CCITT SGXV
Working Party XV/1
Experts Group for ATM Video Coding

Document AVC-26
Jan. 31, 1991

SOURCE : MPEG
TITLE : REPORT OF THE 13TH MEETING IN BERLIN
PURPOSE: Report

The following two MPEG documents are reproduced for information.

MPEG90/348 Recommendations of 13th meeting
MPEG90/349 Report of the thirteenth WG11 meeting

(Chairman's note: "Recommendation" is used differently in ISO. Exact definitions in CCITT and ISO should be found.)

END

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 0032
MPEG90/348
December1990

Source: Leonardo Chiariglione - Convenor
Title: Recommendations of 13th meeting

Recommendations of 13th meeting

1. WG11 recommends the approval of the 12th (Santa Clara) meeting report (WG11 N00)

2. WG11 recommeds the approval of the reports of the following Ad-hoc groups
   1. On System CD (MPEG90/331)
   2. On Software Simulation (MPEG90/346)
   3. On Audio CD (MPEG90/349)

3. WG11 recommends the issue of a letter (WG11 N0034) in response to the US National Body resolution (MPEG90/297)

4. WG11 recommends the issue of liaison letters to:

1. EBU/ETSI JTC	(WG11 N0035)	in response to MPEG90/
2. EBU V3/ABR	(WG11 N0036)	
3. SMPTE	(WG11 N0037)	
4. CMTT/2	(WG11 N0038)	
5. CCIR WP 11 B	(WG11 N0039)	in response to MPEG90/351
6. IEC SC60/A	(WG11 N0040)	
7. ANSI	(WG11 N0041)	
8. CCITT WP XV/1	(WG11 N0042)	in response to MPEG90/140

   and the sending of this and future WG11 meeting reports to the Chairman of IEC SC60/A.

5. WG11 considering
   - its terms of reference (WG11 N0001);
   - the report of the Coordination Meeting on Imagery (MPEG90/341);
   - its decision to develop generic standards for audiovisual coding
   - the liaison letter from the CCITT Experts Group on Video Coding for ATM

   recommends that the ongoing phase of work on audiovisual coding at bitrates up to about 10 Mbit/s be carried out in collaboration with CCITT, by holding joint meetings on
   - Video
   - Systems
   - Implementation

   and on whatever other matters of common interest may be identified in the future.

6. WG11
   - thanking those members who have contributed patent statements and

• recalling that no CD may be submitted for ballot without clearance of patent issues strongly recommends that all members activate themselves to obtain further patent statements enabling the use of the MPEG standard according to ISO directives.

7. WG11 recommends the approval of the meeting report of the following groups:
   - Video (MPEG90/343)
   - Audio (MPEG90/342)
   - Systems (MPEG90/344)
   - VLSI (MPEG90/338)
   - Test (MPEG90/340)
   - DSM (MPEG90/345)

8. WG11, heard the meeting report of the requirement and planning group (MPEG90/339), recommends that its current workplan, foreseeing the stage of CD to be reached on November 1992 be maintained. In the spirit of collaboration between Standards Organisations, WG11recommends that the date for preselection tests be moved to 2-6 September 1991and thanks Messrs. T. Hidaka and Y. Yamada for hosting the meeting and carrying out the tests at JVC. The meeting report is approved.

9. WG11 recommends the approval of the recommendations of the following groups:
   - Video

     1. The members of MPEG-Video have reviewed the Committee Draft (CD) and revised its content on the basis of inconsistencies and inadequacies. The list of changes to the document is approved and will be included in the revision 2 of the MPEG-Video CD to be dated 90/12/07 and to be distributed to all MPEF-Video members by regional coordinators.
     2. The MPEG Video CD is frozen and its normative content can only be modified on the basis of demonstrated inadequacies and inconsistencies. Editorial changes remain allowed and the procedure to report proposals for changes, prior to the San José meeting is by sending documents to the regional coordinators and to the MPEG Video Chairman.
     3. The MPEG Vodep committee approves the preparation of a video tape to demonstrate the current status and image quality of the MPEG Video work. Submissions are to be sent to Dr. Westerkamp. Deutsche Thomson Brandt, who will edit the tape. The deadline for submissions is 1990/01/15.
     4. The MPEG Video committee is starting work on conformance testing and sollicits inputs from its members on testing methodology, items to be tested for conformance and possible test patterns. In addition the MPEG Video committee welcome reports on any technical problem associated with testing.

