ADVANCED TELEVISION SYSTEMS COMMITTEE STATUS REPORT

NAB Convention, 1988

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INTRODUCTION

In a 10 day period in 1982 three separate events occurred that together represented a turning point in the development of modern television technology.

First: A public demonstration of high definition television in Washington, DC on February 28, 1982.

Second: The International Radio Consultative Committee (CCIR) recommended a worldwide digital television studio format also in late February 1982.

Third: The FCC decided not to standardize a transmission system for broadcasting AM stereo in March 1982.

These three events provoked a feeling of strong concern, generating the fear that, without appropriate action, the United States television industry would not be able to provide meaningful input into the development of advanced television systems.

Each of these events had a special significance.

At the demonstration of high definition television, the pictures were surprisingly sharp, especially when projected on a large, wide aspect ratio screen. Such performance highlighted the current limitations of our current NTSC system. Consumers who saw the demonstration wondered when they could have pictures like that in their homes. Producers spoke enthusiastically of using HDTV to make television programs, or perhaps even movies. Broadcasters wondered how they would be affected and whether they would be able to participate in HDTV.

The CCIR recommendation did not provide a single set of scanning parameters, but it did provide a common digital format for the existing 525/60 and 625/50 scanning standards. Such an agreement had never been previously attained, primarily because of conflicting commitments and investments among the participating countries. This agreement -- by more than 150 countries -- was astonishing, particularly since it involved a complex technical issue. It was clear evidence that international standards activities would play a much more important role in our domestic standards development.

The final event in early 1982 was the FCC's decision to not set a standard for AM stereo broadcasting. In earlier years the procedure for standards development had been well established: private sector companies developed potentially competitive systems for a given spectrum using service. Each was tested and evaluated. The industry then decided which system might best serve the public interest and petitioned the FCC to adopt the system as the standard.

The 1982 AM decision strongly signalled that this customary method of standards selection would no longer be followed, at least for the foreseeable future.

It was in this context that the industry, through the Joint Committee on Intersociety Coordination (JCIC) -- composed of the National Association of Broadcasters (NAB), Electronic Industries Association (EIA), Institute of Electrical and Electronic Engineers (IEEE), National Cable Television Association (NCTA), and Society of Motion Picture and Television Engineers (SMPTE) --founded the ATSC in 1983. Since then, over 50 companies and organizations, representing terrestrial broadcasters, professional and consumer electronics manufacturers, cable operators, satellite companies, motion picture producers, and institutions of higher education have become ATSC members. Our mandate is to coordinate development of voluntary national technical standards for advanced television systems and to make recommendations to the United States Department of State for its use in developing United States positions on various standards issues as those issues are considered from time to time by the CCIR and other international organizations.

ORGANIZATION OF THE ATSC

The ATSC was originally organized into three different technology groups. The first group -- Improved NTSC -- was to address evolutionary improvements in the quality of the current NTSC system involving fully compatible changes to the present radiated signal standards. The second group -- Enhanced 525 Line Systems -- looked at techniques for higher quality, using 525 lines, but not constrained by compatibility. Multiplexed analog component (MAC) systems are an example of enhanced systems. The third group -- High Definition Television -- considered voluntary standards for high definition systems, systems characterized by an improvement in both horizontal and vertical resolution of approximately 2 to 1, a wide aspect ratio of at least 5:3, and multiple-channel high fidelity sound.

The ATSC Executive Committee decided last summer to combine the work of the Improved NTSC and Enhanced 525 Line groups for greater efficiency. The Executive Committee is now considering further modifications to the organization. There has been some confusion on division of responsibility within the technology groups because advanced television systems, we now know, do not divide neatly into the three separate categories originally contemplated when the ATSC was formed. Current proposals for advanced television distribution include a variety of technologies, each of which is to one degree or another in competition with the others. One possible organization under consideration is two technology groups; one group would have responsibility for distribution systems and the other group would have responsibility for production systems.

