INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONALE DE NORMALISATION
ISO/IEC JTC1/SC2/WG11
CODING OF MOVING PICTURES AND ASSOCIATED AUDIO

ISO/IEC JTC1/SC2/WG11   N 0029
MPEG90/271
October 1990

Source: Leonardo Chiariglione - Convenor
Title: Twelfth WG11 meeting report

Twelfth WG11 meeting report

The Twelfth WG11 meeting was held at the Marriott's Hotel in Santa Clara, California, USA, on 10-14 September 1990 at the kind invitation of Apple Computer.

1. Opening of the meeting
A welcome speech was delivered by Dr. David Nagel, R&D Vice President of the hosting organisation.

2. Roll call of participants
The list of participants appears as Annex I

3. Approval of agenda
The agenda was approved (Annex II)

4. Allocation of contributions
Over 50 contributions were brought to the meeting. They were numbered as MPEG90/xyx. The complete list appears as Annex III.

5. Communications from the Convenor
The Convenor informed the meeting that CCITT SG XV had established an Experts Group on Video Coding for ATM. Its Chairman, Mr. S. Okubo, attending the WG11 Santa Clara meeting was welcomed by the Convenor.

The liaison document issued by WG11 on the use of MPEG bitstreams in an H.221 environment had had positive reaction from CCITT SG XV WP1 which had fed back a number of comments which WG11 should process during the week.

6. Eleventh MPEG Meeting Report
The report was approved (WG11 N0006).

7. Liaison matters
Mr. Anderson was requested to coordinate liaison matters with CCIR, CCITT, EBU and EBU/ETSI JTC. The report of the meeting appears in Annex IV.

8. Processing of National Bodies Position Papers
There were no such Papers.

9. Terms of reference of WG 11 Subgroups

WG11 subgroups which had not prepared a proposal of terms of reference were asked to do so. The Audio group presented a document at the end of the meeting and the VLSI members were asked to come to the next WG11 meeting with proposals of terms of reference to be used as inputs by the VLSI group.

10. Planning for MPEG Second Work Item

The analysis of requirements for the next phase of MPEG work was carried out under the Chairmanship of Mr. Okubo, who kindly put his long experience in the CCITT to the benefit of WG11. His report appears as Annex V.

11. Report of Ad-hoc group on System multiplex

Mr. Pineda, Chairman of the Ad-hoc Group, made an oral report of the meeting (WG11 N0025) which was approved.

12. Report of Ad-hoc group on Timing requirements

Dr. Szabo, Chairman of the Ad-hoc Group, made an oral report of the meeting (WG11 N0026) which was approved.

13. Organisation of Twelfth Meeting

Annex VI reports the allocation of meetings of WG11 and its subgroups. Because of the advanced stage of development of the MPEG CD more joint meetings between the subgroups were needed.

14. Reports of subgroup activities

The Audio group successfully developed the first draft of the Audio part of the MPEG CD.Annex VII is the Audio meeting report.

The Video group was in a position to freeze the normative content of the Video part of the MPEG CD. Annex VIII is the Video meeting report.

The System group successfully developed the first draft of the System part of the MPEG CD. Annex IX is the System meeting report.

The Subjective Test group had more discussions on the test procedure for the next phase of MPEG and selected new sequences for that purpose. Annex X is the Subjective Tests meeting report.

The VLSI groups analysed several items concerning algorithm implementability in VLSI. Annex XI is the VLSI meeting report.

The DSM group discusses recommendations to be issued on desirable features, including the interface, of DSMs target of MPEG standards. Annex XII is the DSM meeting report

15. Patents for MPEG CD

The Convenor received two statements concerning patents relevant for the MPEG CD. All Companies were actioned to provide similar statements by the Berlin meeting.

16. Approval of MPEG CD

The Santa Clara meeting provided the long expected moment of formally approving the first complete draft of the MPEG CD for registration with SC2. The draft is composed of three parts: System, Video and Audio.

17. Planning of subgroup activities

The need to arrive at a publishable CD in December prompted the establishment of several Ad-hoc Groups, in charge of completing details of some parts of the MPEG CD. They were (in bracket the WG11 document giving the details of the group):

Ad-hoc Group on System CD	(WG11 N0022)
Ad-hoc Group on Audio CD	(WG11 N0026)
Ad-hoc Group on Software Simulation (Audio)	(WG11 N0023)

18. Schedule of future MPEG meetings

In compliance with JTC1 directives aiming at improving work effectiveness and logistic problems of hosting organisations by a long-term planning of meetings, a five-year plan was adopted (WG11 N0011). The next three meetings will be in Berlin (04-07/12/90), San Francisco (04-08/03/91) and Kurihama (08-12/07/91).

19. Recommendations of Twelfth meeting

The were approved (WG11 N0028).

20. Distribution of MPEG documents

Dr. D. Mead (Hughes Aircraft), Dr. B. Hammer (Siemens) and Mr. J. Yonemitsu (Sony) kindly undertook the distribution of MPEG documents to MPEG members in their regions.

21. A.O.B.

There were no other businesses.

22. Closing

The Convenor closed the Santa Clara meeting, a milestone in WG11 history because of the official status reached by the full MPEG CD, thanking Apple for their warm hospitality and perfect facilities, in particular

Mr. James Normile
Mr. Lung Yeh
Mr. Ken Chu
Mr. Dan Wright
Mr. Frank Chu
Mr. Jonathan Parkes
Mr. Greg Duffy
Mr. Warren Chou
Mr. Adam Tom
Ms. Shirley Doughty
Ms. Maria Sanchez
Mr. Jeff Tuckwood
Mr. Scott Stein
and Apple Security.

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(Santa Clara, California, USA, 10-14 September 1990)

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Meeting Agenda
(Santa Clara, California, USA, 10-14 September 1990)

WG11 Plenary:
1. Opening of the meeting
2. Roll call of participants
3. Approval of agenda
4. Allocation of contributions
5. Communications from the Convenor
6. Eleventh MPEG Meeting Report
7. Liaison matters
8. Processing of National Bodies Position Papers
9. Terms of reference of WG 11 Subgroups
10. Planning for MPEG Second Work Item
11. Report of Ad-hoc group on System multiplex
12. Report of Ad-hoc group on Timing requirements
13. Organisation of Twelfth meeting
14. Reports of subgroup activities
15. Patents for MPEG CD
16. Approval of MPEG CD
17. Planning of subgroup activities
18. Schedule of future MPEG meetings
19. Recommendations of Twelfth meeting
20. Distribution of MPEG documents
21. A.O.B.
22. Closing

MPEG/Video
Review SM and Experiments
Review DP
Review status of validation experiments
Work on buffer constraints
Interaction with the System group on the finalization of the video bitstream

MPEG/Audio
1. Opening of the meeting
2. Approval of the agenda
3. Allocations of contributions
4. Communications from the chairman
5. Stockholm meeting report
6. Terms of reference
7. Review of DP
8. System requirements
9. Coordination with Video and System editing groups
10. Future work items
11. Next meetings
12. Recommendations of the Santa Clara meeting
14. A.O.B.
15. Close of the meeting

