Production and Post Production in the Eighties

The 15th Annual SMPTE Television Conference

A report prepared by Gerald C. Engbretson

Photographs by Donna Foster-Roizen

Continuing into "The Digital Decade" as described at last year's Television Conference in Toronto, the 15th Annual SMPTE Television Conference brought experts from all over the world to San Francisco to exchange ideas on this year's theme—"Production and Post Production in the Eighties." As usual, the major topics were timely and important to the future of the television industry. The four sessions were: Digital Video Recording, New Camera Technology & Digital Techniques, Future Directions for Television, and the All Digital Studio. The session on "future directions" had several papers on high-definition television and was followed by an impressive HDTV demonstration.

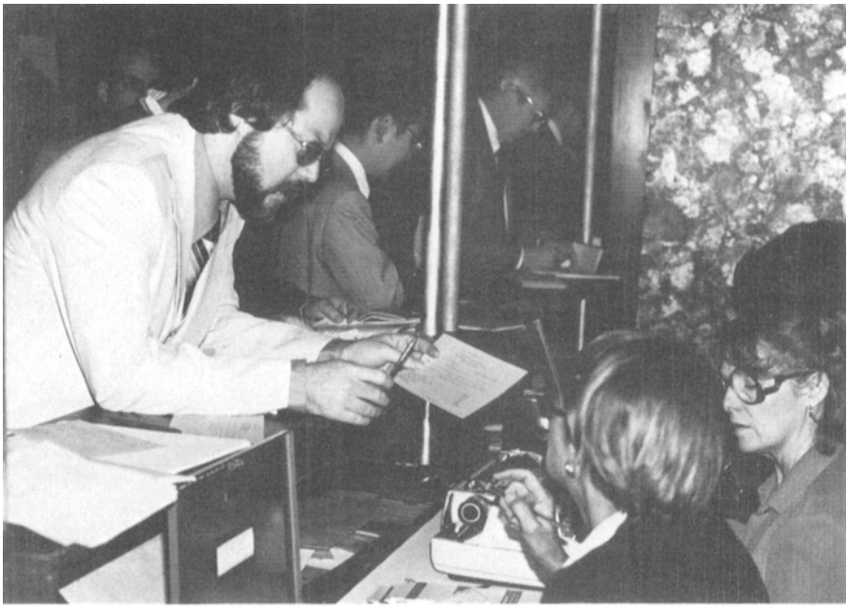
This conference was particularly significant because of the Society's increasing role in the possible formulation of worldwide standards for digital television. Besides the many excellent papers given during the conference, there was a series of exciting and important tests and demonstrations given earlier in the week to help determine desired parameters for such a digital system. There was also an informative panel discussion on the topic of the digital demonstrations and an NHK demonstration of high-definition television.

Several committees, working groups, and study groups met before, during, and after the conference to discuss related technical topics. Those groups represented not only the SMPTE, but other technical organizations such as the EBU and IEEE. To complement the technical presentations and group discussions, 23 companies exhibited equipment which exemplified the major topics of the conference.

Because of the important topics (and the exciting location), a total of 846 people attended the 15th Television Conference, with the paid registration reaching a total of 773.

SMPTE Digital Video Demonstrations

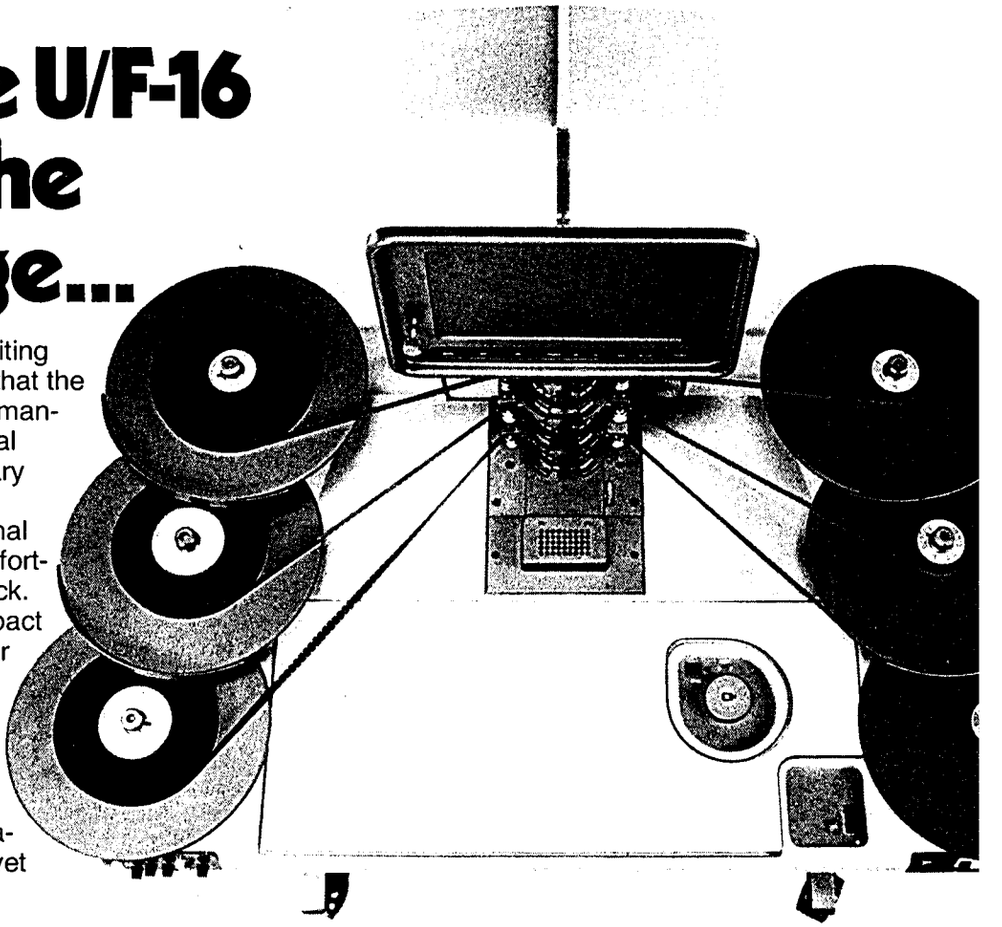
A series of demonstrations were held on 2–5 February 1981 at the KPIX Studios in San Francisco just prior to the 15th Annual



Registration Desk at the 15th Annual SMPTE Conference in San Francisco.

The report was prepared by Gerald C. Engbretson, who served as a special reporter to the 15th Annual SMPTE Television Conference, February 6-7, 1981, St. Francis Hotel, San Francisco, California. Mr. Engbretson is Engineering Section Manager, VTR Development, for Ampex Corporation, Redwood City, California. He was assisted by SMPTE Technical Editor, Arthur Biderman. Donna Foster-Roizen is a free-lance photographer, based in San Francisco, whose work frequently appears in the *SMPTE Journal* as well as other technical magazines.

Our unique U/F-16 gives you the cutting edge...



Sit down and try our new 16mm editing console. You will realize, instantly, that the U/F-16* has been designed and human-engineered with the *editor's* physical comfort and requirements as primary objectives.

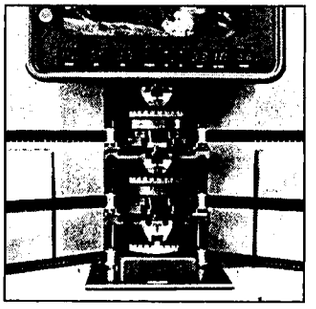
The U/F-16 is extremely functional and uncluttered in design. It is comfortable to work with. Easy on your back. Safe and gentle with your film. Compact enough to work with and store in your home. Lightweight enough to transport in a passenger car when necessary.

Best of all, our U/F-16 *combines* all the advantages of sophisticated flatbeds with the simplicity and reliability of upright editing machines — yet it is reasonably priced!

*U.S. and foreign patents pending.

Outstanding Features:

- Basic console design features six terraced horizontal feed and take-up plates accepting one 16mm picture track and two 16mm magnetic sound tracks. 1200 ft. capacity on all plates.
- Unique terraced arrangement makes the U/F-16 far more compact than conventional flatbeds, yet provides greater work area for the editor and his tools. All plates and controls are readily accessible to the editor without stretching.



- Like a synchronizer turned up on its end, the U/F-16 coaxial drive mechanism permits in-line vertical arrangement of all sprocket wheel assemblies for convenient marking, synching, and cutting of film. Permits instant coupling, uncoupling, and locking on any track by means of a simple lever.
- Single sprocket drive for simple threading and safer handling of each track.
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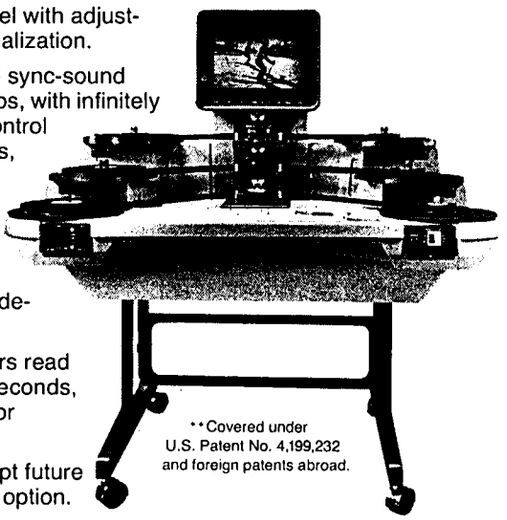

- Electronic counters read hours, minutes, seconds, frames, and feet or decimeters.
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SMPTE Television Conference. Digital video is one of the most important technologies affecting television program production and broadcasting. A digital code that will be compatible to broadcasters around the world requires agreement on a number of important parameters; therefore, the Society undertook to demonstrate results obtainable using a range of values of key parameters—to give viewers a factual basis to aid them in establishing appropriate standards. The two parameters under close scrutiny were (1) the sampling frequency (the rate at which an analog signal is sampled for conversion to a digital format) and (2) the chroma ratio or quality level (ratio of the luminance to color-difference components).

A number of SMPTE groups are involved in work in this field. A large part of the work necessary for this particular series of demonstrations was carried out by the Working Group on Digital Video Standards, whose Chairman, Ken Davies, was responsible for the overall implementation of the demonstrations. Other SMPTE groups involved were: the Committee on New Technology, chaired by Robert Hopkins; the Task Force on Component Digital Coding, under Frank Davidoff; the Study Group on Digital Television (Chairman Charles Ginsburg); and the Study Group on Digital Television Tape Recording, whose chairman is William Connolly.

