Journal of the Society of Motion Picture and Television Engineers

VOLUME 83 • NUMBER 12 • DECEMBER 1974

Report on the 116th SMPTE Technical Conference and Equipment Exhibit

By RODGER J. ROSS

The papers input for the Toronto Conference, totaling 117, was as good or better than any that was held in the past. There is no doubt that the papers and the Symposium on Television Monitoring will prove to be of substantial assistance in resolving problems and advancing communications techniques.

In addition to papers from the United States and Canada, authors came from England, Germany, France, Czechoslovakia, USSR and Japan to describe what they are doing on a wide range of motion-picture, television and photo-instrumentation projects.

The large number of papers presented made concurrent sessions necessary throughout the week. However, as the papers were presented in adjacent theaters, it was easy for those attending the Conference to move from one theater to the other as their interests dictated.

Of great concern at the present time in the film and television industries is the question of monitoring and verification of television program materials — especially television commercials. This was the subject of a symposium on Thursday of Conference week. Different methods of monitoring and verification in current use were described and views were expressed by many of them concerned with those operations, including advertisers, agencies, monitoring services and broadcasters. The symposium gave an opportunity to bring out into the open for discussion a number of proposals to solve the present impasse, as well as the needs of users of monitoring systems.

At the conclusion of the all-day symposium Bruce S. Longfellow of the FCC gave an explanation of the rules covering television broadcasting and urged that a feasible solution be found applicable to both film and videotape.

The session on Engineering Management on Friday, although not as well attended as many of the others, included several excellent papers. Outstanding was the paper by Arch Luther, RCA Corp., "TCR-100 Cartridge Video Recorder: History of a Product Development." The audience heard a dramatic account of the way in which this new machine was created and the various factors which influenced the design.

Of particular interest to broadcasters were the two papers on Monday morning on the design and construction of the CN Tower and the multiple antenna system it will support. When it is completed the tower will be the tallest free-standing structure in the world with a height of 1850 ft (564 m).

Two papers describing the Nippon Electric Company television frame synchronizer and its operational implementation by NBC in the United States stressed the great strides that are being made in the correction of time-base errors in magnetic television recording and satellite transmission. There was a large attendance at this session.

Another feature that attracted a big crowd was the paper by Alfred Fleischer and John Pytlak, "L.A.D. — A Motion Picture Laboratory Control System Based Upon Laboratory Aim Densities." In this paper a method was described to make use of a uniformly exposed and processed film patch spliced into materials to be printed to control printing and duplicating processes.

Tuesday morning a demonstration was given by Ioan Allen on Dolby noise reduction and cinema equalization techniques as applied to optical soundtracks. A big crowd was on hand for this and for the following paper by Petro Vlahos, AMPTP Research Center, "Performance Parameters of the Hue-Modulated Multi-Channel Push-Pull Color Soundtrack." Then Frank E. Pontius of Westrex Inc. described a new photographic recording system for producing hue-modulated tracks.

While the attendance for the Photoinstrumentation sessions was quite small, several interesting papers were given. Noteworthy was the paper on the "Acceleration Analysis of Crop Cutting by High-Speed Photography," by Graeme R. Quick.

A special feature during the session on Satellites in Broadcasting on Thursday morning was a live demonstration of the ATS-6 satellite. The presentation originated in Denver, Colo., and was transmitted to Toronto where it was received by an earth terminal set up in the City Hall Square across the street from the hotel.

Another paper and demonstration that drew a large crowd—with many standing in the aisles — was given by Karl Kruger of the Canadian Broadcasting Corp. in Toronto entitled "The Potential of Super 8 in Television." This was a report of the work done by the CBC Super 8 Study Group concluding with a demonstration that included materials from a variety of sources assembled on videotape to serve as a super-8 picture and sound quality reference.

TORONTO Post-Conference Report

Edit. Note: This article gives the highlights of the Conference as viewed by Rodger J. Ross, a recipient of the Society's Progress Medal. Selected by Editorial Vice-President Gerald G. Graham for this assignment, Mr. Ross has expertise in both the film and television industries. In preparing his report, he listened to as many papers as time permitted. In addition he has had the advice of a number of specialists who attended papers in other sessions. We are grateful for their cooperation and for Mr. Ross' considerable efforts.