MPEG/Systems
Review of validation experiments
Review of conclusions of Ad-hoc group on System bitstream
Interaction with Video group
Interaction with Audio group
Review and editing of DP

MPEG/VLSI
Approval of Porto meeting report
Actions (if any) arising from audio evaluations
Update (if any) of hardware reference model arising from the latest versions of
video part of CD
Agree feedback on VLSI issues arising from systems part of CD
Agree feedback on VLSI issues arising from audio part of CD

MPEG/Tests
1. Review of proposed subjective assessment procedure on the high-transfer-rate MPEG video
2. Discussion on requirement for high bitrate MPEG
3. Selection of test sequences (525/60, 625/50, film)
4. Discussion on format for the proposed D1 tape
5. Schedule

MPEG/DSM
1. Review of previous meeting
2. Discussion on basic requirements and possible media for MPEG bitstream
3. Discussion on interface between MPEG bitstream to DSM
4. Schedule

MPEG documents of Santa Clara meeting
(Santa Clara, California, USA, 10-14 September 1990)

No.	Date	Source	Title
204	Jul	Pineda	Meeting notice: ad-hoc system meeting August 7-8
205	Jul	Szabo	Need for meeting on August 9th and 10th
206	Jul	Szabo	MPEG ad-hoc timing group meeting announcement
207	Aug	Simon	Proposed text for the system CD
208	Aug	Simon	Can we eleiminate the system stream
209	Aug	Simon	Stream types in the system multiplex
210	Aug	Simon	Proposed text for the CD on special access modes
211	Aug	Pineda	Report of Ad-hoc Systems Group meeting Aug 7-8
212	Aug	Simon	Suggested improvement to Rev 4 of the System multiplex
213	Aug	Convenor	WG11's Response to ANSI Resolution
214	Aug	Szabo	MPEG timing/buffering issues
215	Aug	Nilsson	Proposal for MPEG multiplex
216	Aug	Mead	Issues which Hughes Aircraft Company wishes to have considered during work on MPEG Work Item 2 (MPEG II)
217	Aug	Szabo	Report of Ad Hoc Timing group meeting, Aug. 9-10
218	Aug	Szabo et al.	Preliminary timing text for Video CD, v. 1
219	Aug	Schylander	MPEG bitstream system requirements and specifications
220	Aug	NTT/BT	ISO MPEG-AUDIO subjective test results for NTT/BT
221	Aug	NTT/BT	Status of BT/NTT music coder during the SBC subjective tests
222	Aug	Bertin	Remarks on STREAM-SPECIFIC-DATA
223	Aug	Convenor	Recommendations of Eleventh WG11 meeting
224	Aug	Simon	32 bit alignment for the MPEG system multiplex
225	Aug	Morris et al.	Coding of the buffer status
226	Sep.	Morris et al.	Comments on preliminary text for MPEG Video coding standard MPEG90/176 Rev. 1 Aug 15 1990
227	Sep.	Morris	Result of experiments on SM3
228	Sep.	de Wit et al.	Applications and requirements for the second phase of MPEG
229	Sep.	Yamada	Simulation results for frame distance dependent weighted interpolation on M = 6
230		van der Meer	Some issues on the decoding delay parameter
231	Aug.	van der Meer	Proposals of workitems for MPEG2
232	Sep.	Veltman et al.	Comments on the (August 17) MPEG Video CD
233	Sep.	Kogure	Consideration of [Phase-2] of MPEG work
234	Sep.	Matsuda	5-10 Mbps coding simulation using MPEG SM3 algorithm
235		Simon	Suggested changes to the audio and video bitstreams
236	Sep.	Morrison	Requirements for MPEG 2
237	Sep	Katayama	SM3 simulation results and the problem of only one matrix
238	Sep.	Artieri et al.	Motion vector and delta motion vector range
239	Sep.	Ohta	Simulation results of SM3 and some discussions
240	Aug.	Okubo et al.	The second work item and its work method
241	Sep.	KDD	SM3 experiments (+ 8esc) and problem on data rate control
242	Sep.	Matsuzaki	Simulation results of 10 Mbit/s coding based on SM3
243	Sep.	Judice et al.	Simulation result based on new Bellcore algorithm
244	Sep.	Adolph et al.	An MPEG demonstrator
245	Sep.	AT&T	Contribution to MPEG

No.	Date	Source	Title
246	Aug.	Gonzales et al	Experiments with adaptive and non-intra weighted quantization and suggested extension to the MPEG video algorithm
247		Yonemitsu	8-ESC in SM3
248	Sep.	Pineda et al.	System CD Rev 1
249	Sep.	Pineda et al.	Annex D of Systems specification Rev. 3
250	Sep.	Szabo-Nadai	Feasibility of multiplexing without a system buffering verifier
252	Sep.	Unagami	Comments on the final decision of the coding algorithm
253	Sep.	Hidaka	Video codec library (525)
254	Sep.	Hidaka	Subjective assessment procedures for high-transfer-rate MPEG
255		CSELT	SM3 simulation results
256			Comments on preliminary MPEG System specification Rev. 1
257	Sep.	Morris et al.	Further comments on draft video CD
258		McCann	Requirements for MPEG phase 2
259		RAI	Applications and requirements for a low bit rate broadcast quality video coding system
260	Sep.	Lippman	Feature sets for interactive images
261	Aug.	Hammer	Requirements on a 10 Mb/s MPEG codec
262	Sep.	Yamada	Comments and proposals for next work of WG11
263	Sep.	Convenor	Press release - Status report of ISO MPEG
264	Sep.	Demos	Considerations for harmonization of digital video standards
265	Sep.	v. d. Kerkhof	Preliminary text for MPEG Audio coding standard
266	Sep.	Andersdon	Report on liaison meeting
267	Sep.	Okubo	Clarification of the liaison statement from SG XV to MPEG
268	Sep.	Okubo	Report of the discussion on requirements for the second phase of work of MPEG
269		Rabowsky	MPEG-2 Audio Rationale
270	11/89	Okubo	List of informed patents (Issue 4)
271	Sep.	Convenor	Twelfth WG11 meeting report
272	Sep.	Chair/Test	Meeting report of MPEG/Test
273	Sep.	Chair/VLSI	Report of VLSI meeting at Santa Clara
274	Sep.	Chair/Audio	Report of MPEG/Audio meeting at Santa Clara
275	Sep.	Convenor	WG11 meeting record and five-year meeting schedule
276	Sep.	Convenor	Ad-hoc group of MPEG System
277	Sep.	Convenor	Twelfth WG11 meeting recommendations
278	Sep.	Convenor	Santa Clara meeting attendance list
279	Aug.	Nilsson et al.	Buffering considerations
280	Sep.	Chair/System	Report of MPEG/System meeting at Santa Clara
281	Sep.	Chair/DSM	Report of MPEG/DSM meeting at Santa Clara
282	Sep.	Convenor	Ad-hoc group of MPEG Audio
283	Sep.	Chair/Video	Report of MPEG/Video meeting at Santa Clara
284	Sep.	Wise	Proposal to amend MVD coding in MPEG
285	Sep.	Wise-Morris	Video bitstream interchange
286	Sep.	Day	Letter to Convenor
287	Oct.	Sandbank	Letter to Convenor

Report on Liaison meeting
(Santa Clara, California, USA, 10-14 September 1990)

Source: **Milton M. Anderson**
Title: **Report on Liaison meeting**
Date :   **September 14, 1990**

CCITT SG XV -- It was decided to prepare a formal response to SG XV at the December meeting. Items to be studied by then include:

1. Will all MPEG audio decoders decode all rates?

2. Can MPEG audio operate at multiples of 62.4 kbit/s?

It was concluded that MPEG video cannot be transcoded to H.261 video, and that while the two algorithms may be implemented on common hardware, they are distinctly different capabilities of terminal equipment. A given terminal equipment may implement one or both.