PAST WORK OF THE ATSC

The ATSC was asked by the SMPTE to study the possibility of removing set-up from the NTSC specification, both in production and in delivery to the public. The SMPTE, in working on component studio systems, had decided that there could be operational problems if the component systems did not have set-up while the composite NTSC system continued to have set-up. This study was undertaken by the Improved NTSC Technology Group. A specialist group conducted tests and surveys to determine the quality impact on the home viewer and the

commercial impact on manufacturers and broadcasters. They considered issues such as the appropriate level of video, sync, and chroma in the absence of set-up; the effect on scrambling, home VCR's, and camcorders; and the transition phase during which programs both with and without set-up might be present. The tests showed that picture quality on a home receiver was affected when set-up was switched in and out. There were different opinions on the significance. Concerns were expressed on the operational difficulty, and thus cost, of making the change by broadcasters. This issue was brought to a vote in the last meeting. The vote was 9 in favor of removing set-up, 9 opposed and 11 abstained. As a result, we will not pursue this matter any further at this point and we will communicate our decision to the SMPTE.

The Improved NTSC Technology Group has also studied the possibility of adding CD quality digital stereo sound to the NTSC signal. A key question is whether digital sound should be accommodated with a subcarrier approach or sound in sync approach. A specialist group was asked to look at all possible system approaches and make a recommendation to the technology group. The specialist group found that various approaches were possible but selection of any one approach could have an adverse impact on different systems being proposed for advanced television distribution to the public. Without knowing which system would be adopted for advanced television delivery, they felt it inappropriate to recommend a system for digital sound. The specialist group is completing its work by writing a report with their findings including a summary and bibliography of the possible approaches for adding digital sound to NTSC.

The Enhanced 525 Line Systems group in March 1986 approved a motion to document the B-MAC system as a standard for use in direct broadcast to the consumer via satellite when component transmission was desired. A specialist group was directed to write the document. The draft included detailed descriptions of the signal format for audio, video, date, and control, including the method of scrambling, encryption key distribution and the data multiplex. However, the specification did not contain details of the encryption algorithm. The company which developed B-MAC considered the algorithm proprietary information. Although they were willing to disclose necessary information under licensing agreements, they were not willing to disclose it as part of the published standard.

This posed a dilemma. Should the document be issued as a recommended standard without the encryption algorithm or should the document be held until an algorithm was available. Members of the group were in clear agreement that a single algorithm, for use in all broadcasts, was required. This raised the question of whether encryption should be proprietary to the originator or whether it should be fully defined in the standard so that other parties could control it. This is a new area of concern for standards organizations. In 1987 the technology group decided to make the document available outside the ATSC as a report, not as a standard.

Early in the life of the HDTV Technology Group, its members decided that HDTV production matters should be pursued before HDTV transmission matters. This decision was in line with earlier decisions by all the world's broadcasting unions and the CCIR. In 1985 the HDTV Technology Group played a key role in forming the United States position at the CCIR on deliberations concerning a single worldwide HDTV studio standard. The technology group re-affirmed this decision in 1987. The position, basically, is that the United States supports the 1125/60 HDTV production system as a single worldwide standard. In 1986 the ATSC asked the SMPTE to fully document this system. The SMPTE reported back to the ATSC in September

1987 with a document which was approved by the HDTV Technology Group as a draft ATSC standard. This draft was sent to the full ATSC committee as a written ballot which was approved by the requisite two-thirds majority on January 6, 1988 becoming the first advanced television system standard to be adopted in the United States.

ONGOING WORK OF THE ATSC

In the last year the emphasis within the ATSC has shifted from production to distribution of advanced television to the public. We have a specialist group which began its activity in February 1986 by adopting the goal:

> Study and provide recommendations to the ATSC regarding a single standard or family of standards for delivery of high definition television to the consumer.

They listed several objectives:

> 1. Analyze and test the relevant characteristics of the spectrum potentially available for transmitting advanced television signals.
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> 2. Gather information about systems capable of delivering advanced television pictures to the consumer.
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> 3. Develop test plans and criteria for evaluating the performance of the proposed systems.
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> 4. Conduct tests of the proposed systems.