   - Audio

   The Audio group recommends that WG11 approves:

     1. the third version of the committee draft (Use of ms-stereo coding in Layer I and II has been proposed and is still under discussion)
     2. the set up of a new ad-hoc group on verification testing
     3. an additional meeting of MPEG/Audio in Stockholm.

   - Systems

     1. The Systems group recommends adoption of Rev. 7 of System CD for distribution outside WG11

   - VLSI

   The VLSI group recommends that WG11

     1. approve change of name to "Implementation studies
     2. approves the terms of reference

3. confirm the relevance of the implementation studies group and acknowledge that it has equal rights in the CD construction process
4. strive to increase the understanding of implementation issues by all its participating organisations

- Test

The Test and Requirement groups recommend that

1. Completion of MPEG Phase-2 CD be planned at the end of 1992
2. The work be splitted into "competition" phase and "collaboration" phase
3. The "competition" phase include subjective tests for picture quality of proposed algorithms, which will take place in September 1991
4. The proposal package description for the subjective test participation be completed at the next meeting
5. The "collaboration" phase use "Test Model" as a tool to elaborate specifications.

- DSM

10. WG11 acknowledging the efforts made by WG11 members in developing and perfecting the three parts of CD 11172, recommends that the dedication of the Systems Group in addressing and solving the new and difficult problems of multiplexing and synchronisation be brought to the attention of all WG11 members.

11. WG11 recommends the approval of the Rev. 1 of CD 11172 (WG11 N0043) for distribution outside WG11.

12. WG11 recommends the establishment of the following Ad-hoc groups (mandate and membership given in WG11 documents indicated in brackets):
    - On Audio CD Confirmation Tests (WG11 N0044)
    - On Audio matters (WG11 N0045)
    - On CD Integration (WG11 N0046)

13. WG11 strongly recommends that hardware verifications of the CD be initiated by members

14. WG11, after inspection of the quality demonstrated by MPEG/Video simulations and MPEG/Audio subjective tests, recommends that a D1 demo tape containing Video and Audio sequences be prepared for distribution outside WG11. Dr. D. Westerkamp of TCE/DTB is kindly asked to edit the material provided by WG11 members and produce the demo tape.

15. WG11 recommends preliminary approval of the Implementation Studies Subgroup Terms of Reference

16. WG11, recognising the need of a strong coordination between its subgroups, recommends that Subgroup Chairmen meet regularly during WG11 meetings, under the Chairmanship of the Convenor, to oversee the progress of technical work. The first task should be to prepare overall terms of reference of the subgroups for approval by WG11.

17. With the purpose of increasing meeting effectiveness by timely availability of contributions, WG11 recommends that:
    - Each contributor make sure that a copy of his/her contribution is delivered to the Convenor at the latest 2 work days before the meeting. Contributors are encouraged to send also a copy to Subgroup Chairmen.

- The Convenor prepare a document list to be made available at the opening of the meeting.
- Each contributor bring sufficient copies of his/her contribution

18. WG11 recommends that National Bodies inform the Convenor and/or the WG11 Secretariat of the names of attending delegates with indication of a Spokesman (WG11 N0047).

19. WG11 recommends the adoption of the revised 5-year meeting schedule (WG11 N0048).

20. WG11 thanks Messrs.
    - J. Yonemitsu of Sony
    - D. Mead of Hughes
    - E. Schroeder of TCE/DTB

    for copying and distributing the MPEG document binder and asks the Convenor to inform WG11 members when the first binder is ready.

21. WG11 thanks HHI and Technical University of Berlin for their warm hospitality and excellent facilities, in particular Dr. Ralf Schaefer and Prof. Peter Noll, and all those who have helped:
    Stefan Rauthenberg
    Robert Ernst
    Maria Charatischwili
    Xuehua Chen
    Gisela Schmidt
    Martin Weckwerth
    Jingxin Shen
    Thomas Dalstein
    Thomas Friedrich
    Aknan Demirkan
    and the companies Deutsche Thomson-Brandt, ITT-Intermetall, Siemens and Telenorma for their support.