Meanwhile, the convenor of WG11 will transmit the report of the meeting to the chairman of the CCITT Video Experts Group for their use at their November meeting in the Netherlands.

CCIR -- The convenor will transmit the complete Swedish Broadcasting Corporation report on the subjective testing results, along with the press release prepared at the meeting, to the CCIR.

EBU and EBU/ETSI JTC -- The convenor of WG11 will transmit the "Eleventh WG11 Meeting Report" officially to the EBU, directed to the Chairman of V3/ABR, Boulevard A. Lancaster, Bruxelles and to the Chairman of the EBU/ETSI JTC.

Report of the discussion on requirements for the second phase of work of MPEG
Santa Clara, California, USA, 10-14 September 1990)

Source: Sakae Okubo (NTT)
Title: Report of the discussion on requirements for the second phase of work of MPEG

1. General

TEST SUBGROUP discussed the subject matter during 11AM-1PM and 2PM-5PM on Wednesday, September 12 under chairmanship of Mr. S. Okubo.
Before starting the discussion, the meeting confirmed its objective and guideline as follow:

Objective
To identify requirements for coding of moving pictures and associated
audio at bitrates up to 10 Mbit/s in terms of:
- application area,
- more specific indications of the intended application field,
- high level technical implications on the video coding, audio coding and management of the combined audiovisual signal,
- others

Guideline
To generate generic or application-independent standards.

2. Contributions
The following contributions were presented with some questions and answers for clarifications followed:

MPEG 90 /216   Issue which Hughes Aircraft Company wishes to have considered
                during work on MPEG Work Items 2 - MPEG II (Hughes)
         /228   Applications and requirements for the second phase of MPEG
                (Philips CE et al.)
         /231   Proposal of workitems for MPEG 2 (PCE)
         /233   Consideration of phase 2 of MPEG work (Matsushista)
         /236   Requirements for MPEG 2 (BT)
         /240   The second work item and its work method (NTT)
         /258   Requirements for MPEG Phase 2 (IBA)
         /259   Applications and requirements for a low bitrate broadcast quality video
                coding system (RAI)
         /260   Feature sets for interactive images (Lippman)

3 Discussion results

3.1 Prospect for the second phase work

Having reviewed a number of tape demontrations of pictures coded at 4.5-12 Mbit/sec, the meeting had a general view that the coming 30 months effort will produce a standard which will provide significantly better coded pictures at the target bitrate range.

3.2 Target bitrates

It was a consensus to define the target bitrates not at specific fixed values but as a range. The upper bound is 10 Mbit/s as expressed in @ 1. The lower bound, however, is open at the moment. There were some discussions that it might be 5 Mbit/s or 2 Mbit/s considering that several to 1 bitrate ratio for video coding is practical and that it should coder the range above the first phase MPEG video bitrate. The matter will be clarified in the future discussion.

3.3 Meaning of "generic" standard

It was clarified that the intention of "generic" video standard is addressed to the source coding-decoding part (I) indicated in Figure 1 which will be commonly to various applications. Adaptations to application oriented media/channels (II) need specific standards according to the applications.
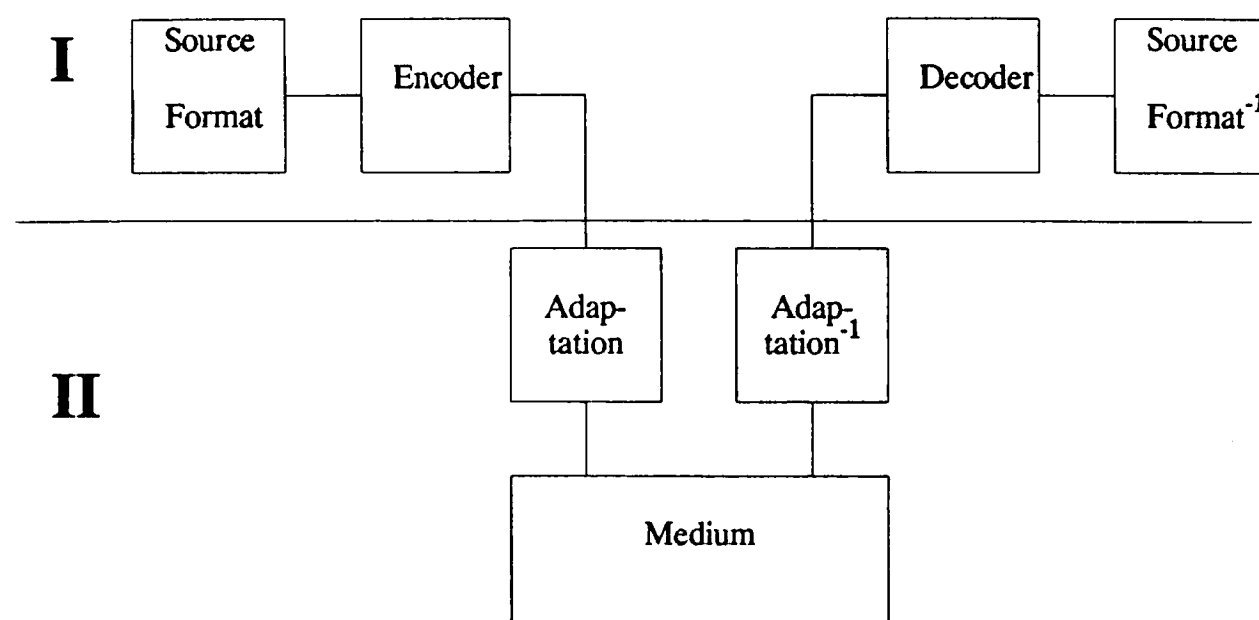

Fig. 1

3.4 Quality objectives

The target quality for the second phase of MPEG is envisaged as not lower than NTSC/PAL/SECAM and up to CCIR-601.

