

Technical Committee Reports

MINUTES OF THE MEETING OF THE DIGITAL AUDIO TECHNICAL COMMITTEE

Date: 1981 November 2

Time: 1930 hours

Place: Waldorf-Astoria Hotel, New York City

Present: Bart Locanthi (Chairman), L. Abbagnaro (CBS Technology), A. Alden (SMPTE), G. Badger (Disco-Vision), M. Bennet (Sony), G. Billia (RAI), R. Blinn (Capitol), E. Busby (Ampex), A. Clegg (Panasonic), K. Davis (CBC Engr./SMPTE), K. Dauphinee (ABC/TV), T. Doi (Sony), R. Ehlig (Eastman Kodak), R. Ferrero (Ferrero Assocs.), H. Ford (Consultant), M. Fujimoto (Victor Co./Japan), T. Fujino (Yamaha R&D Studio), Y. Fukuju (Sony), J. Gibson (RCA & SMPTE), M. Gourgon (Canadian Broadcasting Corp.), T. Griffiths (Decca), A. Heaslett (Ampex), B. Jones (CBS Technology), J. Kawada (JVC), M. Kennedy (Ampex), R. Koch (Ambichron), T. Kogure (Matsushita), T. Kohler (Philips), R. Lagadec (Willi Studer), L. Märtin (AEG-Telefunken), L. Manno (Consultant), C. Matassa (Consultant), R. McDonough (Harris Corp.), J. McGill (Digital Sound), John (Jay) McKnight (Magnetic Reference Lab.), P. Mitchell (Mystic Valley Audio), T. Miyaji (Pioneer North America), Y. Moriyama (Pioneer/Japan), H. Niederehe (Scheidtweiler), A. Penchansky (*Billboard*), B. Pisha (Audio Electronics), L. Poradowski (Roanwell Corp.), S. Pramanik (Bang & Olufsen A/S), D. Queen (Dan Queen Assocs.), D. Rana (*Stereo Review*), L. Schuweiler (3M Co.), T. Stockham, Jr. (Soundstream, Inc.), K. Suetsugu (Sony), N. Takahashi (Victor Co./Japan), S. Takaoka (Pioneer Electronic), H. Tendeloo (Polygram), D. Thomsen (Sony Germany), E. Torick (CBS Technology Center), R. Wartzok (RCA Records), A. Weissner (TDF Labs.), B. Whyte (Consultant), M. Willcocks (Willcocks Consultants), T. Yamamoto (Pioneer Electronic), T. Yazawa (Sony), R. Youngquist (3M Co.), R. Zavada (Eastman Kodak Co.).

The members introduced themselves and the meeting began at 9:45 AM, in the Barron Suite of the Waldorf-Astoria Hotel.

1 S. Temmer's letter of 1978 February to the Antitrust Division of the U.S. Justice Department was acknowledged. This letter caused the AES to "back off" from the development of digital audio standards. Between the time of that letter and the present, legal and procedural guidelines were adopted by the Society and have

served as the basis for an exchange of technical data at committee meetings held during that same period. The chairman then read Mr. Temmer's 1978 letter, noting that only a few digital audio machines were in the marketplace in 1978, and further that the AES lacked clear administrative procedures applicable to standards work at that time.

The chairman then noted that to date the AES has established basic rules and guidelines for standards activity, and further that the AES is now the Secretariat for the ANSI S4 Committee on Audio Engineering. In addition, there are now at least eight professional digital audio recorders, seven PCM digital audio adapters for video cassette recorders (VCRs), and two semi-professional digital audio cassette recorders in the marketplace.

2 In light of the foregoing information presented to the committee, the chairman proceeded to the second item on the agenda and asked if there were a consensus as to whether the AES should proceed with draft standards, and opened the floor for discussion.

R. Zavada discussed SMPTE's endorsement of ANSI procedures, particularly those concerned with the solicitation of the views of all parties having vested interests in particular items of standardization.

J. McKnight followed with a discussion of three points raised in Temmer's letter, all of which have been taken care of by events which transpired between the time of the letter and the present date:

2.1 In early 1978, the AES lacked adequate administrative procedures applicable to standards work. This matter was covered by the chairman in the first item of the agenda, and additionally by a statement of AES policy on standardization published in *J. Audio Eng. Soc.*, vol. 2, no. 1/2 (1979 January/February).