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ISO/IEC JTC1/SC2/WG11
CODING OF MOVING PICTURES AND ASSOCIATED AUDIO

ISO/IEC JTC1/SC2/WG11 N 0033
MPEG90/349
December 1990

Source: Leonardo Chiariglione - Convenor
Title: Report of the Thirteenth WG11 meeting

Report of the thirteenth WG11 meeting

The thirteenth meeting of WG11 was held in Berlin, Germany, at the Heinrich-Hertz-Institut and at the adjacent Technical University of Berlin. A welcome address was delivered by dr. Ralf Schäfer, Head of the Image Processing Department of HHI. Mr. W. Andriessen, Observer from IEC SC 60 A was welcomed by the Convenor.

The list of participants is given in Annex I and the approved meeting agenda in Annex II. The list of contributions submitted at the meeting and those related to it are given in Annex III.

The Convenor informed the meeting that the MPEG CD had been registered with SC2 with the number 11172. The draft is in three parts: 11172-1 (Systems), 11172-2 (Video) and 11172-3 (Audio).

The 12th meeting report was approved (WG11 N0029).

A US resolution on two aspects of WG11 work was discussed and an answer produced (WG11 N0034).

The definition of terms of reference of WG11 subgroups was completed with those of the VLSI subgroup, which will from now on be called Implementation Studies Subgroup. The next task will be the preparation of a homogeneous set of all subgroups terms of reference.

The planning for the second MPEG work item was kindly undertaken again by Mr. S. Okubo, who also treated the problem of identification of requirements. The meeting report is given in Annex IV.

The size of the working group with its multidisciplinary membership required a further effort in establishing effective liaisons with the different groups and committees operating in ITU, IEC, EBU, ETSI and SMPTE. A dedicated group of individuals worked on these aspects and Mr. G. Morrison kindly undertook the task of drafting the liaison letters that were approved by the meeting (WG11 N0035 to N0042). During the discussion on WG11 N0042 the meeting was pleased to learn that two manufacturers, represented at the meeting, were already designing 11172-2 VLSI chips with H.261 capabilities.

Mr. S. Okubo, Chairman of the CCITT Experts Group on Video Coding for ATM, introduced the request of his group (MPEG90/323) for a collaboration between WG11 and the CCITT Experts Group for the ongoing MPEG second work item. The meeting was pleased to receive this request, which follows a previous liaison letter of WG11 to CCITT WP XV/1 (WG11 N0012). The spirit of the request, aiming at avoiding duplication of work and proliferation of standards for applications of a similar nature was exactly in line with the desire, expressed several times by WG11, to develop generic standards for audiovisual coding.

The quality of video tapes showing pictures coded according to CD 11172-2 and the quality of audio coded according to CD 11172-3 suggested the opportunity to prepare an "MPEG demo tape" for distribution outside WG11. Dr. D. Westerkamp (TCE/DTB) undertook the task of assembling

and editing the video tapes contributed while Mr. G. Stoll (IRT) will prepare background coded audio.

The reports of the Ad-hoc groups on System CD (MPEG90/) and Software Simulation (MPEG90/) were approved.

The meeting was organised according to the table given in Annex V.

The reports of the subgroups are given in annex as follows:

Video	Annex VI
Audio	Annex VII
Systems	Annex VIII
Test	Annex IX
Implementation	Annex X
DSM	Annex XI

The document prepared by Mr. Kogure, Chairman of MPEG/DSM (MPEG90/309), as input to the meeting is annexed to this report (Annex XII). WG11 members are encouraged to distribute this document within their organisations and technical communities in order to obtain feedbacks for the next meeting.

Several patent statements conforming to ISO procedure were collected. Members were urged to provide all remaining statements needed for use of 11172.

Revision 2 of 11172 was approved (WG11 N0053).

The need to come to an early finalisation of the CD prompted the establishment of 3 Ad-hoc groups. Mandates and memberships are given in WG11 N0044 to 0046.

The collaboration with CCITT on video coding in the ongoing work for the MPEG second work item led to slight changes in meeting planning, as detailed in WG11 N0048. The meeting was pleased to accept the kind offer of Israel and United Kingdom to host the 1992 March and November meetings respectively.