CONFERENCE COMMITTEES

It would be nearly impossible to assemble a technical program of 120 papers without assistance. Program Chairman Maurice French, Canadian Broadcasting Corp., had splendid support from his Topic Chairmen, who were responsible for obtaining papers within their assigned areas of activity. The Topic Chairmen were as follows: Associate Program Chairman: Harold Eady; Program Topic Chairmen: *Television Systems,* Michael Barlow; *Photoinstrumentation,* Donal Clayton; *SMPTE Symposium on Television Broadcast Monitoring,* Roland J. Zavada; *Film for Television, International Papers Liaison,* Leslie H. Holmes; *Motion Picture Systems,* Ted Litwin; *Small Format,* Peter Elliott; *Theater Design and Projection,* William Shaw; *Satellites in Broadcasting,* C. A. Siocos; *Cable Television,* Israel Switzer; *Television and Film in Education,* Lou Wise; *Laboratory Practices, Sound Recording & Reproduction,* Findlay J. Quinn; *Engineering Management,* Stanley Quinn; *French Liaison,* Denis Gamache.

All of the amenities which we have come to expect at SMPTE Conferences — and consequently take for granted — only occur because of the careful planning of the Conference Arrangements Committee. The Committee was comprised of the following people: *Local Arrangements Chairman,* Alex MacGregor; *Auditor,* Jack Kligman; *Banquet Chairman,* Steve Cook; *Equipment Exhibit Chairman,* Robert Dexter; *Hospitality Chairman,* Bob MacKenzie; *Ladies Programme Chairlady,* Sheila Oliver; *Luncheon Chairman,* Geoffrey Oliver; *Membership Chairman,* Murray Marshall; *Opening Films Chairman,* Sir Arthur Chetwynd; *Projection Chairman,* Peter Taylor; *Audiovisual Assistance,* "Pat" Murphy; *Publicity Chairmen,* Harold Eady, Bob Desrosiers; *Registration Chairman,* Peter Mugford; *Transportation Chairmen,* Bernie McCallister; *Hotel Arrangements Chairlady,* Margaret Belanger; *Administrative Assistant,* Findlay J. Quinn; *Assistant to Program Chairman,* Gina Caruso; *Press Room,* Linda MacDonald; *Student Assistance at Conference,* Humber College of Applied Arts, Toronto.

The Four Seasons Sheraton Hotel, located in the center of metropolitan Toronto, is practically new and it offered fine facilities for an SMPTE Conference. Throughout the Conference week, Channel 10 of the hotel's cable television system was the SMPTE Conference Information channel. This service was provided courtesy of the National Film Board of Canada. Most of the interviews were conducted by Harold Eady, who was Associate Program Chairman and also Publicity Co-Chairman, and by Conference Chairman Maurice French.

A view of the CN Tower.

Highlights of Technical Program

For a listing of all papers included on the technical program, the reader is referred to the fifth article in this Report, Summaries of the Technical Papers Program, pp. 976–987.

TELEVISION SESSIONS (Monday)

Design and Construction of the CN Tower (Grant) Mr. Grant, manager of design and construction, described the CN Tower, nearing completion on the Toronto waterfront. When it is finished, this structure will be the highest in the world, at a height of 1850 ft (564 m). It is the first stage in a 200-acre (81-hectare) 1½-billion dollar Metro Center project being developed jointly by the Canadian National and the Canadian Pacific Railways. The prime purpose of the tower is to support all antennas needed for present and anticipated future television and FM stations in the Metro Toronto area. This was a primary requirement in gaining federal government approval for the erection of the structure.

The base for the tower was excavated to a depth of 300 ft (91 m), 120 ft (37 m) into bedrock. The structure is hexagonal in shape, with three legs 30 ft (9 m) in width, designed for a maximum wind loading of 27 tons/sq ft (29.5 kg/cm^2). At the 1150-ft (351-m) level a 7-story circular "pod" provides space for observation decks, a restaurant and technical facilities. From level 3, visitors will have a view 70 miles (113 km) in all directions. Transportation to and from the pod will be by elevators outside of the tower, but enclosed in glass, operating at 1200 ft/min (366 m/min).