2.2 The adoption of standards prior to the availability of a commercial product might be considered in restraint of trade. While this position could be challenged, it is a moot point now, since there are more than a dozen machines available in the market.

2.3 AES recommendations are taken seriously by the audio community and should not be made lightly in the absence of well-defined guidelines. (This has been covered in 2.1 above.)

In the absence of any other substantive comments from the floor, the chairman asked if there were any objections to the AES Technical Committee on Digital Audio's going forward with digital audio standards. Not only were there no objections, but rather there was a general acclamation urging our going ahead with matters of digital audio standards.

3 The third item on the agenda at the meeting was item

4 of the previously distributed agenda, namely, brief reports concerning digital audio activity in the United States, Japan, and Europe.

3.1 (USA) T. Stockham reported that digital editing facilities for Soundstream master tapes are now operating in Los Angeles and Gütersloh, Germany, in addition to the one in Salt Lake City, Utah.

3.2 (Japan) T. Yamamoto reported:

3.2.1 Relative to compact disk (CD) manufacture, Sony, Matsushita, and Pioneer have pilot plants in process.

3.2.2 JVC and Yamaha are actively designing AHD disk pilot plants.

3.2.3 Solid-state lasers for CD players are being sampled by several manufacturers in the 810-nm region.

3.2.4 16-bit A/D and D/A chips are being produced by Sony, Matsushita, and Mitsubishi.

3.2.5 EIAJ format adapters for consumer-type VCRs are being produced by Sony, Toshiba, Sanyo, JVC, Hitachi, Sharp, and Matsushita.

3.2.6 Several companies showed compact cassette digital audio recorders (JVC, Sony, Pioneer, Sharp, and Sanyo).

3.2.7 A complete Digital Audio Disk Committee report was presented to the committee (125 pages). It explains that 50 companies have been cooperating in a study of possible standards for the digital audio disk (DAD), and describes the organization, meetings, and working groups of the Conference and its aims and accomplishments as of 1981 October. Disk characteristics under study include performance, physical specifications, signal format, reliability, video compatibility, production methods, and user operating features. Approximately 17 pages of the body of the report are devoted to matters of signal format and eight pages to problems of commercialization. Additional discussion compares several of the DAD systems now in development. Three of the eight appendices list technical details and specifications of "Compact-Disc Digital Audio" (Sony Corp., Philips), "The MD System" (Telefunken/Teldec), and the "Audio High-Density Disc (AHD)" (Victor Co. of Japan). One appendix lists the Conference membership; others record meeting dates and members of committees and working groups. (*Editor's note: We regret that copies of the report are not available from the AES.*)

3.3 (Japan) T. Doi reported that to date Sony has sold approximately 200 professional type 1600/1610 PCM VCR adapters. Sony has a new digital tape editor for Umatic VCR digital recordings. Also, the new Sony 24-channel 1/2-inch fixed head digital tape recorder is available with editor.

Professional fixed head digital recorders are also being produced by JVC and Mitsubishi.

Sony showed a prototype compact cassette digital recorder at the Japan Audio Fair last October.

T. Stockham asked a question about the kind of tape being used in compact cassette digital audio recorders and the linear recording densities used. Replies from the manufacturers were:

3.3.1 The JVC machine uses a metal pigment tape (150 mils wide), sampling frequency of 33.6 kHz, 14-bit equivalent quantization, 46 kb/in, 8 tracks and a tape speed of approximately 9.5 cm/s.

3.3.2 Sony uses video-type tape (150 mils wide), 38 tracks, 4.75 cm/s and 43 kb/in.

3.3.3 Pioneer uses video-type tape (150 mils wide) at 5 cm/s, 50 kb/in and 10 tracks.

3.3.4 Sharp uses chromium dioxide tape at 36 kb/in.

3.3.5 Sanyo uses metal pigment tape at 74.6 kb/in.

3.4 (Europe) H. Tendeloo reported that many European record companies now make all their classical master tapes in digital format. Furthermore, several European companies are preparing to manufacture CD players. Some exhibited CD players at the Berlin Audio Fair, next to Telefunken who showed their mini disk and JVC with their AHD system.