The 13th meeting recommendations are given in WG11 N0032. This includes a recommendation generated from the analysis of MPEG90/316 aimed at making sure that there is sufficient coordination among the groups of WG11 for the definition of a complete MPEG System. This will be accomplished in the future by holding regular meetings of the Chairmen of WG11 subgroups under the chairmanship of the Convenor.

Dr. D. Mead (Hughes) had kindly undertaken the task of copying and distributing MPEG documents in the Americas for 1991, and Mr. J. Yonemitsu will continue the same task in the Far East. Mr. E. Schröder will distribute the 13th meeting documents to Europe. Other European candidates will be needed in the future.

There being no other business the meeting was closed at 17:00 of 90/12/07 with thanks to the hosting organisations.

Annex I

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Annex II

AGENDA

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. Twelfth MPEG Meeting Report
7. Processing of National Bodies Position Papers
8. Terms of reference of WG 11 Subgroups
9. Planning and Requirements for MPEG Second Work Item
10. Liaison matters
11. Preparation of MPEG demo tape
12. Report of Ad-hoc Group on System CD
13. Report of Ad-hoc Group on Software Simulation
14. Organisation of Thirteenth meeting
15. Reports of subgroup activities
16. Patents for MPEG CD
17. Approval of MPEG CD
18. Planning of subgroup activities
19. Schedule of future MPEG meetings
20. Recommendations of Thirteenth meeting
21. Distribution of MPEG documents
22. A.O.B.
23. Closing

MPEG/Video

Review of contributions
Report on validation and verification (05/12)
Review comments on CD (06/12)
Accept contributions for MPEG demo tape
A.O.B

MPEG/Audio

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. Recommendations of the Berlin meeting
9. A.O.B.
10. Close of the meeting

MPEG/Systems
CD document review
Discuss unresolved technical issues
Review of simulation results
Joint meeting with Video group
Joint meeting with Audio group
CD approval
A.O.B.

MPEG/VLSI
Approval of Santa Clara meeting report
Actions (if any) on outstanding implementation issues from Video, Audio and System CD
Terms of reference

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 the previous meeting
2. Explanation of proposed spec. for recommendation
3. Classification of proposed each bitrate, related to the Test Group
4. Recommended interface between MPEG bitstream and DSM
5. Proposed package construction
6. Confirmation of the total schedule

Annex III

List of MPEG documents for Berlin meeting

No.	Date	Source	Title
289			
290	Dec.	Morrison	Information on EUREKA project VADIS
291	Dec.	Quaglia	Compatibility check
292	Dec.	AT&T	
293	Nov.	Astle	Problem with pel aspect ratio
294	Nov.	Astle	Comments on MPEF Video CD dated 9/14/90
295	Dec.	Morrison	MPEG standard validation procedure
296		Morrison et al	Proposal for MPEG system syntax
297	Nov.	ANSI	U.S. National Body resolutions
298	Dec.	Veltman	Results of MPEG bit stream exchange in Japan
299	Dec.	Veltman et al.	Comparing 2 MPEG system buffering methods
300		Mc.Cann	European requirements fo applications of MPEG phase 2
301	Nov.	Reader	Bitstream verification
302	Nov.	Anderson	Proposed changes to MPEG video coding standard
303	Nov.	Anderson et al	Comments on "Comments on MPEG Video CD" from Morrison et al.
304	Dec.	Katayama	Simulation results
305	Dec.	Katayama	There were some simulation problems of DCT (not IDCT) mismatch
306	Dec.	Pineda	Proposal for including STC in pack header
307		Vekeman	Optimizing the AC coefficient code tables
308	Dec.	Wang et al.	Compatible even field coding from odd fields using the co-sited field in single and averaged modes
309		Kogure	Discussion guide of DSM group
310	Nov.	Hepper et al.	Test sequences for MPEG2
311	Nov.	Hepper	625/50 demo tape of proposed test sequences for MPEG 2
312	Dec.	Herpel	Bit stream exchange
313	Dec.	Herpel	Coding results at 4.6 Mbit/s
314		Schroeder	Report on systems ad-hoc meeting in Holmdel NJ
315	Dec.	Morrison	MPEG buffer specification
316	Dec.	Morrison	A modified MPEG organisational structure
317	Dec.	Morrison	MPEG standard validation procedure
318	Dec.	Morrison et al	Proposal to correct the definition of the bit rate field
319	Dec.	Morrison et al	Comments on MPEG System CD (rev 2)
320	Oct.	Nilsson	Effects of multiplex on buffering
321	Nov.	Morrison et al	Comments on MPEG video CD
322	Dec.	Morrison et al	List of outstanding system issues
323	Nov.	CCITT	Letter to Dr. L. Chiariglione, Convenor of ISO/IEC JTC1/SC2/WG11
324	Nov.	Morris et al.	MPEG Video buffering and the buffer fullness measure
325	Dec.	Morris	Proposal to alter the interpretation of the pel aspect ratio field
326	Nov.	van der Meer	Requirements for MPEG-2
327	Nov.	Kogure	Report on MPEG-1 bitstream exchange
328	Nov.	Kogure	Simulation results of 5 Mbps video coding based on SM3
329	Dec.	Hidaka	Format of MPEG2 D-1 test tape
330	Dec.	Yamada	Comment on Video CD as for M and N
331		Pineda	Report on Systems ad hoc meeting in Holmdel NJ