Construction proceeded by continuously raising a framework into which concrete was poured. After a slow start, the concrete structure rose at an average rate of 20 ft (6 m) per day. The tower will be open to the public in the fall of 1975.

Steel antenna supports will be erected on top of the concrete shaft, at the 1500-ft (457-m) level. The antennas will be put up by helicopter lifts in mid 1975.

Multiple Antenna System — CN Tower (J. K. MacDonald) In this paper a description of the multiple antenna system was given. In recent years many buildings have been erected in downtown Toronto higher than the TV transmitter of the Canadian Broadcasting Corp. on Jarvis St. This caused multiple signal reflections adversely affecting television

reception for many viewers in the area. The solution for this problem is to build a very high tower as close as possible to the reflecting surfaces.

Seven separate broadcasting organizations cooperated in the design of the antenna system which will consist of a single FM antenna for all FM users, a Channel 5 TV antenna, a Channel 9 antenna, UHF antennas for Channels 19 and 25; provision for Channels 45, 51 and 57, and for Channel 79. The entire antenna structure will be protected from the weather by a radome of glass-reinforced plastic; this will reduce the danger of ice forming on the structure and falling to the ground.

Two separate organizations were formed to provide the antenna system: a company known as Master FM Ltd., which will own and operate the FM antenna complex; and an antenna consortium composed of CBC, CFTO-TV, CN Tower and Master FM Ltd. to develop specifications and co-ordinate the overall antenna system. The contract for the design, fabrication and erection of the antenna system has been awarded to EMI Sound and Vision Equipment Ltd. in England.

High-Speed Bi-Polar Memories Used for Video Signals Storage and Processing (Douaihy) A bi-polar random access memory was developed to store digitized video signals at clock rates in excess of 10 MHz with processing of information through the memory done without multiplexing or time-sharing techniques. Although semiconductor memories have been used to store and process digitized video signals the required multiplexing techniques have tended to add complexity to the supporting logic. In order to achieve the writing and reading at high clock rates (10.7 MHz for NTSC or 13.3 MHz for PAL) the bi-polar memory with cycle times of less than 50 ns and a capacity of 3K × 8 was developed.

The need for storing data is associated with time-base correction of video signals. The video, originating, for example, is converted to a digital format at an average rate of 10.7 MHz. This rate which represents the third harmonic of the color carrier subfrequency in the NTSC system might be subjected to random deviations by virtue of the time-base error normally associated with recorded video signals. The digitizing frequency, therefore, with its time-error-induced fluctuations is used to write the digitized data into the memory at a variable instantaneous rate.

Television Frame Synchronizer (Kano, Inaba, Sugimoto & Ito) The NEC Frame Synchronizer has been developed to eliminate the difficulties associated with genlocking and rubidium standard operations in handling non-synchronous television signals. Incoming signals from various remote sources are stored temporarily in a digital memory system with a capacity of approximately 3 megabits, and corrections are made. The sampling frequency is three times the color subcarrier or 10.7 MHz. The main functions can be classified in four steps — digitizing the input signal; storage; retrieval; and re-insertion of local sync, blanking and color burst. The resulting output signal, after being processed, is completely synchronous with locally generated signals in frequency and phase. At the conclusion of the paper presentation, a slide was shown taken from a split-screen video display, to demonstrate the stability of the corrected signals from the frame synchronizer.

Operational Implementation of a Frame Synchronizer (Butler) The first use of the frame synchronizer by National Broadcasting Co. was on 7 April 1974, when a tennis match in Germany was being integrated into a locally originated program. This was the culmination of a long search for a device to correct non-synchronous incoming video signals. A non-sync condition can be caused by the time base being different as compared with the local reference signal, or by variations in the time base such as those encountered in video distribution by satellite and in playback from an unstable recording device. These non-synchronous signals interfere with the insertion of special effects at the mixing junction. The servo systems in videotape recorders are also disturbed by shifts occurring in the time base at switching points.