Polygram is building facilities for replication of compact disks.

H. Tendeloo then presented Polygram's position paper (Report A) on recommended sampling frequencies for professional machines supporting both 48 kHz and 44.1 kHz. Also, Polygram would lend its support to transmission systems already using 32 kHz (EBU).

3.5 (Europe) G. Billia presented the EBU position paper (Report B) supporting 48 kHz for a worldwide sampling frequency for broadcast and professional application, and 32 kHz for radio transmission links and for satellite broadcasting.

3.6 (International CCIR) E. Torick presented a report on a recent CCIR meeting held in Geneva, 1981 September 21 to October 8 (Report C):

3.6.1 Japan: NHK reported on a 2-track 15-in/s, 1/4-inch tape machine using a sampling frequency of 50.4 kHz with 16-bit linear quantization.

3.6.2 Europe: EBU recommended 32 kHz and 14-bit linear quantization without pre-emphasis for satellite broadcasting; for less critical applications, a non-linear coding transformation to 10 bits having 5 scale ranges, each of 9 bits, plus 1 bit for sign (pre-emphasis/de-emphasis permitted).

3.6.3 Europe: EBU recommended a 64-bit frame length for input/output (IO) interfacing (40 bits for data, plus 20 bits for auxiliary data, plus 4 bits for synchronization).

3.6.4 Europe (Italy): recommended 16-bit linear quantization for most applications; 14 bits for general broadcasting; 32-kHz sampling frequency for transmission and broadcasting; and 48 kHz for studio application.

3.7 (USA—SMPTE) J. Gibson reported on the SMPTE Study Group activity on digital audio covering a review of issues related to the choice of sample rates for digital audio (Report D) and sample-rate statistics of digital audio packaged in television and motion-picture frames (Report E). The conclusion reached by the same study group was that 60 kHz was the first choice for a sampling frequency and 48 kHz was the only other choice for digital audio compatibility with

motion-picture and digital video applications.

3.8 (USA—SMPTE) R. Zavada endorsed Mr. Gibson's report and presented a report on the leap-frame problem of digital audio in television (Report F).

3.9 (Japan—Reply to IEC Questionnaire) Dr. Yamamoto presented a copy of the Japanese IEC representatives' recommendations to the IEC (Report G). Conclusions:

3.9.1 The sampling rate for DAD should be different from any digital audio recorders to prevent pirating.

3.9.2 Professional sampling rates should be 50.4 kHz and/or 44.1 and 47.25 kHz.

3.9.3 Since the 32-kHz, 14-bit linear system has a rather limited signal-to-noise ratio, little, if anything, is lost by converting to 32 kHz by DA/AD conversion.

3.9.4 Pre-emphasis is recommended for most source material.

The meeting adjourned at this point for lunch.

The afternoon meeting began at approximately 1:45 PM.

Since the chairman had received so many documents from concerned organizations worldwide relative to recommended sampling frequencies, this became the first topic for the session.

R. Youngquist presented the 3M Company's position paper (Report H) supporting 48 kHz for the sampling frequency for professional digital recording in the interest of a universally acceptable sampling rate. This is currently proposed within many technical video and broadcast groups.

A. Heaslett presented Ampex's position paper (Report I) preferentially supporting and promoting 48 kHz as the sampling rate for both audio and video professional products.

H. Tendeloo presented Polygram's position paper (Report A) supporting both 48 kHz and 44.1 kHz as acceptable sampling frequencies for professional application.

R. Lagadec presented Studer's position paper (Report J) supporting 48 kHz, 44.1, and 32 kHz for appropriate applications.

E. Torick presented a Draft Recommendation of the AES, recommending 48 kHz as the preferred sampling frequency for professional applications requiring a 20-kHz audio bandwidth and that wherever possible this frequency be used for consumer application (Report K).

T. Stockham reported that in the history of Soundstream they had used 37.5 kHz, 42.5 kHz, and 50 kHz for sampling frequencies as their product developed. Further, that over 200 albums have been made using 50 kHz as the sampling frequency. If there were a possible internationally agreed upon single preferred sampling frequency of 48 kHz, his company would support it.