No.	Date	Source	Title
332	Nov.	CCITT	Report of the first meeting of the experts group for ATM video coding in the Hague (November 13-16, 1990)
333	Nov.	Reader	Bitstream verification
334	Dec.	Yamada	Proposal for System MUX, BFM, and TS
335	Dec.	Yamada	Correction for MPEG90/330
336	Dec.	SBC	Report - Test with "Glockenspiel" on a modified ASPEC codec
337	Dec.	Simon	The relationship between MPEG and MHEG
338	Dec.	Chair/Impl.	MPEG/Implementation Berlin meeting report
339	Dec.	Okubo	Report of the requirement subgroup
340	Dec.	Chair/Test	MPEG/Test Berlin meeting report
341		Zavada	Record of the meeting of the joint ISO/IEC Steering Committee on Image Technology held in Geneva on 1990-05-28/29
342	Dec.	Chair/Audio	MPEG/Audio Berlin meeting report
343	Dec.	Chair/Video	MPEG/Video Berlin meeting report
344	Dec.	Chair/System	MPEG/System Berlin meeting report
345	Dec.	Chair/DSM	MPEG/DSM Berlin meeting report
346	Dec.	Pan	Report on the Audio ad hoc committee on software
347	Dec.	Convenor	Berlin meeting attendance list
348	Dec.	Convenor	Berlin meeting recommendations
349	Dec.	Convenor	Berlin meeting report
350	Dec.	Musmann	Report of "Audio CD ad-hoc group"
351		Heightmann	Liaison letter between ISO/IEC MPEG and CCIR IWP 11/7

Annex IV

Report of the REQUIREMENT subgroup

Source: **Sakae Okubo (NTT)**

1. General

The requirement subgroup met on December 5 and 6 under chairmanship of Mr. S. Okubo. Before starting discussion, we confirmed the target outcome of this meeting be to clarify the following items to form a basis for the PPD (Proposal Package Description);

- technical requirements,
- time schedule, milestones, and
- work method for shifting from "competition" to "collaboration".

2. Available documents

MPEG 90/268	Santa Clara meeting report (Chairman)
MPEG 90/292	Suggestions for MPEG-2 standard (AT&T)
MPEG 90/300	European requirements for applications of MPEG Phase 2 (IBA/NTL)
MPEG 90/326	Requirements for MPEG-2 (Philips)
MPEG 90/332	Letter to Dr. Chiariglione (CCITT Experts Group)

3. Discussion results

3.1 Technical requirements

3.1.1 Picture quality

The target quality and corresponding bit rates for the MPEG Phase-2 work were summarized in the following two categories;

- NTSC/PAL/SECAM level: 3-5 Mbit/s
- "MAC" level : 8-10 Mbit/s

We may select test sequences appropriate for each category to relax the subjective test burden, e.g.

- lower bit rates : A, B, C, D
- higher bit rates: C, D, E, F

It is expected that the overlapping test sequences would provide information concerning bit rate dependency of proposed coding algorithms.

3.1.2 Compatibility

1) Guideline

The meeting discussed on how to relate the second generation standard for up to 10 Mbit/s and the first one for 1.5 Mbit/s, as a continuation of the discussion at the previous meeting in Santa Clara. A major problem seems to be whether we can achieve target quality by maintaining a close relation between the two generation standards.