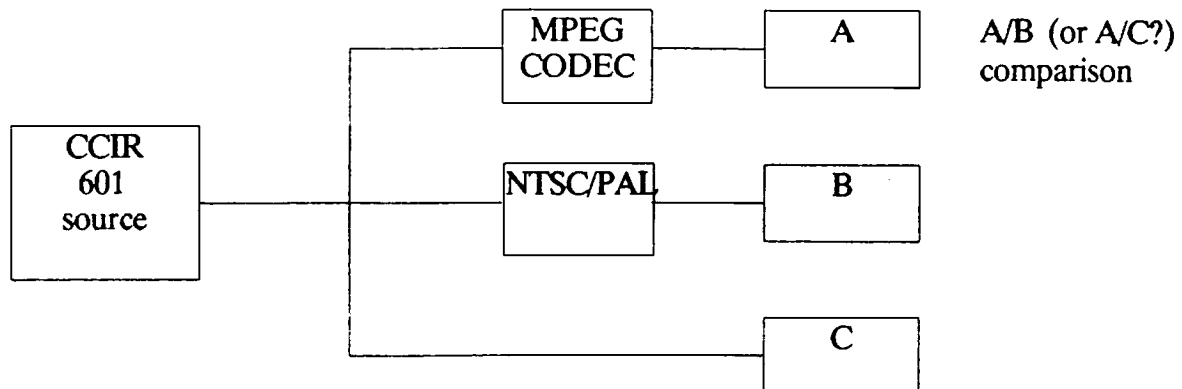A comparison method shown in Figure 2 was suggested.

```
                    ┌─────────┐      ┌─────────┐
                    │ MPEG    │──────│   A     │      A/B (or A/C?)
                 ┌──│ CODEC   │      │         │      comparison
                 │  └─────────┘      └─────────┘
  ┌─────────┐    │
  │ CCIR    │    │  ┌─────────┐      ┌─────────┐
  │ 601     │────┤  │NTSC/PAL │──────│   B     │
  │ source  │    │  │         │      │         │
  └─────────┘    │  └─────────┘      └─────────┘
                 │
                 │                   ┌─────────┐
                 └───────────────────│   C     │
                                     │         │
                                     └─────────┘
```

Fig. 2

It is pointed out that the bitrate(s) at which evaluation tests are carried out should be carefully selected because a fixed value may allow optimization at that particular point.

This matter requires futher clarification.

It is also pointed out that tradeoff among quality, bitrate and hardware cost should be carefully considered when evaluatin coding schemes.

3.5 Applications

Through the presentation of contributions, such applications as listed in Table 1 were identified for the second phase work of MPEG.

3.6 Technical implications

Based on the possible applications, there were found several features which need technical investigation in the second phase work of MPEG.

1) Picture formats
   - Range of picture representations is to be covered
        CCIR-601 format
              720x240x2x30; 720x288x2x25
        Coming EDTV format (16:9 aspect ratio)
              960x240x2x30; 960x288x2x25
        Progressive scan format
              e.g. 960x576/480x1x24/25
   - Interlaced pictures are to be coded (inter-frame and inter-field prediction?)
   - System for multiple screen/multiple images is to be considered
   - Broadcast television and scalable window system are to be considered.
   - Raster format and quality are able to be independently considered

2) Statistical multiplexing
- Utilization of MPEG bitstream properties
- Buffering and rate control for multichannels

3) Short decoding delay from arbitrary point of the program
- Random channel selecting in broadcasting reception
- Granularity of random access

4) Signal encryption/scrambling
- for authorized reception

5) Error protection for different channels
- selective protection for headers etc.
- more frequent sinchronyzation words for noisy channels

6) Repetition of coding-decoding (up to 3 times)

7) Wider range of motion compensation

8) Adaptation to ATM transimission

9) Practical fast forward and reverse playback for disk and tape

3.7 Symmetry of coding and deconding

There are three cases of different symmetry in terms of allowable complexity:
- decoder < coder
    e.g. broadcasting reception

- decoder ~ coder
    e.g. VTR, visual telephony

- decoder > coder
    e.g. ENG, SNG

This issue was thought to be sorted out ad later stage when we can see possibilitis of coding schemes to be developped. It was pointed out that a minimum encoder-decoder combination should provide targeted performance.

3.8 Audio coding
The audio coding experts who partecipated in the discussion summarized the current state of arts as follow:
       production quality at 192 Kbit/s per channel
       close to transparent at 128 Kbit/s per channel (comparable to CD quality)
There were opposing views whether the second phase audio coding standard(s) is required or not. This matter should decided by AUDIO SUBGROUP and reported back at the next meeting. It was pointed out that multilanguage program may require several channels, thus their aggregate bitrate may affect video performance.

3.9 Compatibility

There are two notions for "compatibility"; forward and backward.
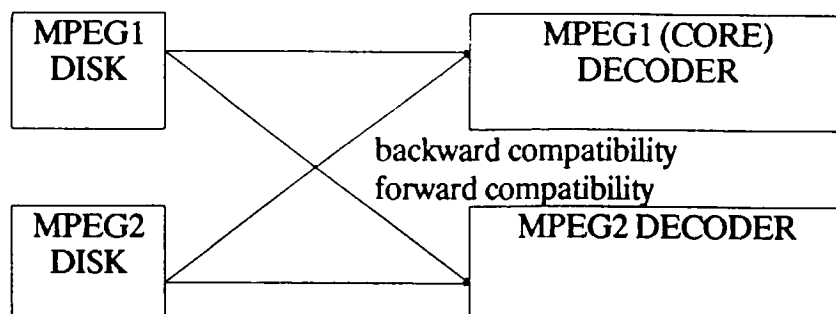These are defined as shown in fig. 3.

```
┌──────────┐                    ┌────────────────────┐
│ MPEG1    │────────────────────│  MPEG1 (CORE)      │
│ DISK     │  ╲              ╱   │   DECODER          │
│          │    ╲          ╱     │                    │
└──────────┘      ╲      ╱       └────────────────────┘
                    ╲  ╱       backward compatibility
                    ╱  ╲       forward compatibility
┌──────────┐      ╱      ╲       ┌────────────────────┐
│ MPEG2    │    ╱          ╲     │  MPEG2 DECODER     │
│ DISK     │  ╱              ╲   │                    │
│          │────────────────────│                    │
└──────────┘                    └────────────────────┘
```

Fig. 3

The meeting felt that backward compatibility is more difficult to achieve.

There were several opinions whether these compatibilities be counted as a necessary feature for the second phase work of MPEG. The items to be considered are:

- If significant performance improvements are not optained, the second phase work looses ground.
- If compatibilities are not guaranteeded, the first phase product will not be accepted.
- Software and Hardware implementation may have different requirements.
- Compatibility may cost something in implementation and quality at a given bit rate

The meeting recognized that this matter should be futher discussed toward the next meeting.

3.10 Area needing standard urgently

During the discussion, it was expressed that DBS using digital video is an area which is requiring early standard of the second phase MPEG.