The demonstrations were also observed by members of the Technical Committee of the European Broadcasting Union (EBU), and it is hoped that all television groups around the world—including the SMPTE and the EBU—will reach agreement on fundamental parameters for a worldwide compatible digital code. Such a code will have a great influence on TV program production for many years to come.

The massive effort necessary for these demonstrations could not have been accomplished without the substantial help—in the form of equipment, facilities, and personnel—of a number of organizations. Studio space and setup assistance were provided by KPIX, under its Engineering Manager, Walt Nichol, and his assistant, Merrill Weiss. Substantial experimental equipment and support was provided by (alphabetically) ABC-TV, Ampex Corp., Barco, CBS Technology Center, Digital Video Systems, Dynair, Marconi, RCA, Sony, Tektronix, Thomson-CSF Broadcast, VG Electronics, and VGR Corp.

A reception for all participants in these demonstrations was held on Thursday evening, 5 February, at the Stanford Court Hotel. Ken Davies spoke on the significance of the demonstrations and the goals that were being sought. Roland Zavada, SMPTE Engineering Vice-President, thanked everyone for their help and presented special awards to five organizations for their contributions: CBS, Digital Video Systems, KPIX, RCA, and Sony.

Meetings at the Conference

A number of groups concerned with various specialized topics took advantage of the presence of many of their members and scheduled meetings of the respective groups during the Conference or slightly before or after it. Among the engineering groups that met were the Committee on TV Technology (Chairman Michael Fisher); the Working Group on Digital Control of TV Equipment (Robert McCall); Working Group on Editing Procedures (Linda Kulmaczewski); Helical Recording Subcommittee (Koichi Sadashige); Video Disc Study Group (Bob Paulson); and Study Group on High-Definition Television

Vernon Kipping served as Audio/Visual Chairman at the Conference.

One of many meetings held to discuss the digital demonstrations: (from left to right) Roland Zavada, Frank Davidoff, and William Connolly.

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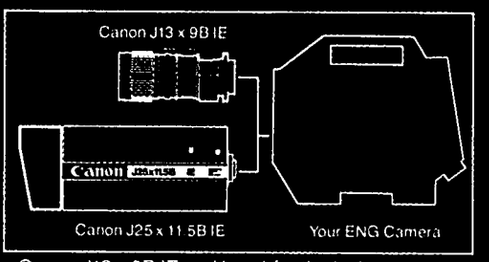

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"Not one of these machines has ever broken down," McAndrew adds. "What makes that even more impressive is that they're constantly being used by different people with different ideas about how carefully to handle equipment.

"Seventy per cent of the time, our equipment is used by ABC and NBC, but we also rent it to local television stations and production companies."

Continental Colour, the country's largest video equipment rental company, has specially built trucks and trailer trucks that are virtually television stations on wheels. Two of these trucks are equipped with one-inch equipment, including a total of two BVH-1100 and four BVH-1000 one-inch high-band video recorders. Continental has also purchased additional Sony recorders for its brand-new post-production facility.

"Sony picture quality is excellent," says McAndrew,

"375,000 MILES WITHOUT A BREAKDOWN."

Martin McAndrew, Continental Colour Recording

"much better than its main competitor. And the slow-motion capability of the BVH-1100's means that each can do the work of two separate machines, in less space, at less expense. No one else's equipment can match these 1100's.

"No wonder our Sonys are almost always on the road. They've covered the World Series, the Winter Olympics, the daytime Emmy Awards, the Tony Awards, operas and symphonies for PBS, and the Pope's visit to the U.S. And we've had zero problems; working with Sony has been delightful."

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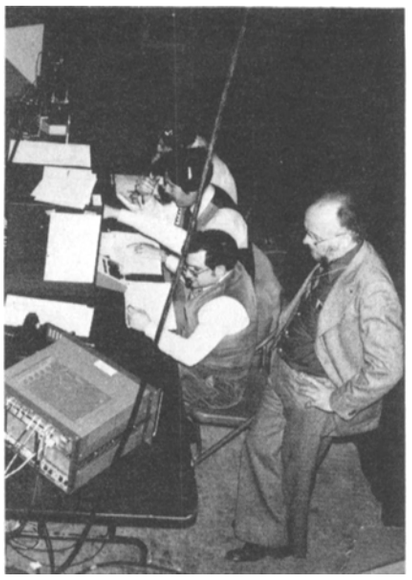


Ken Davies (foreground) monitors procedures for the digital demonstrations. Merrill Weiss and Hal Grant, both of KPIX, are shown in the background.

(Chairman Donald Fink; meeting chaired in his absence by Richard Green).

As indicated above, a number of groups involved with the subject of digital video participated in the planning, setup, presentation, and analysis of the SMPTE Digital Demonstrations. In addition to this work, formal meetings were held by the Working Group on Digital Video Standards (Chairman Ken Davies) and the Task Force on Component Digital Coding (Chairman Frank Davidoff) to discuss matters pertaining to the demonstrations.

Meetings were also held by TAG IEC 60/B (Chairman Norman Ritter); the Papers and Publications Advisory Committee (Maurice French, SMPTE Editorial Vice-President); and the Board of Editors of the *SMPTE Journal* (Chairman Calvin Hotchkiss). A delegation from the European Broadcasting Union (EBU) was also in attendance at the conference and scheduled several of its own meetings as well as a Joint EBU/SMPTE Meeting.

Reports of the SMPTE Engineering Groups will be published in the *SMPTE Journal* as they become available. At press time, notes on the following groups were available.

The IEC SC 60B TAG (Technical Advisory Group), chaired by Norman Ritter, met at the conference. This is a group of technical specialists and represents the United States in matters before the IEC SC 60B (Subcommittee on Video Recording). Several members of the Group will be attending the next meeting of Group 60B in March 1981 in Prague, Czechoslovakia.

The Working Group on Editing Procedures, chaired by Linda Kulmaczewski, is a subgroup of the Committee on Video Recording and Reproduction Technology. The Working Group continued its efforts directed toward establishing a standard for interchangeable edit decision lists.

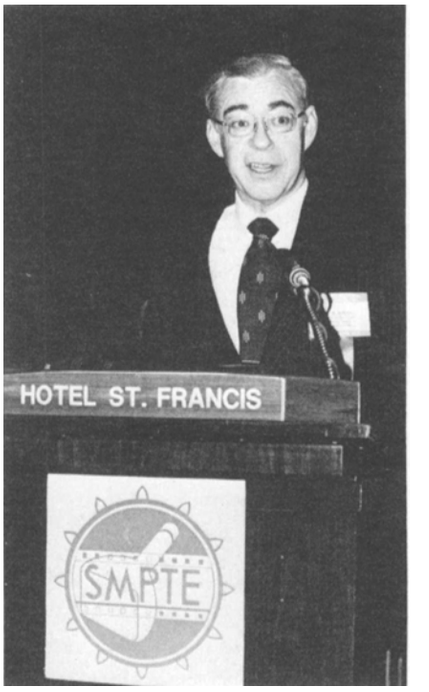
The Helical Recording Subcommittee (Chairman Koichi Sadashige) discussed several topics related to helical videotape recorders, including a proposed specification for permissible tape dropouts with Type B and Type C recorder/reproducers.

The Video Disc Study Group, chaired by Bob Paulson, is charged with the study of the development of the video disc. Various formats were discussed, and consideration was given to the establishment of quality standards for video discs.

The Papers and Publications Advisory Committee was convened by Maurice French, SMPTE Editorial Vice-President,

Behind the scenes at the digital demonstration at KPIX studios.

Ken Davies, Chairman of the Working Group on Digital Video Standards, speaking at reception for participants in digital video demonstrations.

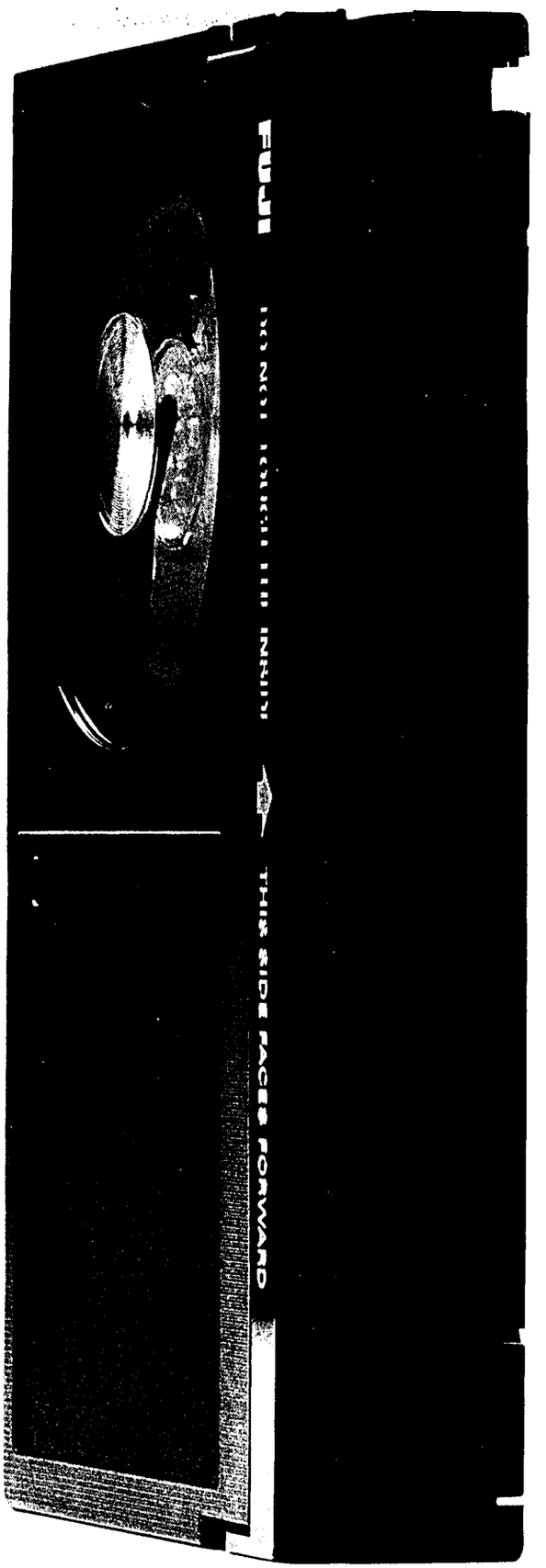


Fred Remley (Vice-President for Television Affairs) welcomes the audience to the Conference.

to review the publication policy of the Society in light of technical progress and the changing interests of the membership. The Committee will recommend long-range publication policies to the Board of Governors.