After extensive discussion, the meeting agreed as a guideline to seek "compatibility" to the maximum extent.

2) Clarification of "compatibility"

During the discussion, however, it was found that the "compatibility" may mean different things according to the proponent. Clarification is required. Some attempt was made to list up possible approaches for achieving compatibility as illustrated in Figure.

There was a suggestion that we could study compatibility issues by evaluating additional transcoding boxes necessary for achieving forward- and/or backward-compatibility.

3) Requirement for the algorithm proposal

Each algorithm proposal for subjective tests is required to describe the "compatibility" aspect.

4) Weighting factor of "compatibility"

There was a remark that the weighting factor of this functionality be clarified before progressing to the request for algorithm proposal since this factor affects the choice of the first model. The matter is still under study as described in Section 3.3.3.

5) Conclusion

This issue should be further studied from various points of view.

Contributions are awaited toward obtaining definite conclusions at the next meeting.

3.1.3 Other functionalities

The meeting considered a number of functionalities required for the second phase of MPEG work in terms of the following three categories. The objective was to maximize the efficiency and effectiveness of the "competition and collaboration process".

1) Require demonstration for proposal
- random access (see PPD of MPEG1 for the definition)
- fast forward
- fast reverse
- low codec processing delay

2) Check at the later stage
- repetition of coding-decoding
- protection against errors
- ATM network capability
- recovery of synchronization after an arbitrary point
- variable pel aspect ratio

3) Not consider at the moment
- normal reverse
- slow motion

Note: These functionalities are rather media dependent.

3.2 Time schedule - alignment of plans between MPEG bad CCITT Experts Group

The meeting compared the MPEG work plan and that of the CCITT Experts Group, and discussed possible alignment.

Firstly, the target date of freezing draft specifications was confirmed to be common; end of 1992. Though this is worded differently as
- completion of Committee Draft (MPEG), and
- completion of Flexible Hardware specification (CCITT EG)

the level of technical maturity is almost identical. It is noted that there was some comment that the hardware verification may go in parallel with freezing specifications, not that it follows serially the completion of specifications.

Secondly, the date of subjective test was discussed. MPEG has been planning to carry our this test in July 1991 and to take some time to define a simulation model (it took six months after the test to define SM1 in case of the MPEG Phase 1). CCITT Experts Group has planned to define a

reference model around the end of 1991 after the "divergence" phase study using informal observation tests. In order to adapt to the MPEG method, CCITT Experts Group thought the subjective test in July 1991 is too early and hoped to defer it to a later date such as November 1991.

The Requirement subgroup did not support the change of date due to

- that it may increase the burden of the host lab,
- that it may make difficult to shift from competition to collaboration,
- that the work schedule alignment was not felt necessary.

Note: This point was reconsidered in the plenary session on December 7, and the date of subjective test was deferred 8 weeks as recorded in the main body of this meeting report.

3.3 Work method for shifting from competition to collaboration

3.3.1 Collaboration phase work

It was a consensus to define "Test Model" and refine it in the collaboration phase according to the previous practices in MPEG and CCITT.

3.3.2 Objectives of the subjective test

The meeting confirmed that the objectives are;

- to quantify the picture quality of candidate algorithms, and
- to find promising schemes for further collaborative elaboration.

3.3.3 Weighting for requirements

We are going to develop a video coding standard which meets several requirements including picture quality and functionalities. Picture quality is expected to be measurable with the subjective test method. The problem is how to evaluate the functionality as well as the mixture of picture quality and functionality.

It was a general opinion of the meeting that the scoring to weight each performance/capability as was practiced for the MPEG Phase-1 need not be repeated. The meeting agreed that for the competition purpose we will initially concentrate on the picture quality.

If we succeed to narrow down the number of candidates as intended from the comparison of picture quality, then we may apply such criteria as compatibility, complexity toward defining TM1. Appropriate criteria for this purpose are to be studied further.