4 Items to be futher discussed.

1) Definition of the lower bound of the target bit rate range.
2) Clarification of quality objectives
    e.g. By using CCIR 5 grade scale ?
3) Symmetry of encoding and decoding
4) Forward and Backward compatibilities
5) Harmonization with CCITT, CMTT

Applications	Required performance	Bitrate (Mbit/s)	MPEG 1 compatibility	CCIR 601 input/output format	Start from arbitrary point	Special playing modes	Symmetry in allowed complexity	Notes
a. Digital video disk / VTR		3-5	yes	yes		yes	$C^\sim = D$	
b. Advanced videotex through B-ISDN or quasi-distributive networks			yes	yes		yes	$C >> D$	
c. Interactive video on next generation DSM			yes		yes	yes	$C >> D$	
d. Reception/transmission of broadcast TV programs	Quality: NTSC/PAL/SECAM $\sim$ CCIR 601	< 10		yes	yes		$C >> D$	constant quality per channel /statistical multiplexing /BER $< 10^{-4}$
e. Reception/transmission of TV programs via CATV				yes	yes		$C >> D$	
f. Reception/transmission of TV programs via B-ISDN				yes	yes		$C >> D$	
g. ENG/SNG							$C << D$	
h. Interpersonal audiovisual communications through B-ISDN							$C^\sim = D$	
i. Hi-qual. multimedia applic. with transm. of live video via computer ntwks (incl. FDDI) or distrib. of stored info.		~ 5						

Meeting Allocation
(Santa Clara, California, USA, 10-14 September 1990)

MPEG	Plenary	Audio	Video	Systems	VLSI	Tests	DSM
Mon.10/09 09:00- 11:00	X						
Mon.10/09 11:00-13:0		ahg	X	X			
Mon.10/09 14:00-18:0		ahg	X	X			
Tue. 11/09 09:00-11:00		ahg	V/S/L	V/S/L	V/S/L		
Tue. 11/09 11:00- 13:00		ahg	X	X	X		
Tue. 11/09 14:00-16:0		ahg	V/L	X	V/L		
Tue. 11/09 16:00-18:00		ahg	X	X	X		
Wed.12/09 09:00-10:00	X						
Wed.12/09 10:00-13:00			X	X		X	
Wed.12/09 14:00-16:00		A/S	X	A/S		X	
Wed.12/09 14:00-18:00		X		X		X	
Thu. 13/09 09:00-10:00							
Thu. 13/09 10:00-13:00		X	X	X	X	X	
Thu. 13/09 14:00-18:00		X	X	X			X
Fri. 14/09 09:00-13:00		X	X	X			
Fri. 14/09 14:00-18:00	X						

List of Participants (MPEG/Audio)
(Santa Clara, California, 10-14 September 1990)

E. Schroeder	DTB Deutsche Thomson-Brandt GmbH	D
H. Gerhaeuser	FhG Fraunhofer Gesellschaft	D
P. Noll	Universit#t Berlin	D
H. Musmann	Universit#t Hannover	D
K. Brandenburg	Universit#t Erlangen	D
G. Stoll	Institut f#r Rundfunktechnik GmbH	D
Y. Dehery	CCETT	F
A. Komly	TDF	F
T. Senoo	Matsushita	J
A. Sugiyama	NEC	J
K. Watanabe	NHK	J
K. Akagiri	Sony	J
L. van de Kerkhof	Philips CE	NL
P. de Wit	Philips CE	NL
B. Aspromonte	Apple Computer	USA
M. Haque	Apple Computer	USA
D. Wright	Apple Computer	USA
N. Jayant	AT&T Bell Laboratories	USA
J. Johnston	AT&T Bell Laboratories	USA
J. Nelson	Brooktree Corporation Ltd.	USA
J. Fritsch	C-Cube Microsystems	USA
B. Conner	Digideck	USA
D. Pan	Digital Equipment Corporation	USA
G. Davidson	Dolby Laboratories	USA
D. Wong	General Instrument	USA
B. Astle	INTEL	USA
I. Rabowsky	Hughes CI	USA
H. Baes	Motorola	USA
R. Beaton	MPR Teltech Ltd	USA
W. J. Carter	PRISM Interactive Products Company (GCT)	USA
G. Chan	UCSB	USA

Annex II

Agenda (MPEG/Audio)
(Santa Clara, California, 10-14 September 1990)

1. Opening of the meeting
2. Approval of the agenda
3. Allocations of contributions
4. Communications from the chairman
5. Stockholm meeting report
6. Terms of reference
7. Review of DP
8. System requirements
9. Coordination with Video and System editing groups
10. Future work items
11. Next meetings
12. Recommendations of the Santa Clara meeting
13. A.O.B.
14. Close of the meeting

Draft of the Berlin MPEG/Audio Meeting Agenda

1. Opening of the meeting
2. Approval of the agenda
3. Allocations of contributions
4. Communications from the chairman
5. Santa Clara meeting report
6. Review of CD
7. Review of the software simulation
8. Next meetings
9. Recommendations of the Berlin meeting
10. A.O.B.
11. Close of the meeting

Annex IV

September 1990
Source: **Hans Georg Musmann**
Chairman of MPEG/Audio
Title: **Terms of reference**

1)Title
Coding of Audio signals

2)Area of work
The area of work consists of the development of international standards for coded representation of audio signals mainly considering their combination with coded picture signals when used for storage and retrieval on digital storage media (DSM).

3)Programme of work
- Serve as responsible body within ISO/IEC for recommending a set of standards consistent with the area of work;

- Cooperate with other standardization bodies dealing with similar applications;

- Consider requirements for interworking with other picture and audio coding algorithms defined by other SC2 working groups;
- Consider requirements for interworking with other picture and audio coding algorithms defined by other standardization bodies;
- Define methods for the subjective assessment of audio quality and objective measurement of performances for the purpose of the area of work;
- Assess characteristics of microeletronic technologies implementing audio coding algorithms;
- Develop audio coding standards considering its combination with coded pictures, the characteristics of storage and transmission media, effective implementation using current technology and constraints from DSMs;
- Propose standards for the coded representation of audio information.

4) List of work items
- Coding of audio signals at bit rates of 192 kbit/s, 128 kbit/s, 96 kbit/s and 64 kbit/s per audio channel;
- Coding the two channels of a stereo audio signal at 2x192 kbit/s and 2x128 kbit/s in studio quality and at 2x96 kbit/s and 2x64 kbit/s. Studio quality, as used here, implies subjective quality sufficient for contribution, distribution and professional processing.

Twelfth WG11 meeting in Santa Clara, California
Separate Meeting of the MPEG/Audio Group
Santa Clara, California, 10-14 September 1990)

Source: Hans Georg Musmann - Chairman of MPEG/Audio
Title: Twelfth WG11 meeting in Santa Clara, California
Separate Meeting of the MPEG/Audio Group
Status: Draft

1. Opening of the meeting

The Audio Group meeting was held at the Marriot's Hotel in Santa Clara,California on September 10-14, 1990. On September 10-11 the ad-hoc group "CD Development", former called "DP Development", prepared a first version of the Committee Draft (CD). The meeting report of this ad-hoc group meeting is given in Annex VI. On September 12, 1990 a joint meeting with the System Group was arranged. The list of participants is given in Annex I.

2. Approval of the agenda

The Agenda in Annex II was approved.

3. Allocations of contributions

MPEG document numbers were assigned to the submitted contributions.

