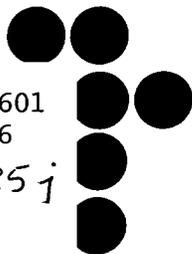


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HIGH-DEFINITION TELEVISION

Robert Hopkins, Advanced Television Systems  
Committee

Kerns Powers, RCA Laboratories

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Renville McMann, CBS

December 5, 1985

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## HIGH-DEFINITION TELEVISION

Renville McMann - CBS

McMann began by stating that the quality of High-Definition Television (HDTV) is determined by the quality of production, transmission, and display. He said that CBS had conducted some studies using high quality cinema film in an attempt to classify and define picture quality relating it to picture resolution and the number of lines. As at present, standard TV images had a resolution in the range of 525 lines. However, the Japanese have been working on the NHK system which has 1125 lines. He said that what they were looking for in HDTV was improved resolution, improved color, wide screen aspect ratio, and stereophonic sound. As for wide screen aspect ratio, the current specification of 4:3 has been used for some time and yields a good picture. However, for HDTV a wider screen of 5:3 was first discussed and it was then decided that 5.33:3 would better allow the transmission of normal wide aspect motion pictures with minimum distortion. In the area of color rendition he said that the interference between color and luminance information should be completely eliminated, and color sharpness should be improved. The quality of stereophonic sound was adequate for small screens, but for best effect when using wider screens it is ideal to have four or at least three speakers. For projecting movies a speaker is needed in the center and provision should be made for "surround sound". This adds another channel bringing the total number of channels required to 5. CBS's goal is to build a DBS HDTV system using two channels, compatible with 525 line receivers and capable of true HDTV performance on special receivers. The system is also to be capable of a wide aspect ratio of 5:3, no frame or field stores are required but multichannel transmission is needed to carry additional information.

McMann mentioned that CBS was trying to get a worldwide production standard established. Discussing the improved color rendition aspect he said that luminance and chrominance should not be interleaved (in band) as it is very difficult to separate the two once they are mixed. A lot of work is currently being done to achieve a complete separation of the chrominance and luminance signals. However, he said that he had not yet seen a perfect and complete separation of the two. He felt that the best method of transmission is to convey the luminance information in one time sequentially separated period from the color signal. McMann then used a chart to compare the HDTV alternatives, namely the present and enhanced NTSC versus the Japanese NHK system.

McMann said that CBS worked on its 2 channel system at the same time the Japanese worked on the so called MUSE (Multiple Subnyquist Sampling Encoding) system. It starts with the 1125 line production standard, and goes to that time compression

encoder which multiplexes luminance and chrominance. Then it goes to a subnyquist sampler sampled at 16.8 MHz which is less than what you need for the 20 MHz luminance signal.

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Dr. Kerns Powers - RCA Laboratories

Dr. Powers displayed a slide to describe HDTV with 1125 lines and 5:3 wide aspect ratio. The reason for the much improved quality was the higher vertical and horizontal resolution, the increased wide screen, and the invisibility to the naked eye of the line structure. However, he said that it was difficult to achieve this degree of quality in actual practice. The HDTV with 1125 lines takes atleast a bandwidth of 30 MHz and more likely 40 MHz for studio applications. He added that it would be quite sometime befor this kind of high definition quality could be used in home viewing.

Powers stated that RCA had achieved a reasonable degree of success in separating luminance and chrominance. They have been able to achieve perfect separation for stationary pictures and very near perfect separation for motion pictures. He was optimistic about the future development in this area. Powers said that there were currently two methods that were in vogue for getting a high quality image into a narrower bandwidth. One method is the continuation of encoding by the color subcarrier which requires a high quality display, and the other is the MAC technique. However, the MAC technique does require a wider bandwidth for a given horizontal resolution. RCA he said, was concentrating its efforts on keeping the NTSC encoded subcarrier and extending the luminance resolution and also widening the aspect ratio. A problem that is encountered is the visibility of the line structure. The interlace of the display and the line crawl that the interlace introduces is one of the most serious flaws in the quality of the display of standard NTSC pictures. He added that high definition technology is needed to achieve enhanced NTSC in a bandwidth of 4 MHz, or an enhanced 525 line system in a bandwidth of 7-8 MHz. In starting with a high definition source one must wind up with a high definition display. Of course with the availability of cheap field stores, scan conversion is easily possible at ooth camera and display ends. He then used a chart to show the variation of picture quality with transmission bandwidth. The present NTSC system has a low transmission bandwidth and comparatively low picture quality. There is a marked improvement in picture quality as we move from the existing NTSC system to the enhanced NTSC, but a much smaller improvement in going to EDTV and finally HDTV. The transmission bandwidth increases when moving from the current NTSC system to the HDTV system. The curve of improved perceived quality versus bandwidth shows a distinct knee of diminishing returns in the vicinity of EDTV at about 7-10 MHz bandwidth.

Finally, he said that RCA's preferred approach to get the best quality into the home in a compatible manner is to use wide screen with 525 lines properly processed in a bandwidth of the order of 7-10 MHz.