3.4 Items to be discussed in other subgroups

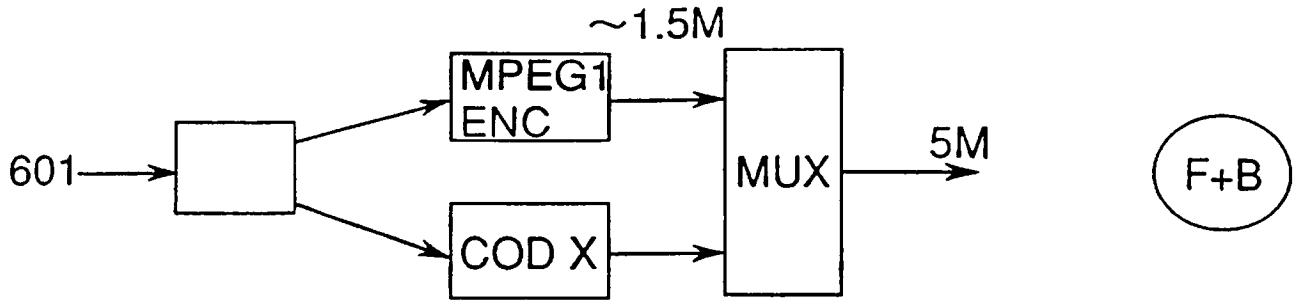
Requirement subgroup awaits input on the following items from other subgroups:

- how to evaluate the complexity of candidate algorithms --- VLSI
- whether bit stream file and executable code are required for submission of candidate algorithms --- VIDEO

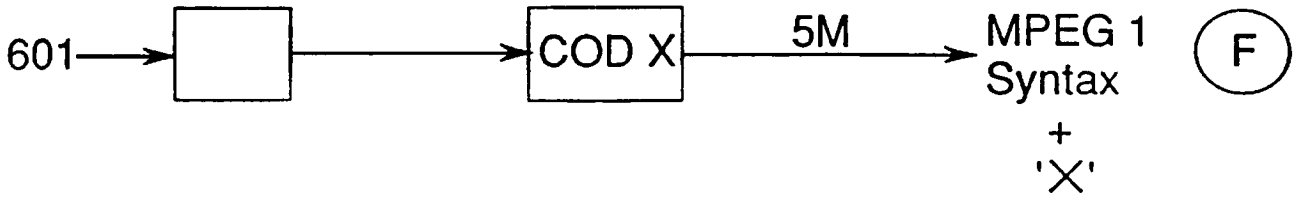
4. Major task at the next meeting

To complete PPD.

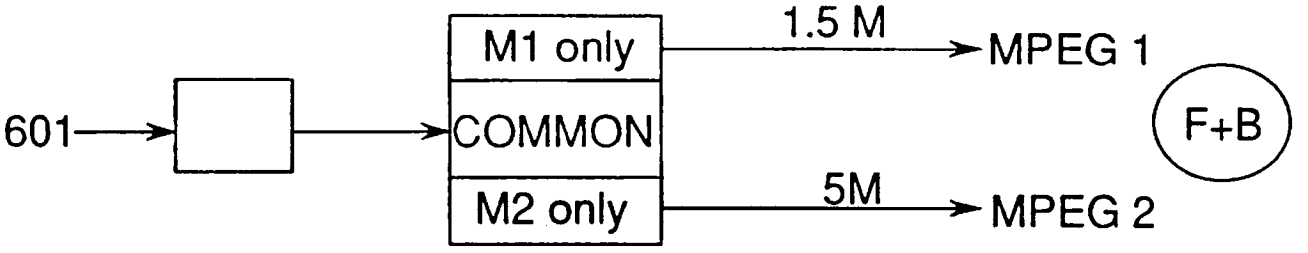
a) Multiplexed multiple bit stream approach



b) MPEG1 superset approach



c) Switchable equipment approach



Note 1: Bitrates are for example.
Note 2: Definition of forward- and backward compatibility is as follows.