The author illustrated the solution by means of the use of a delay line long enough to correct for non-synchronous incoming signals; when the time base is not correct, an instantaneous alteration in the delay line could then be made accordingly. When the delay is effected in very small increments, the corrections are not noticeable, since they are spread over relatively long periods.

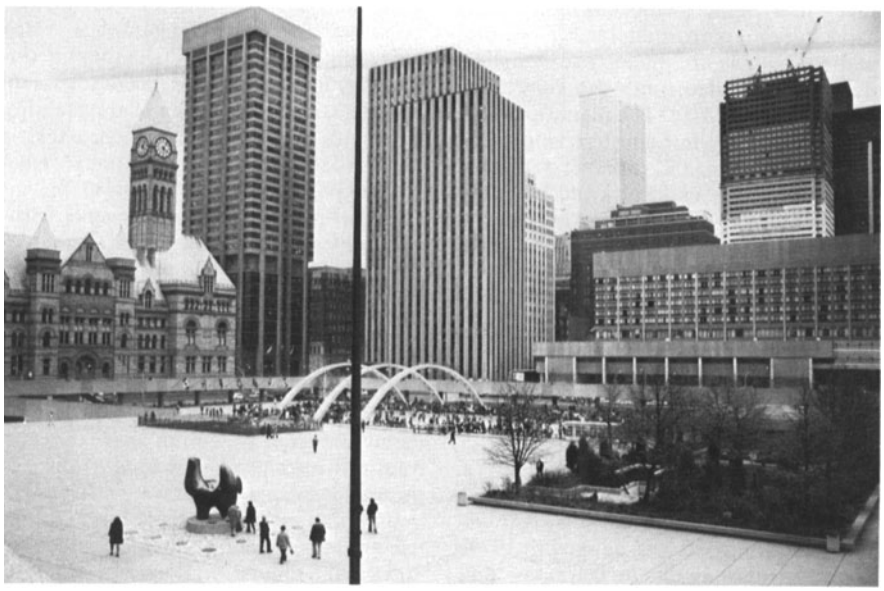
In June 1974 the NEC frame synchronizer was installed at the NBC plant facility at Burbank. Although difficulties resulting from non-synchronous video switching were the main reasons for installing the device, other recent television broadcasting developments are creating problems that the frame synchronizer is well suited to solve. For example, electronic journalism with the need for instant integration of remote events without genlock have made the frame synchronizer a powerful tool, especially in dealing with large time-base errors.

Slow-Scan Television System for Balloon-Borne Telescope (Niwa) At the Institute of Space and Aeronautical Science, University of Tokyo, a narrow-band television system for space observation utilizes an image memory tube and is employed as a finder system for a balloon-borne solar telescope. A storage electrode in the image memory tube separates the image section and scanning section. Exposure time of the electronic shutter can be varied by changing the pulse width supplied to the accelerating electrode in the image section. When the integrated voltage reaches a predetermined value a reset signal stops the shutter pulse, and the exposure time is kept constant with changes in average scene brightness.

The video bandwidth is limited to 100 kHz for 580 scan lines and 1.8-s reading-out period. The video signals from the camera or FM receiver are supplied to a slow-scan monitor, and the pictures appearing on the screen are recorded with a motor driven camera on 35mm film. During flight tests made in 1969 and 1970 slow scan signals were sent from the balloon gondola with a 914.5-MHz FM transmitter.

Coarse pointing of the telescope in the gondola is controlled automatically by the output signal of the sun sensor. The image in the telescope is divided by a half-mirror, one of the optical paths being utilized for an on-board film camera, while the other goes to the television camera. Fine control of the optical axis

Program Chairman Maurice French conducting a pre-session meeting of the authors in the Authors' lounge.



A view of Nathan Philips Square with the Four Seasons Sheraton Hotel in the background.

direction is commanded from the ground while watching the television monitor. During a lengthy flight at an altitude of 27 km (16.8 mi) the focal position of the telescope changes by thermal elongation of the telescope structure. Watching the sunspot images on the television monitor, the telescope eyepiece can be adjusted by means of ground commands. Later an electronic focusing system was developed utilizing differentiation of the video signal passing the edge of the sun.