The *SMPTE Journal* Board of Editors (Chairman Calvin Hotchkiss) met to discuss what its members could do to provide the readership with the best possible *Jour-*

The measure of performance.



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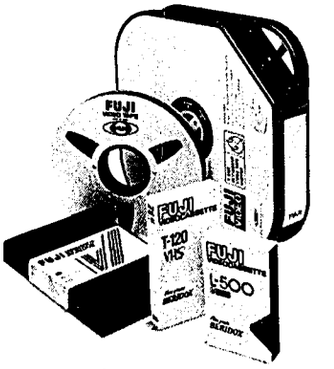


FUJI

See us at NAB Booth 1307

Carlos Kennedy (General Arrangements Chairman) and Leonard Coleman (SMPTE Financial Vice-President) discuss the demonstrations.

SMPTE press conference: Charles E. Anderson, SMPTE President, emphasizes the importance of compatible worldwide digital standards.

Board of Governors Meeting: (left to right) Robert M. Smith (Past President), Joseph A. Flaherty (Executive Vice-President), Charles E. Anderson (President), Donald F. Breidt (Executive Director), and Harold Eady (Secretary).

Board of Editors Meeting: Calvin Hotchkiss (Chairman) and K. Blair Benson discuss change in editorial format of the *SMPTE JOURNAL*.

nal. Review of papers, search for papers, and possible innovations for the *Journal* were discussed.

Opening of the Conference

Opening Tape

This session, as well as the other three sessions, began with a videotape. The connecting theme of all four videotapes was that digital video was no longer "in the future" but was already a way of life today. Thomas E. Scott, the Opening Tapes Chairman, assembled these tapes as a composite demonstration of digital technology as it is in use today. The tape for the Friday morning session was provided by Dolphin Productions, Inc., New York.

Welcoming Speech

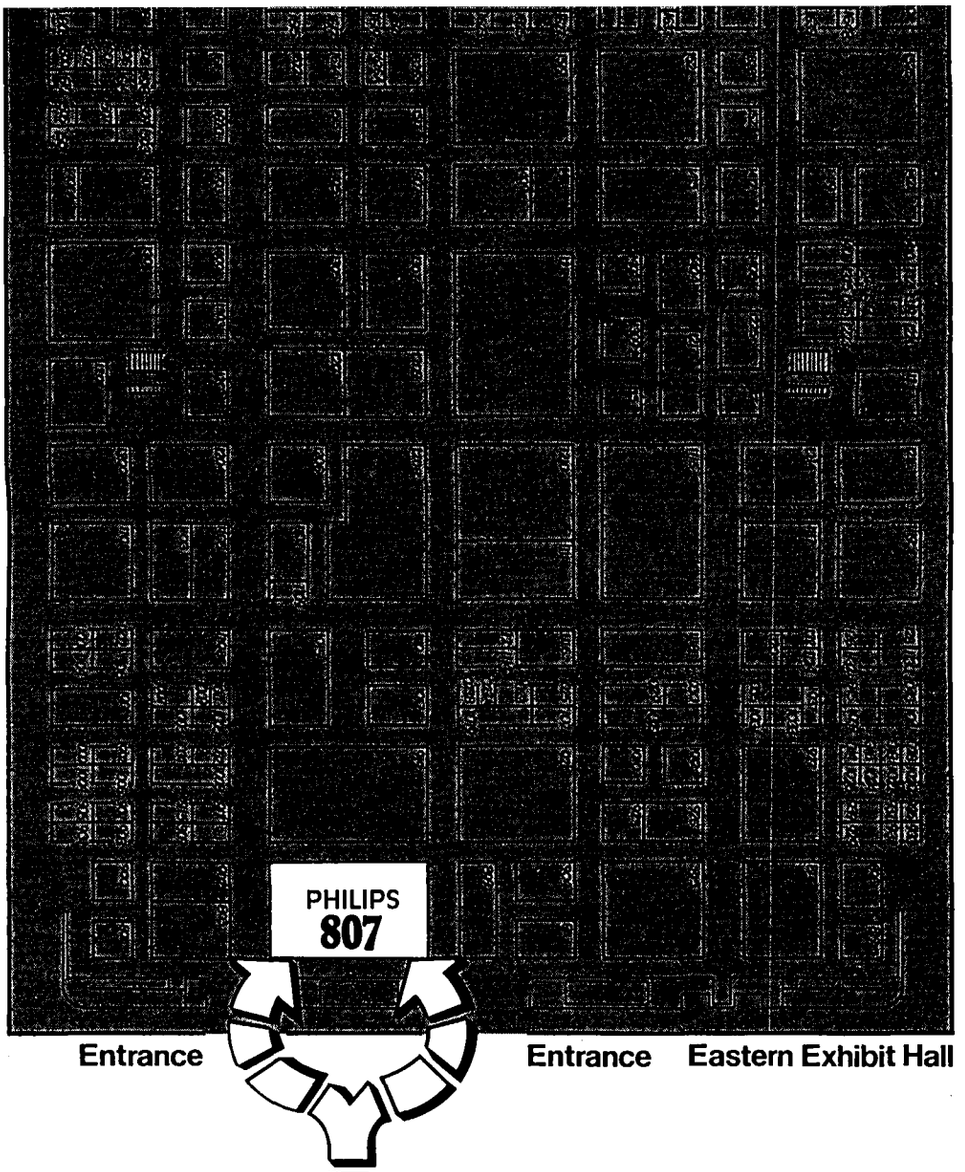
The traditional speech welcoming the participants to the Conference was delivered by the SMPTE Vice-President for Television Affairs, Fred M. Remley. Mr. Remley stressed the deep involvement of the local SMPTE section in each Television Conference. Various U. S. (and Canadian) cities have served as sites of past conferences, and it is important to recognize the dedication and effort of the local people for each of these conferences—especially, the San Francisco section for their work on the present conference. Particular recognition should be given to the Papers Program Chairman, L. L. Pourciau, and the General Arrangements Chairman, M. Carlos Kennedy.

Technical Papers

Digital Video Recording

This session was chaired by David Fibush, with Thomas E. Mehrens serving as Vice-Chairman.

David Schnuelle of TPC Communications reported on the **SMPTE Digital Television Tape Recording Study Group Users Survey.** The charge of this Study



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Maurice French (Editorial Vice-President) plans production of the new book *Television Technology in the 80's* with Jack Christensen (Managing Editor).

Joint EBU/SMPTE Meeting discuss the establishment of compatible international digital standards.

Group was to provide a forum on the exchange of user and manufacturer needs for digital videotape recorders. Much data was obtained on a wide range of subjects, and considerable agreement was obtained in two specific areas: equipment interchangeability among different manufacturers and the preservation of operational capabilities of present helical VTRs.

Max Artigalas of Thomson-CSF, France, presented **8/16: A New Channel Code for Magnetic Digital Recording.** After a brief discussion of existing codes in common use, he then described a new code, the 8/16. The 8/16 code handles the 8-bit words corresponding to video samples and transforms them into 16-bit words which have the same length as the input words (in serialized form). Several advantages of the new code were given, and it was suggested that the 8/16 code would be appropriate for a digital videotape recorder organized in two channels with bit rates of about 160 Mbit/s.

Dominique Nasse of Centre Commun D'Études de Télédiffusion et Télécommunications (CCETT), France, discussed **Recent Developments in Error Concealment Techniques.** One can cope with the errors in the video data by replacing the impaired samples with estimates derived from adjacent error-free areas. This is called error concealment (and is common practice in analog-VTR dropout compensators). Both nonadaptive and adaptive methods of concealment were discussed, and it was concluded that—with an adequate error-detecting system—adaptive concealment should enable a digital VTR to yield visually perfect pictures after many generations. Marie-Jean Colaitis was coauthor.

J. L. E. Baldwin of the Independent Broadcasting Authority, U.K., presented

L. L. Pourciau, Papers Program Chairman, opens the Session of New Camera Technology and Digital Techniques.

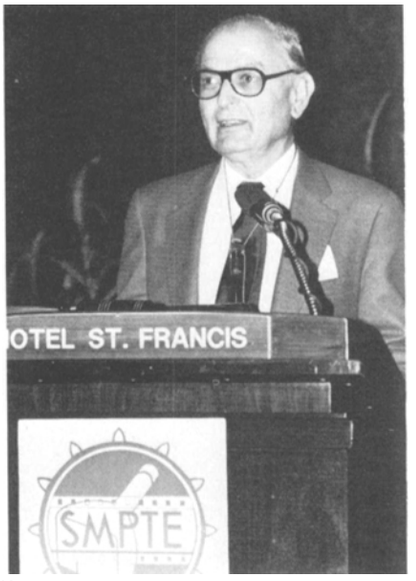
A Format for Digital Television Recording. He noted that various parameters must be considered before deciding upon an optimum format for a digital television recorder. The operational requirements of slow, stop, and reverse motion together with picture in shuttle exclude longitudinal and transverse recording. It seems that a helical recorder with four video heads and a wrap angle for video of 270° could yield a sensible basis for a format suitable for coding standards requiring bit rates up to about 240 Mbit/s.

Yoshitaka Hashimoto of Sony Corporation, Japan, spoke on **Digital Video Tape Recording with Increased Packing Density.** Experiments have been carried out with both composite and component digital

C. Terzani, President of the EBU Technical Bureau, L. Robinson, Conference Program Manager, and C. E. Anderson, SMPTE President, at the EBU Reception.

John Baldwin presented a technical paper on digital TV recording.

Question and Answer period during the All Digital Studio Session.



A. A. Goldberg presented a technical paper on digital TV error reduction.

videotape recorders (DVTRs). After a brief description of a composite DVTR shown last year at IBC, Mr. Hashimoto described a new component DVTR, which was used during the digital demonstrations preceding the conference. A Type-C one-inch VTR was chosen as the basic transport, with modified heads and record/playback processing electronics. Eight heads were used to record the video signals, using a bit rate of 330 Mbit/s and a packing density of 41 Mbit/in^2. Although useful for demonstrating the feasibility of such high packing densities, it was pointed out that a number of technical problems still had to be solved in order to cope with the requirements for component-coded digital video recorders. Coauthors were Masahiko Morizono, Hirofumi Yoshida, and Takeo Eguchi.