Craig Cuttner - Home Box Office

Cuttner began by introducing HBO. It has more affiliates (10,000) than all four networks combined and 17 million subscribers all of whom use NTSC displays. He said that, looking at high definition in terms of bandwidth everyone expected cable TV to be the great provider of bandwidth, but this is not true. Part of the reality of this problem is the economics. All of HBO's 10,000 affiliates have NTSC reception and so far its all C band. Cable he said is not a new phenomenon and some thought it to be. 40% of Cables have 12 channel systems and they needed to add new channels and enhance the existing services. HBO supported the production standards for HDTV. This is particularly important because 70%-80% of their product originates from a 35mm film, which has so far been the basis for comparison of HDTV systems. He said that they were waiting for the transmission and display system that is compatible and capable of carrying HDTV to be developed since they already have the program software. Cuttner emphasized that whatever the production standards end up being they must be analyzed and carefully thought out with respect to distribution and display.

Cuttner stated that HBO had conducted detailed studies with regard to various factors including economics. He said that people are market and entertainment driven and want as many channels as possible, but are not too concerned about minor variations in picture quality. He said that HBO had improved the technology of film transfers (to improve the quality of TV movies). It promoted and implemented the development of new technologies that would allow an evolution in transmission and display. Finally HBO promoted the maintenance of standards from a business stand point. This enabled them to provide not only enhanced but also incremental service, and does not penalize existing customers by variations to suit a small percentage of customers who would opt for High Definition or wide screen display.

In closing Cuttner mentioned that in the budgets of satellites, where DBS was studied in relation to high definition, the cost per channel bandwidth did not make it economically attractive. HBO he said, felt very strongly that HDTV as a value added service would first come forth as enhanced NTSC or some variation of it.

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Robert Hopkins - Advanced Television Systems Committee

Hopkins described the forming of the Advanced Television Systems Committee (ATSC) in early 1983, and went on to talk about the work of the ATSC and CCIR in attempting to establish a worldwide standard for HDTV. The function of the ATSC is to develop standards for advanced TV systems for the US, and propose positions to the US State Department for their use in formulating related national policy and assist the State Department in setting international standards via the CCIR. The ATSC established three technical groups to look into separate areas of TV. 1.Improved NTSC - this group considers the possibilities of working with compatible changes to the current NTSC format. 2.Enhanced 525 line systems - these are the MAC type systems (component system with wide screen). 3.HDTV - high definition with at least twice the present horizontal and vertical resolution.

The group working on enhanced 525 line systems is currently in the process of making a recommendation for component systems through satellite DBS. Of the two original contenders CBS has withdrawn their system leaving only the B-MAC system of Scientific Atlanta for discussion. The work of the first group (improved NTSC) has been somewhat difficult at times because much of what could be done to improve NTSC could be done in the 'receiver' stage. Hopkins stated that he was not convinced that a new standard was required to make a change in the 'receiver'. The third group which is the HDTV group is one that has been receiving considerably more attention from the press during the last few months. Earlier this year this group made the recommendation of a system consisting of 1125 lines and a 5.33:3 wide aspect ratio. The recommended system was to have 1920 samples per line for luminance and half of that (960) for each color difference signal. This recommendation was passed on to the State Department as a proposal for the US decision in terms of international negotiations. He then went on to describe the decision making process adopted by the CCIR and the associated delays experienced in arriving at a final decision. In this context he stated that the proposal made by the US has been through a lot of discussion and debate and had still not been finalised at the level of the CCIR. The recommendation proposes parameter values for HDTV studios and for the international exchange of programs.

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#### Speakers' Comments and Responses to Questions

In response to a question regarding compatibility and a universal system Hopkins stated that it is difficult to define compatibility. He stated that a 1000 line TV signal by definition will not be compatible with a 500 line system in terms of direct compatibility and if the worldwide standard is 60 Hz it will not be directly compatible within a country using 50 Hz. The 2 channel system McMann referred to takes the HDTV system and

breaks it up such that part of it is absolutely compatible. Discussing further the issue of compatibility Hopkins said that different companies might have different perspectives since they view it in economic terms and in relation to how their customers will be affected. He said that the production standard will be compatible with existing distribution standards if the production standard can be electronically converted into the existing distribution standards, and he emphasized the importance of getting on with establishing a production standard.

In enabling CCIR to arrive at a compromise the question was raised as to why a third field rate was not given more consideration. Hopkins responded saying that the BBC had suggested a compromise of 80 Hz. However, it was obvious to all countries concerned that implementing 80 Hz would pose more problems than either 50 Hz or 60 Hz. Since 50 Hz is not acceptable because of the lower temporal sampling rate and visible flicker, the issue once again reverted back to the question of deciding on 60 Hz as a worldwide standard.

A member of the audience asked what work had been done to improve audio in the general improvement of HDTV. McMann in responding to this query stated that audio would be transmitted in digital form using 5 channels instead of the usual 2 channels.

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