Derivation of Correction Matrix for Non-Standard Color Television Display Phosphors (DeMarsh) The colorimetric standard for color television in the United States is based on the assumption that display devices have phosphors with chromaticities corresponding with the primaries specified by NTSC. The phosphors presently used in television differ significantly from the NTSC primaries, however, and as a result pictures generated for an NTSC display will show objectionably large color errors when viewed on current phosphor displays. A correction matrix can be utilized in display devices to compensate for the non-standard phosphors, but when the correction is inserted in non-linear signals, residual color errors will occur. A correction matrix can be selected which gives the best distribution of residual color errors or places the errors in parts of the color space where the faults will be least objectionable. Several different methods for computing the correction matrix were described.

Full correction results in overcorrection of saturated colors when applied to gamma-corrected signals. A good compromise can be achieved by correcting for approximately 85% of the change in primaries.

Tape-recorded interviews of Conference participants were broadcast throughout the week over the hotel's closed-circuit system.

LABORATORY PRACTICES (Monday)

LAD — A Motion-Picture Laboratory Control System Based on Laboratory Aim Densities (Fleischer & Pytlak) In this paper a new laboratory control system is proposed, in which a film patch, designated LAD for Laboratory Aim Density, is spliced into original or duplicate negatives, treated as a scene and printed at the midpoint in the printer scale. All other scenes are timed with respect to the LAD patch using a color analyzer, scene printer or trial print. Aim print-through densities and tolerances were given for each film type on which the original or duplicate is printed.

The use of the LAD patch eliminates the need for subjective decisions on curve placement. This will facilitate interlaboratory exchange of interpositives and duplicate negatives. At the same time the LAD method makes allowance for the artistic considerations so important to producers and color timers. At the conclusion of the paper a demonstration film was shown in which all of the duplicates were made using the LAD control method. The original negatives had deliberate exposure variations of plus or minus one camera lens stop from normal on some scenes.

The objective in developing this proposal was to overcome poor-quality duplication evident in many motion-picture and television productions. In this work, many laboratories may be involved, each with its own control method. There is a communications problem — what is a normal duplicate negative and how should it be printed? Gale and Kisner outlined the problems and suggested techniques for dealing with them ("Techniques in Color Duplication," *Jour. SMPTE, 69:* 874-881, Dec. 1960), but their methods have not been utilized routinely because of the need for time-consuming plotting of full curves and measurement of highlight and shadow densities at each stage.

Assuming normal film-process variability, reasonable control of printer, film batch and processing, the placement of picture information on the curves can be defined on the basis of a single density. A piece of camera negative film is flashed and processed to obtain a Status M density of 0.80 R, 1.20 G and 1.60 B. This density corresponds with the median density of normally exposed film, in the center of the density range for each color. If this LAD patch is then printed in the center of the useable straight-line portion of the duplicating film curve, consistent good curve placement of normally exposed negatives can be expected. Incoming materials — original negatives, duplicate negatives or interpositives — can be timed with respect to the LAD standard patch. For Eastman Color Print Film 5381 (7381) the LAD patch printed to 1.0 END will usually give acceptable results in the trial print, when timing is carried out with a color analyzer set up with the LAD patch to obtain a visually grey display.

SOUND SESSION (Tuesday)

Computer Simulation of Photographic Sound (Charles & Mitasik) When a sinusoidal signal is being recorded on film, as a variable area track, the recorder does not have an infinitely narrow slit, in the optical system, and so does not produce a perfect sinusoidal exposure. There is an exposure gradient at the edges of the triangular mask in the recorder.

A computer program has been prepared to simulate photographic soundtracks, so as to gain a better understanding of the effects of photographic characteristics on soundtrack quality. The mathematical models are variable, and alternative models have been programmed in some cases. With this method it is easy to simulate 35mm, 16mm and 8mm, variable-area or variable-density, dye or silver tracks. A description was given in the paper of the simulation program and how photographic characteristics affect the quality of 16mm variable-area sound. These simulations can be utilized to study the behavior of complex systems, such as multilayer color films, and the effects of differences in recorders, printers and projectors.

Continued on p. 951.