Dieter K. E. Pohl of Robert Bosch GmbH, Television Systems Division, discussed **Aspects and Considerations About the Mechanical Format of Digital VTRs.** Compared to analog TV studio signals, magnetic recording of digitized video signals must handle extraordinarily high bandwidths with correspondingly low signal-to-noise ratios. A consideration of the different mechanical recording principles shows that the best practical compromise is a segmented helical format. An optimization must be found between various parameters. The realization of "special mode" operations must be taken into account from the beginning. Recording of the digitized signals in a digital VTR needs careful evaluation of channel encoding and error management, which must be different for audio and video. All editing facilities of analog VTR are mandatory for digital VTR.

C. Robert Thompson of RCA spoke on **Mechanical Tape Format Considerations for Digital Television Recording.** In order to provide maximum effectiveness for future users of digital video tape recorders, the implementation of operational capabilities must be carefully selected. Mechanical tape format is a key ingredient in this selection process. Implementation of key features such as cassette loading, on-air variable-speed operation, picture in shuttle, component recording, composite recording, and their impact on format parameters were also discussed.

Michael Felix of Ampex Corp. discussed **Formats for Digital Video Tape Recorders.** Since the bandwidth of digital VTRs is many times that of analog recorders, high packing density is essential. In any form of magnetic recording, the highest packing density always occurs at the narrowest track width, since doubling the number of tracks per inch reduces the SNR less than does a doubling of the number of longitudinal bits per inch. The author feels that the Miller Squared Code, which was specifically developed for high density digital tape recording, is the optimum code for DVTR because it has zero overhead and is especially suitable for overwriting. The author suggested that a good compromise is a 180° wrap, two-channel helical machine using overwrite rather than flying erase. Coauthors were D. Dolby and M. Lemoine.

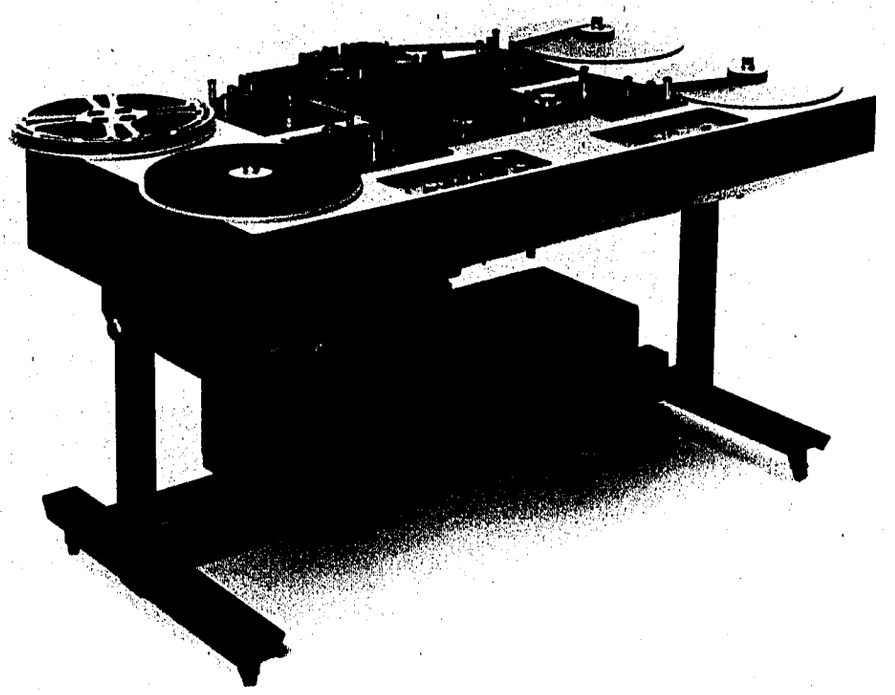
New Camera Technology and Digital Techniques

The Session Chairman was L. L. Pourciau, and he was assisted by Gerow D. Brill. The opening tape was provided by Image West Ltd.

Kenneth Clunis of 3M/Mincom Division discussed **DVTR Editing Considerations for Multiplexed Audio Versus Separate Audio Edge Tracks.** Digital recording brought unique new problems to professional audio editing. Among these are the requirement for a digital cross-fade, to replace the cross-fade splice obtained by a bias ramp-up/ramp-down transition in analog audio machines. Error correction and cross-fade digital techniques require a buffer or delay to process the data. Another serious consideration which the author pointed out is the choice of sampling rate chosen for the audio and video signals. The audio industry is trying to achieve a standard sampling rate for professional audio recording based on establishing an integral relationship between the U.S. and European television frame rates. Clunis proposed a digital audio format which allows maximum flexibility for inter-standard editing compatibility.

A. A. Goldberg of CBS Technology Center presented the paper **Digital Television Error Correction Without Overhead Bits.** The author described a spectral

THE VIDEO REVOLUTION



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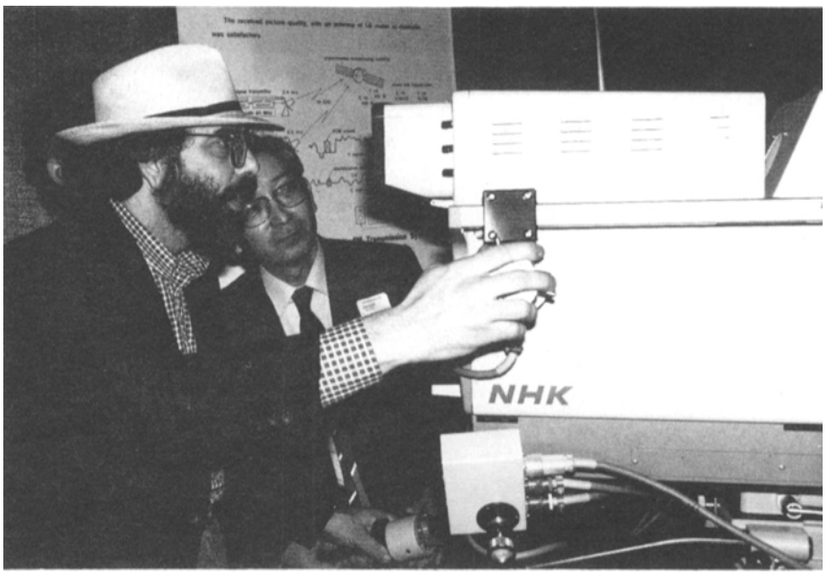


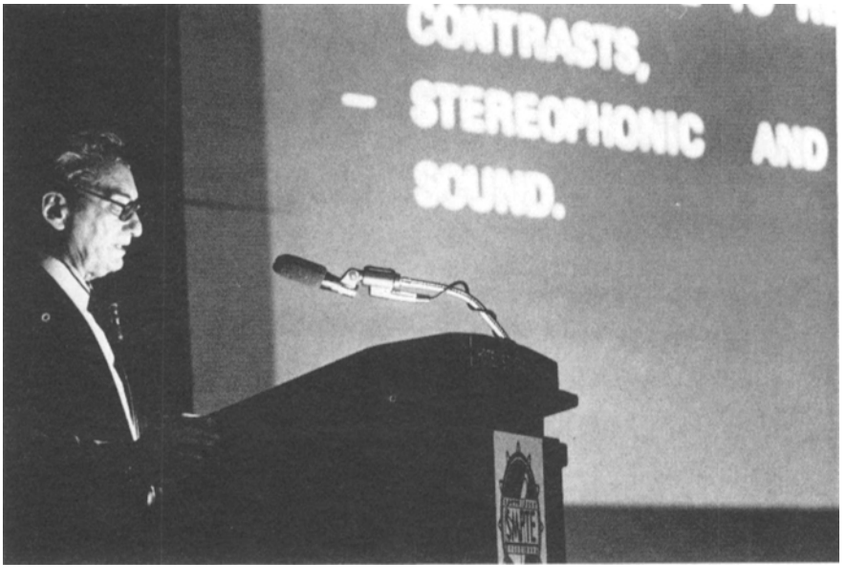
Francis Ford Coppola, the renowned Director and Producer, studies the picture quality attainable with the NHK high-definition color camera, while Dr. Fujio of NHK looks on.

means to detect and significantly correct bit errors in a pulse code modulated (PCM) television signal by recognizing the unique characteristics of isolated bit errors in a digital bit stream. The newly developed circuit described does not use any overhead bits, yet performs bit error correction and not simply error masking. Subjective tests prove that the bit error rate of a PCM television signal can be significantly reduced by this technique. The operating principle of the spectral error correcting system is based on the fact that an isolated bit error in the digital signal produces a spike in the video, having spectral energy well beyond the frequency band of a composite NTSC color television signal. By using this information, bits in error can be identified and corrected. The author described details of the circuitry involved and presented a tape showing examples of video—with and without utilization of this correction technique. John P. Rossi was coauthor.

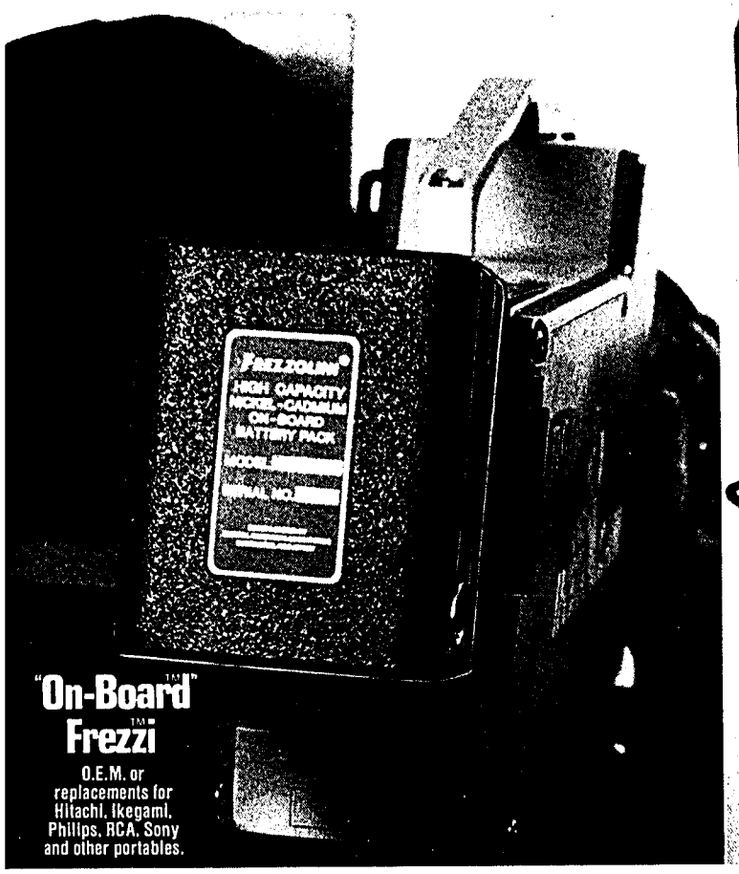
L. W. Germany of Pye TVT, U.K., presented **Reflections of a Camera Designer.** A number of compromises are normally required in the design of a television camera. The paper defined the ideal camera design and discussed a number of features affecting camera performance, including the optical system, choice of pickup tube, deflection, signal processing, subjective performance, and users' needs. The author commented on tolerances, physical limits, and other constraints, all of which reflected the state of the art in camera technology today. Coauthors were H. Blom and E. Tienkamp of N.V. Philips, the Netherlands.

