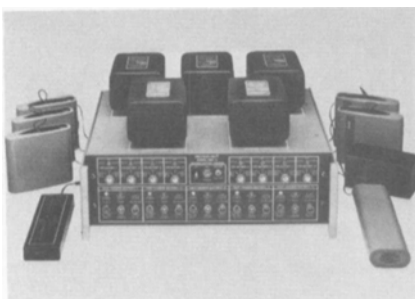


Figure T-8. Frezzi multicharger charging various battery packs (Frezzolini Electronics).