The specialist group also recommended that field tests be undertaken expeditiously to measure the propagation characteristics of signal bands suitable for broadcasting HDTV. This work is underway having begun last September in Washington, DC.

The first test is designed to give us propagation information relevant to the dual channel systems being proposed. Identical signals are broadcast on channel 9, WUSA-TV and channel 58, the experimental station WWHD-TV. The receiving system is highly automated. We are measuring the time differential on receiving the two signals, the attenuation differential, group delay, multipath, and a host of routine parameters. The equipment has been placed in transportable cases so it can be moved to other locations. A personal computer supervises measurements. About 22 Mbytes of data have been gathered, but not analyzed, at this time.

Another set of tests will begin this month to determine propagation characteristics relevant to systems which require a single channel wider than 6 MHz. Tests will be conducted at UHF, 2.5 GHz, and 12 GHz. We will measure attenuation, group delay, multipath and depolarization. Receiving equipment will be in a vehicle with a 30 foot mast. Measurements will be made on grid on main lobes of the antenna. The UHF signal will be 12 MHz wide, double sideband AM with the carrier in the middle of the channel. We will look at the quadrature output since some of the proposed systems are designed for quadrature modulation. We are using double sideband because better information can be obtained by using equal upper and lower sidebands. We will use FM at 12 GHz. We may use both AM and FM at 2.5 GHz.

The ATSC is grateful to several organizations for their assistance in this work. I specifically want to mention the NAB, PBS, CBS and the CRC in Canada.

We also have a Task Force responsible for subjective assessment, a very important area when it is necessary to compare various transmission systems. The different systems are based on different assumptions of appropriate compromises. It is inevitable that each system will exhibit some artifacts in the display. The practical assessment of their acceptability can only come from the viewer. The first step in this phase is to examine the several techniques now in use, worldwide, and to select particular methodologies which are most appropriate for the display of advanced television and for developing comparative quality assessments of a number of transmission systems.

The group has examined the CCIR 5 point scale which has been used internationally for at least 30 years. They have rejected this technique for several reasons, the primary reason being that it does not give good information for small differences in quality. A technique highly recommended by the group is called the Double Stimulus Continuous Quality Scale, a method invented by the British Post Office to be able to determine smaller differences in picture quality. It is a paired comparison with a reference picture and a test picture. There are other methods that the group recommends for pilot studies, methods which are too new to have gained international acceptance. They have also composed a table of viewing conditions and recommend that all studies have two things in common:

1. A viewing distance of three times picture height.

2. Some of the test material should always be used in any test in any lab.

This common thread throughout all tests will help in relating the results of the tests.

We have still another group, the Task Force for Cable Television Distribution. The work is being done under the aegis of the NCTA's Engineering Committee. They are proceeding to determine the transmission characteristics typical of cable systems. Parameters such as frequency response, carrier to noise delivered to the end subscriber, and distortion levels are well understood and commonly measured by cable operators. A survey was sent to several operators asking them to provide their data. Other parameters, such as micro reflections, or short echos, have not been considered a problem in the past and are, therefore, not well understood. Such tests will be conducted using the same equipment that is currently being used for the terrestrial broadcast propagation measurements.

FUTURE WORK OF THE ATSC

The work I have described represents a good start to achieve our objective -- the orderly and timely development of advanced television services for the benefit of the viewing public. But, as you can see, there is still much work to be done. The proposed systems must be analyzed and tested. We will be working closely with the Advanced Television Test Center, formed by the NAB and others, and the FCC's Advisory Committee in carrying out this work.

Ultimately, decisions must be made. We believe that a private sector organization structured and funded along the lines of the ATSC is an essential part of the mechanism needed

to achieve national technical standards for advanced television systems. The NTSC Committees, formed in the 1940's and 50's were private sector groups whose work products became FCC standards. The value of that mechanism is proven by the duration of their standards. Similarly, when appropriate, the FCC can consider incorporating ATSC recommended technical parameters into a government mandated standard.

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