Takashi Sueoka of NHK (Japan Broadcasting Company) was the senior author of a **Super Camera Using Saticon and Built-in Computer Control System.** The paper was presented by Dr. Takashi Fujio. A high-performance TV camera (Super camera) was developed based on a new concept of camera engineering art. The camera consists of a 1-inch Saticon pickup tube and microelectronic circuits and provides built-in computer control facilities for the setting up and maintenance of the camera system. Saticon's low flare and high-resolution power characteristics render excellent picture quality. A film was shown demonstrating excellent results when the new camera was used with a new laser beam film recorder. Coauthors were K. Wakui, K. Murakami, T. Mochizuki, T. Kawai, and K. Ohzeki.

John O. Ryan of Ampex Corp. presented **Advances in EFP Camera Performance.** The author outlined several advances in the state of the art incorporated in the latest family of Ampex broadcast color television cameras. Mr. Ryan focused on three general topics: (1) the use of microprocessors, (2) video processing,



Joseph Polonsky presented three areas of needed research in high definition TV.



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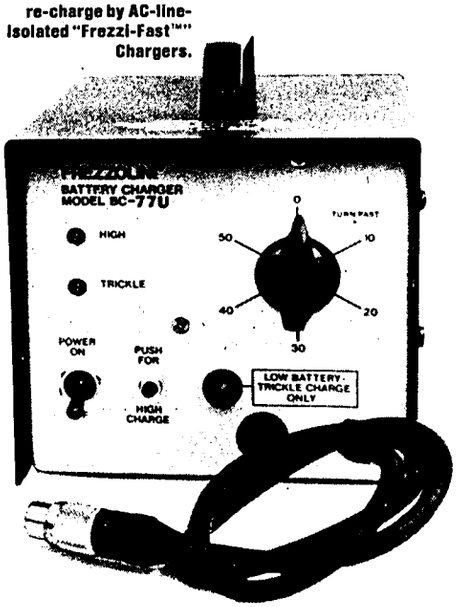

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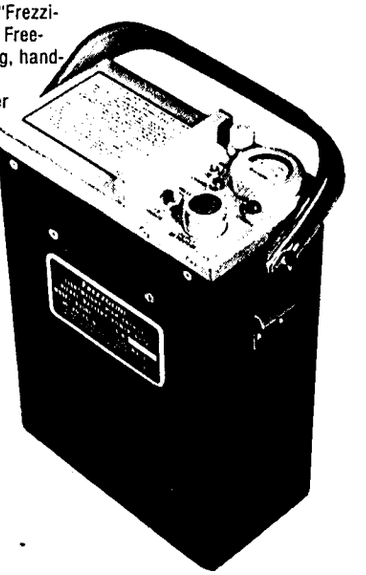

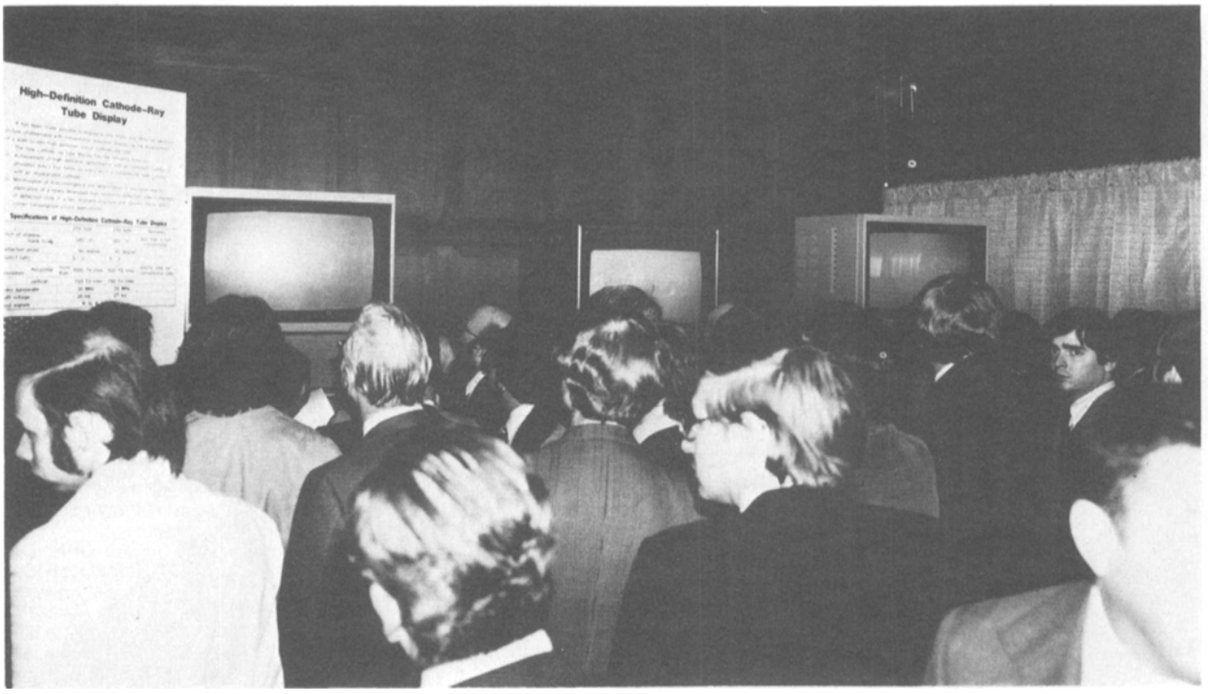

Viewers studying the NHK demonstration of high-definition television.

and (3) remote control. Microprocessor technology has been used to produce spatial error correction. This technique permits improvement in registration and shading correction and can be applied to manual and automatic setup of a modern television camera.

A. Franken of N.V. Philips, the Netherlands, spoke on a **High Resolution Camera System.** A new camera tube has been developed to meet the needs of a high resolution system. New concepts of a low-lag diode gun with high beam reserve have been introduced in the camera tube. A special application is the integration and storage of images. These images can be read out in slow scan. The construction and the performance of the device were discussed.

R. G. Neuhauser of RCA Corp. spoke on **Lag Reduction and Lag Characteristics of Television Camera Tube Signals.** Lag in decay and buildup of a television camera tube signal is one of the major factors restricting the usefulness of a television camera at low light levels. Lag can be reduced substantially by several factors. These are a lower value of the storage capacitance of the photoconductor, the use of bias lighting, and the employment of an electron gun producing a lower effective beam resistance. These factors are shown to be cumulative. Measurements of lag characteristics compared to visual observations show that the conventional "third field" lag specification fails to categorize the visual perception of lag in a television picture, and so a different method for specifying lag was suggested.

Future Directions for Television

The Chairman of the Session was Skipwith Athey, with Gene Tharpe as Vice-Chairman. The opening tape was provided by Digital Image, Inc., Berkeley, Calif.

Kiyomi Iizuka of Tokyo Broadcasting System, Inc., Japan, presented **Multiplex Sound Television Broadcast in Japan.** Multiplex sound television has been in operation in Japan since 1978. As of September 1980 a total of 29 stations were telecasting multiplex sound programs. The greatest technical challenge is the production of stereo pop music programs because

Panel discussion of the digital video demonstrations. The panelists (left to right) were Roland Zavada, Charles Ginsburg, Frank Davidoff, Ken Davies, William Connolly, and Stephen Kerman (Session Chairman).