J. Gibson, representing SMPTE, stated their position: namely, that while a 60-kHz digital audio sampling would be best for motion-picture application and digital video application, 48 kHz is the only other acceptable digital audio sampling frequency (Report L).

By this time, the Japanese delegation, T. Kogure and T. Doi, appeared to be disturbed that there seemed to be a large momentum developing in the direction of a single digital sampling frequency, 48 kHz.

Mr. Kogure was concerned about the vacillation of the U.S. position: six months earlier, at the IEC meeting in Prague, the U.S. delegates strongly recommended 50 kHz as the preferred sampling frequency for professional digital audio application, and for consumer application wherever possible; now, they recommended 48 kHz. What would the U.S. position be tomorrow?

The reply to Mr. Kogure was that the degradation in quality resulting from reducing the sampling frequency from 50 kHz to 48 kHz was small, and that the advantage in arriving at a possible single universal international sampling frequency was a reasonable compromise.

Dr. Doi repeated that Sony had sold over a thousand professional machines (200 of the PCM 1600/1610 type) using 44.1 kHz as the sampling frequency, and we would be discriminating against the users of these machines if we did not consider this information. Furthermore, the Philips-Sony compact disk player was already settled upon to use 44.1 kHz. He was very much concerned that the weight of the AES in recommending 48 kHz would adversely affect the digital audio community.

After much discussion, there was a consensus at the meeting that 44.1 kHz should be included in Mr. Torick's proposal. The amended draft is Report M.

Dr. Lagadec read a summary of a joint Studer-Sony proposal for an I/O interface format (Report N).

K. Tanaka submitted his proposal by mail for an I/O interface (Report O).

Before the meeting adjourned, the chairman agreed to establish two working groups: one to handle the necessary balloting and resolution of a Draft Recommendation for professional digital audio sampling frequencies; the other to handle similar matters for a Draft Recommendation for I/O interfacing of digital audio equipment.

Progress Report

E. Torick of the CBS Technology Center has accepted the chairmanship of the working group to prepare a Draft Recommendation on sampling frequencies for professional digital audio equipment, and A. Heaslett of Ampex has agreed to accept the chairmanship of the working group to prepare a Draft Recommendation on a preferred I/O interface for professional digital audio equipment.

Both working-group chairmen will ascertain that adequate representation of concerned manufacturers and potential digital audio equipment will be involved in their activities. It is also hoped that preliminary meetings of the two working groups can be scheduled during the 71st Convention in Montreux.

The official AES Technical Committee will consist of 20 members. These will be appointed before the con-

vention in Montreux. Any interested observers will be able to attend and participate in all but administrative meetings. Fig. 1 shows the flow of data from the working group to becoming an AES standard, to a national standard, to an IEC standard.

BART LOCANTHI
Chairman

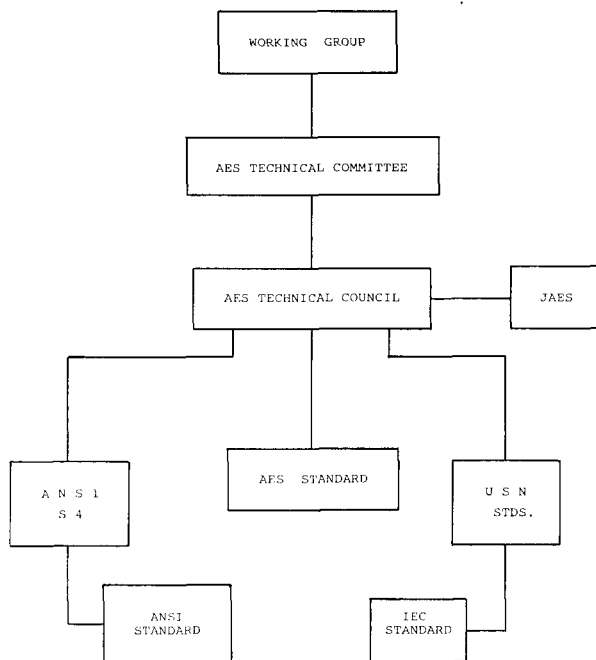


Fig. 1. Flow chart for AES standardization activity.

Editor's note: A limited number of copies of Reports A through N mentioned in the above report are available from the AES Headquarters Office at a total cost of \$10.00.