4. Communications from the chairman

The chairman reported from the MPEG plenary meeting that
- patents have to be identified which are relevant to the coding standard being developed
- patents have to be granted on a non-discriminatory basis, otherwise the standard has to be changed
- the Audio Group is invited to contribute to a hardware demonstrator of MPEG it is planned to prepare a D1-tape with test sequences of video and audio at the next MPEG meeting in Berlin.

5. Stockholm meeting report

The sentences starting with "This new ad-hoc group ... by the whole group" are substituted by:
"This new ad-hoc group consists of 4 members of each of the MUSICAM and ASPEC group and Prof. Noll and Prof. Musmann. The collaborative development of the CD allows to improve the resulting coding algorithm by combining the most effective modules of the MUSICAM and ASPEC proposal. New alternatives have to be discussed (without scoring) with respect to the eleven defined performance criteria. In view of the time schedule, it has been agreed to use the respective MUSICAM module as a fall back mode if the improvement by the alternative module is doubtful. Every module of the standard has to be approved by the whole ad-hoc group."

6. Terms of reference

A draft for the terms of reference has been prepared, see Annex IV.

7. Review of DP

A first version of the "Committee Draft" (CD) has been reviewed and submitted as a document MPEG 90/265 Rev 1. A second version has been prepared later and will be enclosed in the document collection of the Santa Clara meeting.

8. System requirements

As a result of the discussions with the System Group, the Audio Group

- recommends to provide the information about bit rate and sampling frequency from outside, otherwise ancillary data must be sacrificed
- agrees to the sync-word 0x000001 as proposed by the System Group
- recommends to provide time stamps from outside, otherwise ancillary data must be sacrificed
- confirms that byte alignment is provided by the AAU which is a multiple of a byte
- confirms that coded silence can be realized by muting with help of the scale factors without decoding.

9. Coordination with Video and System editing groups

E.F. Schroeder, DTB, is nominated as contact person.

10. Future work items

Two documents MPEG 90/231 and MPEG 90/269 are related to this topic and will be discussed at the next meeting in Berlin.

Possible targets are: 2x128 kbit/s coding in studio quality
                    2x64 kbit/s coding in transparent quality
                    Tandem coding

11. Next meetings

Next meeting of MPEG/Audio will be on December 6-7, 1990 in Berlin. The ad-hoc group "CD Development" will have technical meetings in-between if necessary.

12. Recommendations of the Santa Clara meeting

A list of recommendations has been prepared for approval at the MPEG plenary meeting.

13. A.O.B.

- An agenda of the Berlin MPEG/Audio meeting has been drafted, see Annex III.
- A press release has been prepared, see Annex V.
- An ad-hoc group "Software Simulation" has been arranged to prepare a C-code which supports the specification of the CD with the following members:

Chairman:	Davis Pan,	DEC
	Bill Aspromonte,	Apple
	Dan Wright,	Apple
	John Nelson,	Brooktree
	Jan G. Fritsch,	C-Cube Microsystems
	Hendrik Fuchs,	University of Hannover

14. Close of the meeting

The meeting was closed with thanks of the chairman to the members of the ad-hoc group "CD Development" for their intensive and successful work.

September 1990
Source: Hans Georg Musmann
            Chairman of MPEG/Audio
Title: Press Release
            Status Report of ISO MPEG/Audio

The audio subgroup of ISO-IEC/JTC1/SC2/WG11 (MPEG) has responsibility of developing a compression technique for coding of audio signals at bit rates of 192 kbit/s, 128 kbit/s, 96 kbit/s and 64 kbit/s per audio channel. In 1989, fourteen proposals have been submitted for this purpose. These were grouped into four clusters based on algorithmic similarities, resulting in one proposal by each cluster. The candidate algorithms are called ASPEC, ATAC, MUSICAM and SB/ADPCM.

In July 1990, these candidate algorithms were evaluated using both subjective and objective measurements. The subjective evaluations were for the measurement of audio quality while the objective test measured several parameters including implementation complexity and coding delay. Formal subjective evaluations were carried out with the support of the Swedish Broadcasting Corporation. The objective tests were carried out by an ad-hoc group of ISO MPEG experts.

Due to hardware problems only two algorithms, ASPEC and MUSICAM could be completely assessed. Both, the ASPEC and the MUSICAM proposal are very close in their basic structure and in their overall performance measured by scoring, whereby the ASPEC proposal is slightly superior with respect to the audio quality, especially for lower bit rates, and the MUSICAM proposal is slightly superior with respect to implementation complexity and decoding delay. Hence, a collaborative development of the draft of the audio coding standard between the ASPEC and the MUSICAM group has been approved and a new ad-hoc group called "Draft Development" has been set up. This new ad-hoc group consists of 4 members of each of the ASPEC and MUSICAM group, Professor Noll, Technical University of Berlin and Professor Musmann, University of Hannover, Chairman of the Audio Group.

The collaborative development of the Draft allows improvements of the resulting coding algorithm by combining the most effective modules of the ASPEC and MUSICAM proposal. In view of the time schedule, it has been agreed to use MUSICAM as a basis for the low complexity first layer of a multilayer coding algorithm and algorithmic refinements including contributions of ASPEC for the subsequent layers.

Annex VI

Source: Hans Georg Musmann
            Chairman of ad-hoc group "CD Development"
Title: Report of MPEG/Audio Ad-hoc Group "CD Development"
            First Version of Committee Draft (CD)

The ad-hoc group met on September 10-11, 1990 at the twelfth WG11 meeting in Santa Clara and was attended by the following representatives:

H.G. Musmann	University of Hannover
P. Noll	University of Berlin
P. de Wit	Philips CE
J.D. Johnston	AT&T Bell Laboratories
Y.F. Dehery	CCETT
G. Stoll	Institut fuer Rundfunktechnik GmbH
E.F. Schroeder	DTB Deutsche Thomson-Brandt GmbH
H. Gerhaeuser	FhG Fraunhofer Gesellschaft
N.S. Jayant	AT&T Bell Laboratories
L. van de Kerkhof	Philips CE
T. Senoo	Matsushita
K. Brandenburg	Universitaet Erlangen

1. Introduction

The ad-hoc group "CD Development" has been set up in August 1990 at the Stockholm meeting of MPEG/Audio and has the task to prepare drafts of the Audio Coding Standard. These drafts are used as a base for discussions at MPEG/Audio.

2. Results

The proposed table of contents of the CD is given in Appendix 1. Those parts where drafts have already been prepared are signed with a ".". Also the responsible persons for writing the draft are indicated. Section 3 (SPECIFICATION OF THE CODED BITSTREAM) will be described in form of layers. Layer 1 contains the basic mapping of the digital audio input samples into 32 subband samples, segmentation of the sequence of subband samples into blocks and block companding by scale factors. Layer 2 provides additional coding of bit allocation, scale factors and subband samples. Bit allocation is controlled by a psychoacoustic model as described in the Appendix 1 of the CD. Layer 3 and 4 are still under discussion. A proposal will be prepared by members of the ASPEC group as a base for discussions. Layer 3 will introduce increased frequency resolution and Layer 4 adaptive segmentation. Stereo coding can be added as an additional feature to any of the four layers. A proposal for stereo coding as well as a source code related error protection scheme will be drafted by v.d. Kerkhof as a base for discussions. Information about the layer used is provided by the system or in the ancillary data.