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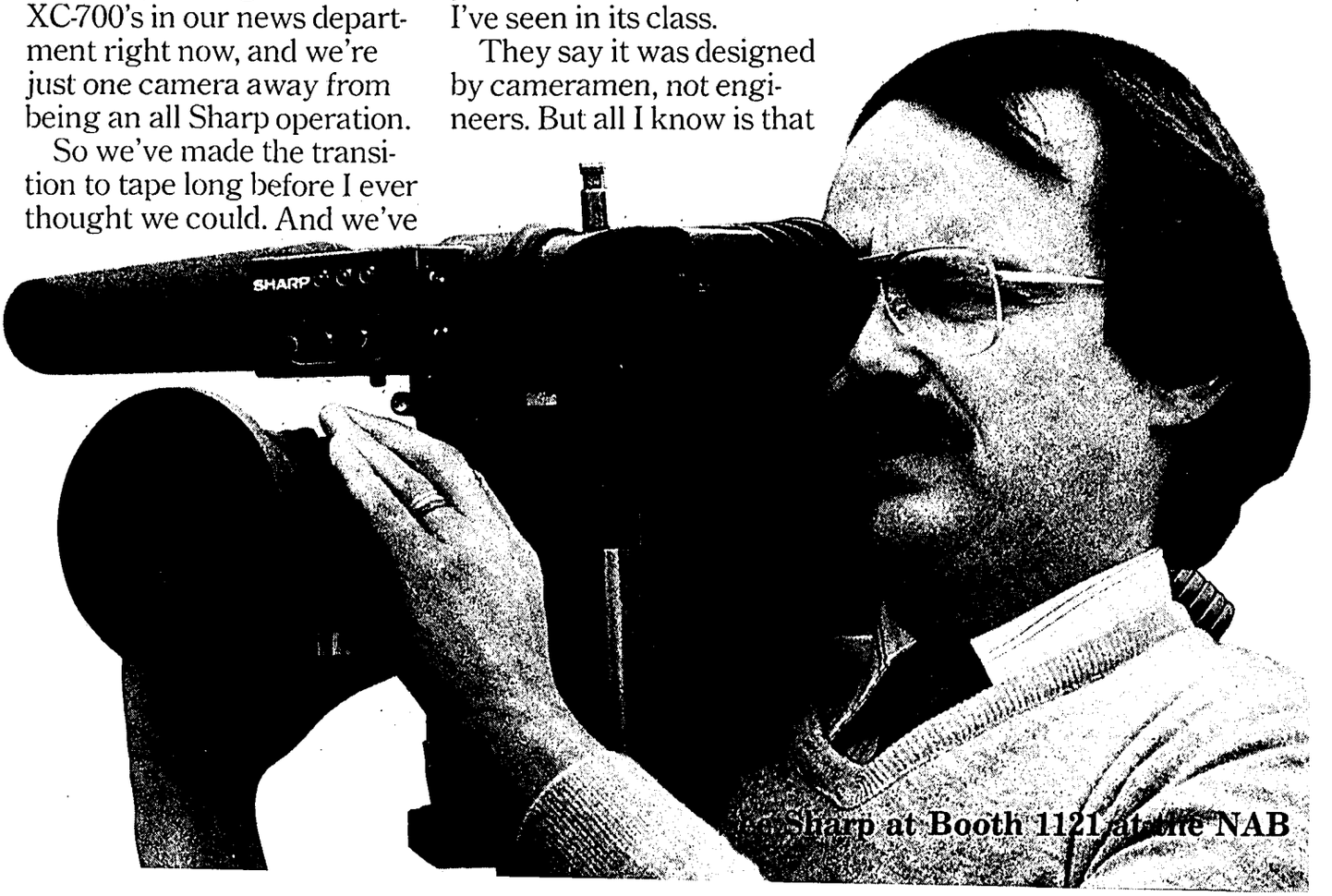

See Sharp at Booth 1121 at the NAB

Meeting of the Working Group on High-Definition Television.

the total sound balance in the studio is not suitable for recording with a group of stereo microphones. To illustrate required techniques, the author described the stereo music program *Sound Inn 'S'* in which 60 microphones are used for around 50 performers. The 60 microphones are connected to a 40-input/16-output main console through submixers. Fifteen outputs of the main mixer are fed to a 16-track audiotape recorder. An audio engineer, watching videotape playback which is synchronized to the multitrack audiotape, mixes down the 15 tracks into L and R. The mixing console is equipped with servomotor-driven faders which feed their positioning data to a computer. The final mixdown is performed by the computer and is recorded directly on one-inch videotape from the multitrack audio tape. The presentation was followed by a demonstration videotape showing a segment from the program described.

Joseph Polonsky of Thomson-CSF, France, presented **Questions on the Orientation of Research in High Definition Television.** Avenues of needed research and development for High Definition Television (HDTV) have been indicated in the pioneering research reports of NHK and in a report by the SMPTE HDTV Study Group. The author made the point that he was not offering data, but rather was posing questions to stimulate discussion. He called attention to three areas in which additional research is needed: marketing, bandwidth compression, and compatibility. He concluded that we have approximately eight to ten years to optimize the future standards of professional and consumer HDTV systems. To illustrate the dynamic nature of this technology, the author posed the question, "How does one select the correct size of shoe for a growing child?"

Broder Wendland of the Universität Dortmund, West Germany, spoke on **High Definition Television Studies on Compatible Basis with Present Standards.** Present day TV systems do not offer the optimum picture quality which is possible within the given standards. Compatible improvements are possible by using digital signal preprocessing at the transmitter end and signal postprocessing at the receiver end. It is the author's opinion that before any new standard for high definition television (HDTV) systems is defined, the possible improvements within the given standards should be considered. In a first step it is shown how to overcome the degradation of vertical resolution by the scanning process. In a second step it is shown that with offset sampling in adjacent lines in connection with certain data transmission techniques it is possible to transmit 8 MHz samples in the luminance channel of a color TV system. This results in a horizontal resolution which is increased by a factor of about 2 when compared with the standard resolution of 4 MHz. Preliminary results were illustrated in slides.

Takashi Fujio of NHK Technical Research Laboratories, Japan, presented **Present State of the Study of High-Definition Television System in Japan.** Dr. Fujio described the present state of the study of a high definition television (HDTV) system which was begun in 1970 to meet the demands for the post-industrial society of the future. He also considered the subjects of picture quality, picture aspect, signal standards, and broadcasting systems which are now being carried out. He described new HDTV equipment, such as a high-resolution camera, a laser telecine equipment for 70-mm movie film, a high-resolution CRT with a wide aspect ratio, and a color multiplexer and receiver for satellite transmission which has already been developed. Transmission tests via the Japanese Medium-scale Broadcasting Satellite for Experimental Purpose have been carried out. To further describe this system, a videotape illustrating some of the hardware was shown. Following the paper presentation, demonstrations were given in an adjoining area using the equipment described in the paper.

NHK Demonstration of High Definition Television

After Dr. Fujio presented his paper, he invited the audience to step next door to observe the NHK demonstration on HDTV. The developed system is a 1125-line color television system, and its presentation at the conference is the first showing of the system in North America. The equipment on display included a special broadband color camera with unique two-inch Saticon pickup tubes and a large screen, and also a direct-view picture-tube display device with a high-resolution face-

Governors Toni Roth, Robert Ringer and Blaine Baker with Nashville Section Chairman Wayne Caluger and Standards Committee Chairman L. Merle Thomas.

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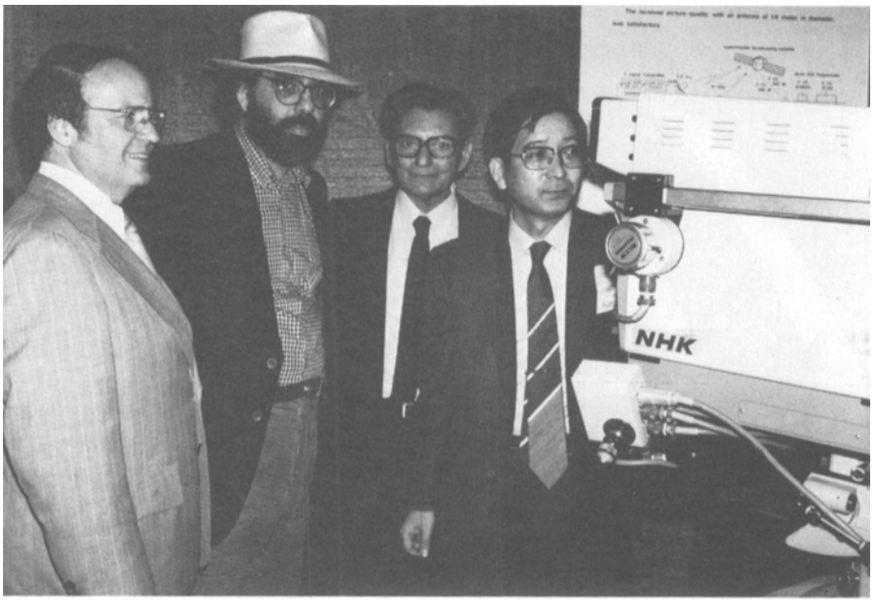

Francis Ford Coppola, with Joseph Flaherty, Vice-President of Engineering at CBS, Joseph Polonsky, Technical Director of Thomson-CSF, and Dr. Takashi Fujio of NHK Research Laboratories.

plate. Prior to this demonstration the equipment had been seen by only a small number of people who had recently visited the NHK Laboratories in Japan. The picture quality was judged by many to be excellent. The demonstration continued for several hours in the afternoon and then resumed again later that evening to give all interested parties an opportunity to see for themselves what is on the horizon for high definition television.

The All Digital Studio

The Session Chairman was Stephen D. Kerman, and Chuck Barrows served as Vice-Chairman. The opening tape was provided by Acme-Cartoon Co., Inc., Dallas, Texas.

Michael S. Tooms of Protel Broadcast Services Ltd., U.K., presented **Systems Engineering Considerations in the All Digital Television Production and Transmission Center.** A design study for an all digital television center has been carried out. Such a study was considered to be the most practical method for: (1) exploring whether alternative system configurations to those adopted for analog environments would be advantageous; (2) evaluating what the consequences of these alternative configurations would be on the specifications of new digital equipment; and (3) determining how the phasing of the introduction of the digital system into a busy operation could best be achieved. Reasons for assuming a trend towards an all digital approach and also reasons for basing the study upon a component coding format were briefly reviewed. A system design configuration based upon deriving maximum utilization of resources and complete flexibility in operation was evolved. The author suggested that the most efficient manner of achieving these objectives would be to adopt multiplexing techniques for routing both the video plus four associated audio signals and the larger number of premix audio signals associated with sophisticated productions.

C. K. P. Clarke of the British Broadcasting Corp., U.K., presented a paper on **Digital Decoding of PAL and NTSC Signals Using Field Delay Comb Filters and Line-locked Sampling.** The introduction of the use of digital component signal processing in certain studio areas will provide improved signal quality and operational flexibility. However, some composite signals will continue to be used in studios for many years. Therefore, high quality decoding at the interface between composite and component signals is important to allow the two systems to co-exist. The use of digital techniques in decoding provides high stability and accurately defined characteristics. This is particularly necessary when complicated comb filters are used to obtain improved separation of luminance and chrominance. Problems associated with a sampling frequency locked to the color subcarrier are avoided by using a method of color decoding which can accept line-locked sampled signals. After discussing various techniques of luminance/-chrominance separation, the author concluded that, with further development, it is expected that decoders using field stores will provide high quality component signals, which can be used interchangeably with directly originated component signals in the digital studios of the future.

John L. Judge of Tektronix, Inc., spoke on **Test Signals in the Digital Domain.** The author described the advantages of digital video test-signal generation over analog signal generation. It was shown that the use of digital techniques improves the relative amplitude accuracy and repeatability of existing test signals while decreasing the number of adjustments typically required by the different current sources in an analog generator. Using these techniques it is not difficult to develop new special signals or modification of an existing signal. A computer program can generate the data values for each point along the signal waveform and format this data into the proper address in the signal ROM. As an example of new test signals available, Mr. Judge described two such signals and their applications: "multipulse" and $(\sin x)/x$. In conclusion, the author indicated that these digital techniques allow generation of optimum test signals rather than just practical test signals.

Thomas S. Robson of the Independent Broadcasting Authority, U.K., presented the paper **Worldwide Standardization — Now or Never.** One problem which often exists in the use of analog equipment on more than one standard arises from the three different color encoding standards: NTSC, PAL, and SECAM. With component coding of the luminance and color difference signals this problem vanishes. The investment in broadcasting equipment and in particular the domestic receiver prevents changing the number of lines per picture or the number of pictures per second. The change from composite to component coding within a studio complex seems worthwhile, as it gives significant benefits. These benefits can be fully realized only if the same standard be adopted worldwide for sampling the picture in the horizontal direction, that is, along the line. It is obviously impossible to agree on a sensible worldwide standard before sufficient relevant information is available for making a suitable choice. As soon as significant amounts of component digital equipment have been designed it will become more difficult to reach worldwide agreement. The author feels that with the present closeness of the EBU and SMPTE in working

Continued on page 320

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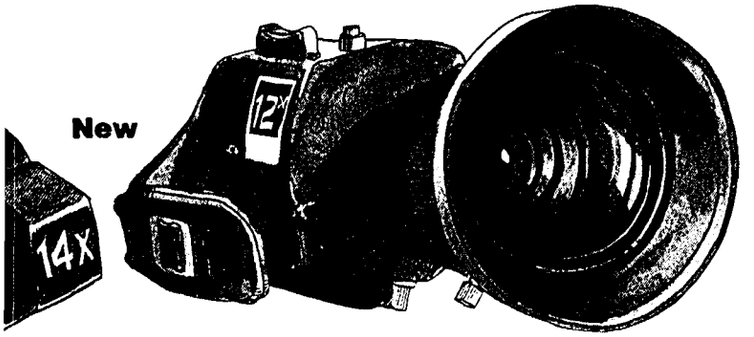

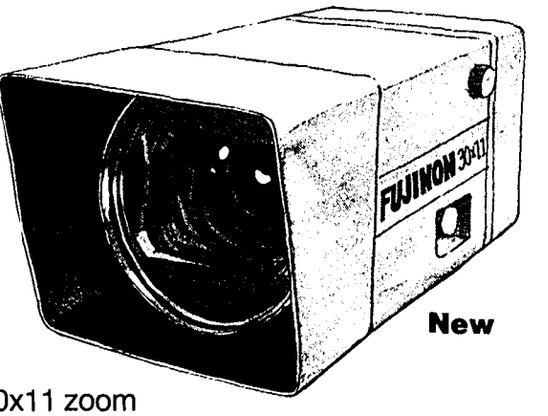

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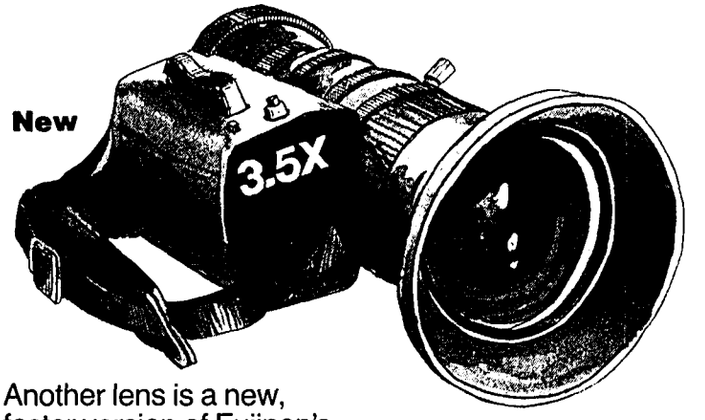

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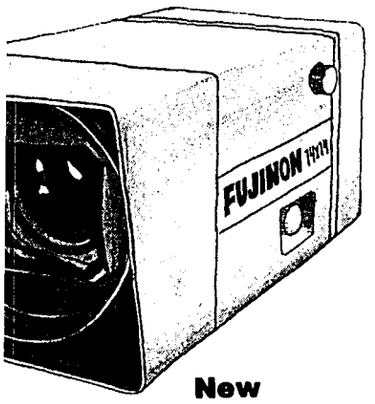

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Continued from page 316

toward achieving a worldwide standard there will never be a better time for a world standard.

Panel Discussion

Immediately after the last paper presentation, the panelists took their places on the platform for the Panel Discussion on the Digital Video Demonstrations. In addition to Mr. Stephen D. Kerman (Tektronix, Inc.), the Session Chairman, the panelists were Frank Davidoff (Frank Davidoff, Inc.), William G. Connolly (CBS Television), Kenneth B. Davies (Canadian Broadcasting Corp.), Charles A. Ginsburg (Ampex Corp.), and Roland J. Zavada (Eastman Kodak Co.). Messrs. Davidoff, Connolly, Davies, and Ginsburg are the Chairmen of the various SMPTE digital groups, and Mr. Zavada is the SMPTE Engineering Vice-President and was substituting for Robert Hopkins (Chairman of the Committee on New Technology), who unfortunately was unable to attend.

Mr. Davidoff introduced the other panelists to the audience and then gave a brief background on the demonstrations. He described the organizational structure and history of the various groups concerned with digital technology and the impetus for organizing the digital demonstrations at the conference. He indicated that after the prepared statements of the Chairmen of the various digital groups, he would invite the audience to ask questions of the panelists.

Mr. Zavada discussed the formal structure of the Society's engineering effort. There are eight parent engineering committees, and in 1975 the Committee on New Technology was established to deal with emerging technologies. He went into the distinction between study groups (which provide an in-depth study of a specific topic with the aim of deriving a report) and working groups (which provide preliminary documentation when standardization is under consideration). Membership in SMPTE Committees is open to anyone who is willing to participate and is *not* restricted to SMPTE members. Mr. Zavada described the evolution of the committees dealing with digital technology and thanked the engineers and their sponsoring organizations for their contributions.

Fran Kennedy (Chairwoman) and Nancy Pourciau (left to right) discuss the Spouses Program.

Ken Davies described the demonstrations. He began by showing a short videotape that gave a good deal of background material. It was indicated that the video components to be digitized were Y, $R - Y$, and $B - Y$. Other factors to be considered were the chroma ratios (quality level), interfacing of the system with the current NTSC system, capability of practical and economical recording, and high-quality and economical transmission of signals by terrestrial and satellite circuitry. The lumi-

The Get-Together Luncheon: John B. Sommers, Executive Vice-President and General Manager of the National Association of Broadcasters (NAB), explains the interactions of the NAB with the FCC.

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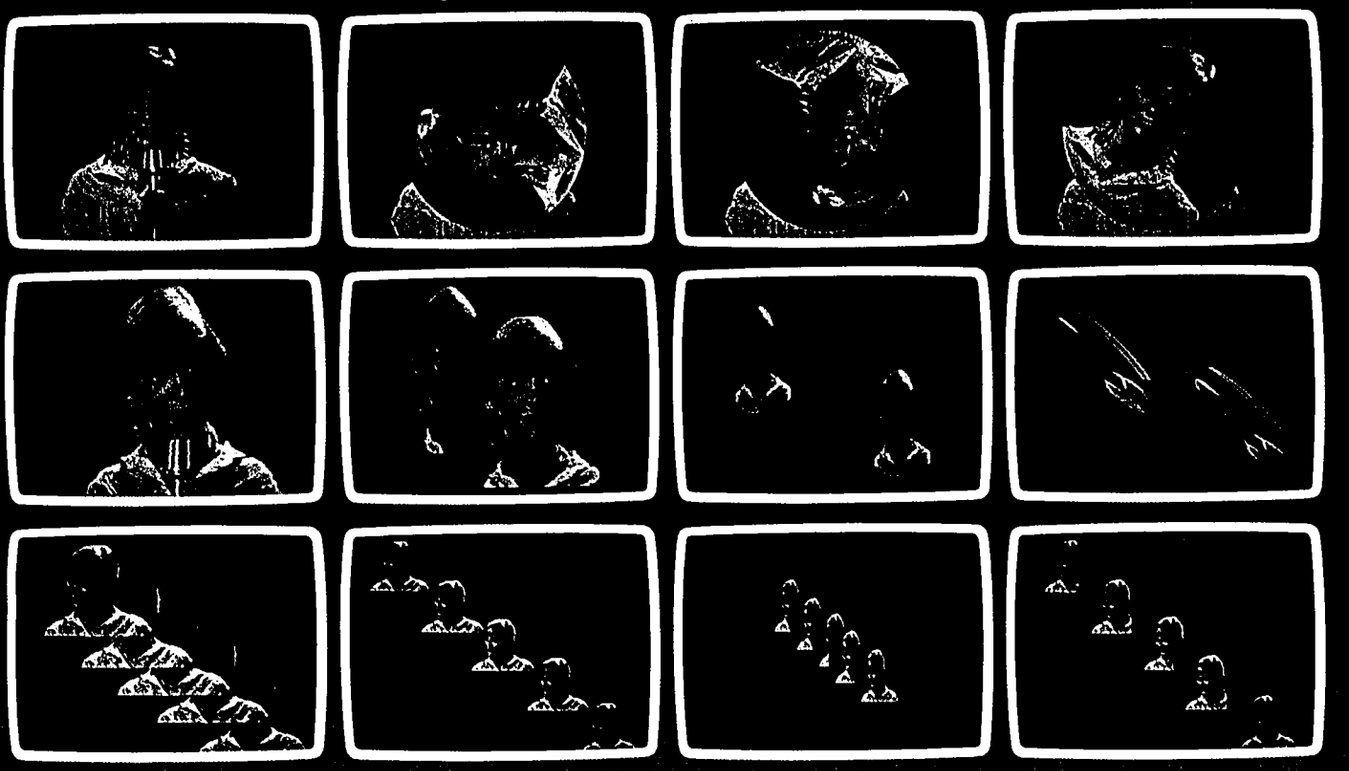

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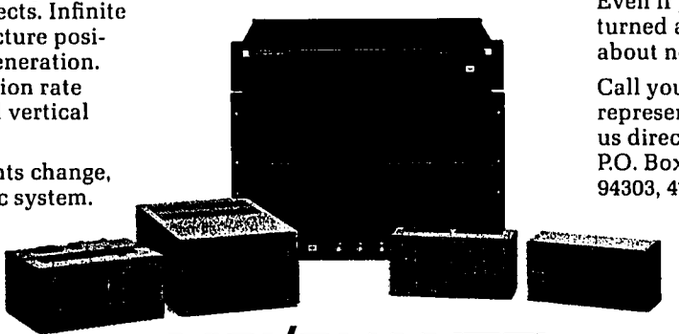