A first version of a "Preliminary Text for MPEG Audio Coding Standard" has been drafted during the meeting and submitted as a document MPEG 90/265 Rev 1. By the end of the meeting a second version was available signed MPEG 90/265 Rev 2.

Furthermore, the ad-hoc group agreed

- to recommend the publication of an official press release about the results of the Stockholm test
- to consider documents concerning the scoring as internal documents of the ad-hoc group that Layer 3 and 4 are subjected to further discussion
- to arrange additional technical meetings if necessary on September 17, October 17, November 5 and November 12, 1990 in order to meet the time schedule. The report of the next technical meetings will be prepared by Mr. Senoo.

Appendix 1

AUDIO CODING

1. GENERAL

	1.	Scope and Purpose	(Musmann)
	2.	References	(Musmann)
.	3.	Symbols and Abbreviations	(Senoo)
.	4.	Mathematical Notations	(van de Kerkhof)
.	5.	Method of Describing Bit Stream Syntax	(van de Kerkhof)
.	6.	Definitions	(van de Kerkhof)
	7.	Organization of the Document	(Musmann)

2. BACKGROUND

.	1.	Overview	(Brandenburg)
.	2.	Requirements	(Johnston)
.	3.	Definitions	(Johnston)

3. SPECIFICATION OF THE CODED BITSTREAM

.	1.	Application Dependent Parameters	(van de Kerkhof)
.	2.	Bit Stream Syntax Specification	(van de Kerkhof)

MPEG Video Santa Clara Meeting Report
Santa Clara, California, 10-14 September 1990)

Source: Didier le Gall, Chairman MPEG-Video
Title: Santa Clara Meeting Report

The MPEG-Video meeting took place in Santa Clara, (California, USA) from September 10th to 14th. A significant milestone was achieved at the Santa Clara meeting and in accordance to the schedule it was decided to freeze the technical (normative) content of the draft to its current status.

EXPERIMENTS AND SIMPLIFICATION OF THE SYNTAX

The results of many experiments were presented during the Santa Clara meeting. In general it was decided to choose the simpler of the two alternatives when no significant difference in quality was present. Among those decisions, we note:

> Weights for interpolation are always 1/2, 1/2
>
> Macroblock Type 8x8 is not used
>
> Motion vector decoding is simplified.

In addition the concept of weighting matrix was generalized to all block types with the default remaining a flat matrix on non-intra blocks.

FROZEN NORMATIVE CONTENT

The video committee has frozen the normative content of the draft of the video part of the standard. Further changes will be made only on the basis of demonstrated inconsistencies and inadequacies of the specifications in the draft.

Further improvements in editorial style and organization are permitted.

MECHANISM FOR DEALING WITH INCONSISTENCIES AND INADEQUACIES

Technical inconsistencies or inadequacies will be communicated by Fax or Email to:

> D. Le Gall, M. Anderson, A.Koster, J. Yonemitsu

and circulated to the experts.

Requests for modification of the technical content will be circulated to the MPEG-Video members by the regional coordinators, comment will be returned to the regional coordinators. The MPEG video chairman sets a deadline for the reply on a specific point.

Action on any point will be taken by the MPEG Video Committee at the Berlin Meeting (december 1990).

VALIDATION SCHEDULE

The following companies: Brooktree, C-Cube, CSELT, Cypress, IBM, JVC, Philips, SONY, Thomson... (the list is non exhaustive and everybody is invited to participate) will exchange coded bitstream generated in accordance with the syntax of the Draft. In addition to reconstructing moving pictures, the verifiers will check that the produced bitstream satisfy the Video Buffer Verifier, i.e. that no buffer overflow or underflow is observed under the assumptions of the Buffer verifier. The verification should take place prior to November 15th so that eventual "problems" can be circulated and discussed in advance of the Berlin meeting.

DEMONSTRATION MATERIAL

It is very important that the Video Committee be able to demonstrate the quality of the MPEG standard under the best possible condition. MPEG-Video members are invited to contribute simulation results based on the MPEG syntax and verified. The contributions will be reviewed at the Berlin meeting and a demontration tape created. The material of the demonstration is not limited to the current test sequences. The bit rates selected should be consistent with the terms of reference of MPEG.

Santa Clara Meeting report, Systems
Santa Clara, California, 10-14 September 1990)

Source: Al Simon, Intel

Title: Santa Clara Meeting report, Systems

The Santa Clara meeting of the MPEG system's subgroup had several important tasks to accomplish.

1) To identify and resolve any remaining technical issues that needed solution before they could be documented in a Committee Draft.

2) To generate and approve a document suitable for submission as a Committee Draft.

3) To reach an agreement with the audio subgroup as to how system generated requirements would be satisfied.

The system's subgroup as a whole dealt with items (1) and (2), leading to a document which was approved by the system's subgroup, subject to a documented list of outstanding technical issues that still need to be resolved. To accelerate the process of reaching agreement on these remaining issues, an ad hoc meeting was scheduled, to be hosted by AT&T in Holmdel New Jersey on Oct 23, 24 and 25.

A joint meeting was held between the audio and systems subgroups, at which we explained the system subgroup's needs. Later a subset of both groups met to discuss outstanding conflicts between the perceived needs of the system's group and the perceived needs of the audio group. It was agreed (by this subset of experts) that the audio group could and would include timestamp information in the audio stream, using a functionality they call "ancillary data".

Further details still need to be worked out, to support such functionality as "coded silence", but it was agreed (by this same subset) that such a capability was at least technically feasible.

Meeting Report of MPEG/Test
Santa Clara, California, 10-14 September 1990)

Source: Tsuneyosh Hidaka, Chairman of MPEG/Test
Title: Meeting Report of MPEG/Test

The MPEG/Test meeting took place at Marriott Hotel, Santa Clara, California, USA from September 12th to 13th. The first part of the MPEG/Test discussed "Requirements for the high-bitrate MPEG" and was chaired by Mr. Okubo. The second part of MPEG/Test discussed about "Subjective Assessment Procedures for the high-bitrate MPEG" and was chaired by T. Hidaka.

1. MPEG2 Test Procedure

The proposed document, Subjective Assessment Procedures for High-Transfer-Rate MPEG, MPEG 90/254, was introduced.

A number of comments and discussion were made on this subject. Since document 254 was prepared based on CCIR Rec. 500-3, which is based on the good experience of the CCIR for the evaluation of high quality picture, the methods discribed on these documents are virtually approved by the MPEG/Test members.

If there is any further comment it should be prepared to next MPEG Berlin meeting.