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Harris Video Systems
Sunnyvale, California

MCI/Quantel (Micro Consultants)
Palo Alto, California

Merlin Engineering Works, Inc.
Palo Alto, California

NEC America Inc., Broadcast Equipment Div.
Elk Grove Village, Illinois

Sony Corp.
New York, New York

Sound Genesis
San Francisco, California

3M Video Products
St. Paul, Minnesota

Tele-Cine, Inc.
Massapequa, L.I., New York

Thomson-CSF Broadcast, Inc.
Stamford, Connecticut

Toshiba America, Inc.
Sunnyvale, California

Vital Industries
Gainesville, Florida

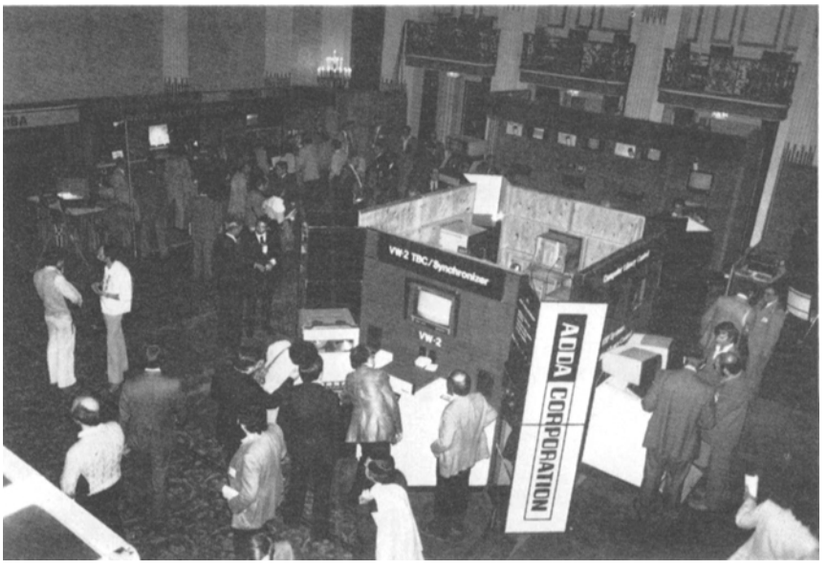
nance sampling rates used were 768, 864, and 912 samples per line (SPL) or 12, 13.5, and 14.3 MHz. Mr. Davies indicated that an information manual giving details of the demonstration equipment had been prepared, and a limited number of copies were available and would be distributed after the session. Some of the equipment used was shown in the videotape, with each group of instruments being described by one of the people responsible for it. The quality of the demonstrations and the pictures produced were *not* shown on the tape because, as Mr. Davies said, "the NTSC window is not well suited to showing the quality — the very high quality — of the digitally generated and processed pictures." A wealth of data has been obtained on the likely performance limits of digital video systems. This data will form the basis for certain decisions on digital standards that will be in use for some time to come.

Next, Mr. Ginsburg discussed the activities of the Study Group on Digital Television. Starting with its first meeting in early 1975, the Study Group considered many different questions pertaining to digital television, including bit rate reduction techniques and the bit rates required for digitizing television signals — both in composite form and in component form. By the spring of 1979 the EBU had decided on the use of digitized component signals (for PAL and SECAM systems); the NTSC countries followed soon after, indicating that they, too, would be seeking digitized components. As the bit rates employed in digital videotape recording demonstrations have become higher (new proposals involve bit rates of up to 224 and even 336 Mbit/s), the problem has arisen of how such high-bit-rate systems will interface with the common carrier. In Europe, where a standard in excess of 160 Mbit/s is under consideration, a mild bit-rate reduction will be necessary to interface with the common carrier (PTT). The situation is even more serious in Canada and the U. S., particularly in the U. S., where there are presently no plans for facilities beyond 90 Mbit/s.

The final prepared statement was by Bill Connolly, Chairman of the Study Group on Digital Television Tape Recording. His main point was that the choice of the sampling rate to be used is a difficult one to make. The generalization "bits cost money" may be correct in the short run; in the long run, however, choosing a (relatively) low bit rate will lead to higher costs and complexity for some post-production processes and may make certain techniques difficult or impossible to carry out. Mr. Connolly feels that no single individual has the wisdom to decide what the sampling rate should be. The collective wisdom and experience of all the SMPTE groups dealing with digital technology may provide the best background for making this difficult decision.

Mr. Kerman then opened the floor for questioning. A number of questions were posed, and statements and opinions were also offered by members of the audience. The panelists offered answers to questions where appropriate and sometimes responded to audience statements.

Mr. Zavada outlined briefly what had been accomplished so far. He indicated what meetings were scheduled for the next few days and weeks and what questions



The popular equipment exhibit displayed a wide range of products related to the topics of the technical program.

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CTVM 3 Colour monitors.
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- Cathode ray tubes: delta gun shadow mask CRT or slot mask CRT.
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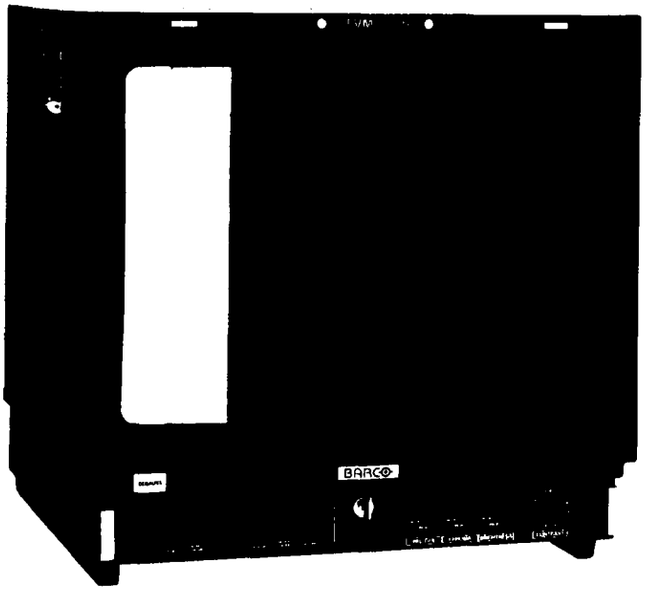

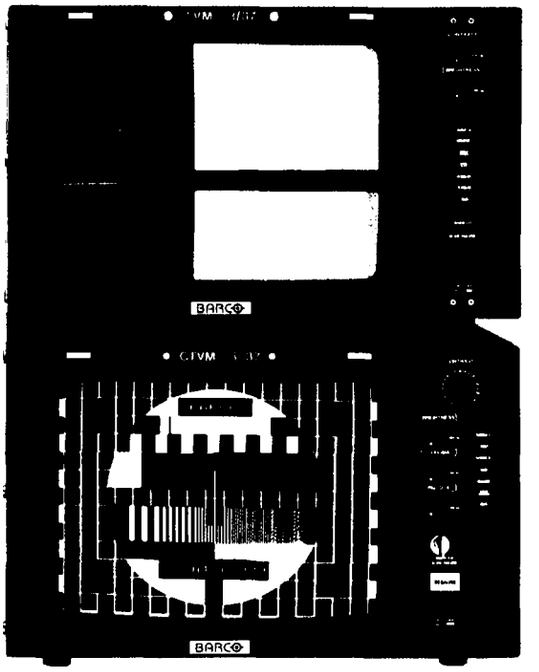

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Wine and Cheese Party at Sabella's Restaurant on Fisherman's Wharf.

were likely to be discussed. He indicated that it appears that the best place to discuss international digital standards might be within the CCIR (International Radio Consultative Committee), which is holding a plenary meeting in February 1982 and an interim meeting in September 1981. He closed by thanking those who had taken part in the work and gave special thanks to the Chairmen of the various digital groups.

Equipment Exhibit

The equipment exhibited at the 15th SMPTE Television Conference served as a fine complement to the Papers Program. As has become traditional at the TV Conference, exhibitors were limited to those displaying equipment directly related to the technical topics on the program, thus enabling the attendees to focus on their special interests. Twenty-three companies participated in the Equipment Exhibit.

Social Events

Luncheon

The traditional get-together luncheon was held on Friday in the California Room of the St. Francis Hotel. SMPTE President Charles E. Anderson introduced the guest speaker, John B. Sommers, Executive Vice-President and General Manager of the National Association of Broadcasters. Mr. Sommers gave a provocative talk on the dealings of the NAB with the FCC. Mr. Sommers indicated that the NAB is committed to ensuring that the government treats all within its jurisdiction in a like manner — the new technology as well as the old.

Wine and Cheese Party

Sabella's Restaurant, located at Fisherman's Wharf, was the site of a Friday evening party — open to all those attending the conference.

Spouses Program

The Spouses Program was under the direction of Fran Kennedy. Beautiful San Francisco weather and some careful planning created an enjoyable program. The activities began each morning with a continental breakfast. On Friday, there was a choice of activities: Chinatown, Golden Gate Park, Pier 39, The Cannery, art galleries, or "just shopping." On Saturday morning, the participants went by bus and ferry to the island of Tiburon for shopping and lunch.

Wine Tour

On Sunday morning, for those that did not have to rush home, Judi Puckett and Charles E. Anderson arranged a wine tour of the rich Sonoma Wine Region. The tour was conducted by Mr. Anderson.

Acknowledgments

The Society wishes to thank the following organizations for providing facilities and services as indicated: Ampex Corp. for the Spouses Continental Breakfasts; Sony Corp. of America for the Sony Trinitron Color Monitors; KRON-TV, KGO-TV, KPIX-Westinghouse, and KTVU-TV for the Wine and Cheese Party; W. A. Palmer Films, Inc. for the audio recording; and Ampex Corp. for the audio tapes.

The SMPTE is also grateful to the organizations that contributed to the "digital demonstrations." They are acknowledged individually earlier in this report, in the section *SMPTE Digital Demonstrations*.

Invitation to Opryland

The next (16th) SMPTE Television Conference is scheduled for 5–6 February 1982 at the Opryland Hotel in Nashville, Tenn. Readers are invited to make plans to attend — see future issues of the SMPTE JOURNAL or contact SMPTE headquarters for further information.