- Comments -

(1) Assessor shall be professional persons
(2) Whether "The Double-Stimulus Continuous Quality-Scale Method" or two TV monitor display method
(3) The Double-Stimulus method was strongly supported by the members especially persons involved in CCIR

2. Selection of Test Sequence (MPEG 90/253)

(1) CCIR 601 A 525/60 D1 Tape
(2) CCIR 601 E 625/50 D1 Tape
(3) Test Sequences from RAI,625/50 D1 Tape

After the tape, listed above, display the following test sequences were selected for the MPEG2 subjective test:

- No.15   FLOWER GARDEN
- No.16   SUSIE
- No.24   POPPLE
- No.29   TABLE TENNIS
- No.30   MOBILE & CALENDER
- No.44, 45   TEMPETE(2.5 sec.each of No.44 and No.45 w/noise)

These six test sequences exist in both 525/60 and 625/50 standard.

However, there is a comment that it will be required to provide test material with quick motion which exist in natural environment like sports programme so that No.38 "FOOTBALL" was selected as option even if available only in 525/60.

2.1. Distribution of the test material

During the meeting, some members preferred MT distribution rather than D1 tape. However, because of the large number programs to be distributed, D1 tape will be much preferable.

- USA
- Europe   D. Hepper (TCE)
- Japan   T.Hidaka (JVC)

2.2. Trimming of the test sequences

Each test sequence must select which portion of the material will be use for subjective test. The length of programme shall be 4 to 5 seconds each.

- Final decision: Berlin meeting

3. Format for proposed D1 tape

In order to make a stable editing tape for subjective test, a certain tape format will be required on the proposed D1 tape.

Chairman of MPEG/Test will provide such format at next Berlin meeting.

4. Schedule (Subjective Test / MPEG2 Video)

- 10-14	Sept.	1990	-Santa Clara	
- 04-07	Dec.	1990	-Berlin:	*Discussion of PPD *Testsequences finalized
- 04-08	March	1991	-SFO:	*PPD finalized *Test procedure finalized
- end	May	1991	-:	*D1 tape delivered to JVC
- 08-12	July	1991	-Kurihama:	*Subjective test

----- plus 20 months to DP

(It is recommended to submit result of simulation in both 625/50 and 525/60 standard)

Report of VLSI meeting at Santa Clara
Santa Clara, California, 10-14 September 1990)

Source: G. Morrison - Chairman of VLSI Group
Title: Report of VLSI meeting at Santa Clara

The VLSI group met on 11 and 13 September. The participants were

G Morrison,	BT
C Porter,	Cypress
G Chan,	UCSB
C-S Wang,	IIT
S Adams,	Fluent Machines
M Polomski,	Fluent Machines
S Sutardja,	IIT
J Carter,	GCT
R Bramley,	Inmos
B Butera,	ITT Semiconductor
H Bheda,	AT&T Bell Labs
H Koyama,	NEC
D Galbi,	C-Cube Microsystems
H Yamaguchi,	KDD
E Kelley,	Hughes
R Saint Girons,	Thomson CE
A Ito,	Fujitsu
M Matter,	Apple
R Shenhav,	Apple
A Wise,	Brooktree
V Fandrianto,	IIT
D Bailey,	LSI Logic
M Newman,	Chips and Technologies
I-F Wang,	TI
K Dallas,	National Semiconductor

VLSI group members also took part in a joint session with the Video group on 13 September.

1. Approval of the Torino and Porto meeting reports was deferred as they had not been widely distributed.

2. The Video group had requested consideration of the impact of adding a downloadable quantisation weighting matrix for non-intra block coefficients. This would need an extra 64 bytes of storage in the decoder. Also relevant are the increased computations and memory accesses required in non-intra blocks.

There was agreement that addition of this feature would cause some increase in complexity. However, the extent ranged from insignificant to quite significant. It was pointed out that although the unit cost might not be affected by the introduction of this new item, the time to market of the first MPEG products could be delayed.

Eventually the group agreed to accept the addition on the basis that the potential for improvement in picture quality outweighed the arguments against, even though the demonstrated evidence

had not been totally convincing. No future requests, such as reverting to separate weighting matrices for luminance and chrominance, would be entertained.

3. The VLSI group approved the proposal in document MPEG90/284 to modify the coding of motion vectors such that the modulo arithmetic use more convenient numbers. There would be no deterioration in the coding performance because no codewords become longer. The VLSI group recommended that the Video Group incorporate this proposal in the video part of the CD.

4. Document MPEG90/228 from several European companies gave some details of a real time decoder being prepared to validate the Systems and Video parts of the MPEG CD by the March 1991 meeting. It is hoped that audio will also be incorporated.

5. Prompted by the needs to set an agenda for the next meeting and to formulate terms of reference for the subgroup activities in the next phase of MPEG, the meeting discussed the role and effectiveness of the VLSI group. The WG11 convenor suggested that contributions be brought to the next meeting in Berlin.

6. During the session with the Video group the joint decision was made to add the additional weighting matrix to the CD.

7. During the session with the Video group the addition of an extra bit to each 'f' field was agreed. This bit would signify that the reconstructed motion vector values should be interpreted as representing integer values rather than multiples of one half. This would double the maximum range of displacements.

DSM Meeting Report
Santa Clara, California, 10-14 September 1990)

Source: Takuyo Kogure - Chairman of DSM Group

Title: Santa Clara Meeting Report

1. Review of the previous meeting

The previous DSM meeting was held at Kurihama/Osaka in October 1989. Present DSM available, for example CD-ROM, CD-RON/XA, Opical Disc and Data DAT were introduced and demonstrated by experts of the respective manufacturers. Discussion was concentrated on the availability and specification for MPEG bitstream.

Every MPEG participant recognized that MPEG phase-1 (1.5 Mbit/s) is suitable to be utilized on the CD-ROM. However, the DSM construction and specification itself is not a matter of standardization in this group. Thus we could not get any conclusion at that DSM meeting.

The DSM group therefore did not have any further meeting until this Santa Clara meeting.

2. Discussion

(1) Area of work

The activities of this group is to provide some kind of consultancy work for the video and audio group, respond to the questionnaire from these groups and at the same time making recommendations which consist of fundamental specifications of possible DSMs and their interfaces.

(2) Bit stream

At the plenary meeting, MPEG phase-2 was discussed. With regard to the bit stream, everybody has already agreed with up to 10 Mbps for the current MPEG phase-2 target.

This explanation is a little bit vague for practical consideration and it is difficult to discuss the actual condition.

(3) Interface

Interface between MPEG Bit stream to DSM was also discussed.

Some sort of data converter will be set at the input and uotput of the DSM. This interface include bit rate converter and at the same time additional data also.

3. Approved conclusion

(1) Making a Recommendation
- Recommend Specifications, including total data capacity or accesstime, of the DSM which is applicable for 5 and 10 Mbps MPEG-2 bit stream.
- Recommend interface between above DSMs to MPEG-2 bit stream which include some sort of bit rate converter.

(2) Schedule
- At the next WG11 meeting, Dec. 4-7, 1990 will call for the proposal of MPEG-2 DSM and its interface.
- At the Mar. 1991 meeting, discuss how to make a recommendation under the submitting proposal.
- At the July 1991 meeting, first draft proposal package will be reported.
- At the end of 1991, proposal package of the recommendation of DSM and its interface will be reported.