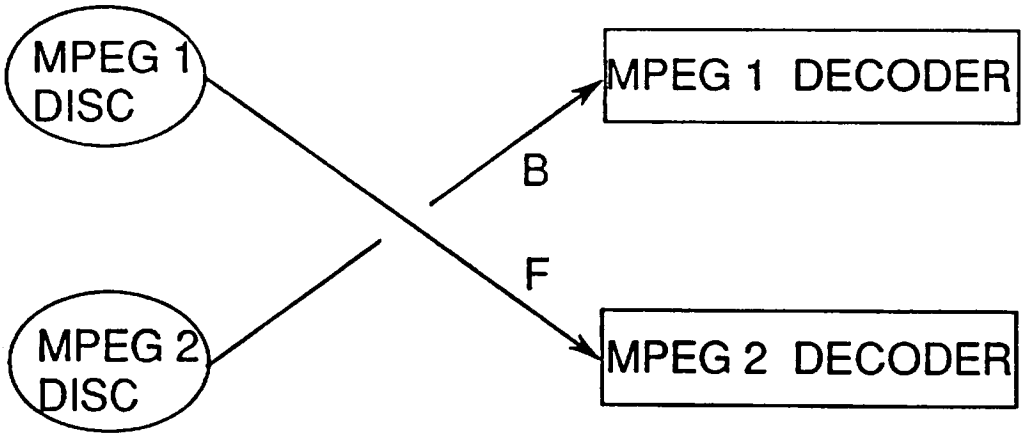


Figure Examples of approach to "compatibility"

Annex V

Meeting Allocation

MPEG	Plen.	Video	Audio	Syst.	VLSI	Tests	Req.	DSM	Liais.	Org.
Tue.04/12 14:00-16:00	X									
Tue. 04/12 16:00-18:00		X		X						
Tue.05/12 18:00-20:00									X	X
Wed.05/12 09:00-13:00				X			X			
Wed.05/12 14:00-16:00		X		X			X			
Wed.05/12 16:00-18:00		X		X		X				
Wed.05/12 18:00-20:00										X
Thu. 06/12 09:00-10:00	X									
Thu. 06/12 10:00-13:00		X	X	X	X	X				
Thu. 06/12 14:00-16:00		X	X	X	X					
Thu. 06/12 16:00-18:00		X	X	X	X			X		
Thu. 06/12 18:00-19:00										X
Fri. 07/12 9:00-13:00		X	X	X						
Fri. 07/12 14:00-17:00	X									

Annex VI

MPEG/Video Berlin Meeting Report

Source: Didier le Gall, Chairman MPEG-Video

The MPEG-Video meeting took place in Berlin, (Germany) from December 3rd to 7th. While a significant milestone was achieved at the (September) Santa Clara meeting including the decision to freeze the technical content of the draft, the outcome of the Berlin meeting was more of a consolidation of the draft. The results of the Berlin Meeting may not be spectacular, but they represent a significant step toward a standard. In addition to the consolidation of the CD, many items were discussed during the Berlin meeting, since there are numerous problems that arise with the maturity of the MPEG video work such as conformance testing.

Review of MPEG-Video Committee Draft

The Committee Draft produced at the Santa Clara meeting was carefully read by the MPEG members, and while most of the changes were of editorial nature either to make the text of the CD more accurate or improve the presentation for a first time reader, some changes resulted in minor modifications of the technical content of the CD; those changes were approved unanimously and resulted in a cleaner, better CD. A non exhaustive list of those changes is given below:

- Better definition of Aspect Ratio.
- Accurate definition of time-codes to be compatible with SMPTE time-codes widely used in video recording.
- Uniformization of the definition of quantizer matrix to 64 8-bits coefficients both in Intra and Non-Intra frames.
- Modification of the Variable length code for Macroblock Type to respect the code construction convention common to JPEG, MPEG and H.261.
- Opening of the variable Length code for DC-prediction error SIZE so as not to preclude an extension in the future.
- Clarification on the Video Buffer Verifier and decoupling of the parameters BIT-RATE and BUFFER Size. More accurate representation of the parameter BIT-RATE.

Interaction with System Committee

Interaction with the system committee led to the conclusion that time-stamps in the video bitstream were no longer needed since this information will be part of the system syntax.

Procedure for continued revision of the CD

The frozen (i.e. no new technical idea) character of the video CD was reaffirmed and the procedure to report possible errors or inadequacies is the same as after Santa Clara meeting, i.e., errors are reported to the regional coordinators and the video chairman.

Discussion of Conformance Testing

Conformance testing is a very important problem that was barely adressed within MPEG. The committee benefited from the experience of our JPEG collegues who presented the methodology discussed within JPEG. Because of the complexity of the issue involved, the MPEG video committee sollicits inputs from its members on the issues of : testing methodology, items to be tested and possible test patterns.

Discussion of technical inputs for the second phase of MPEG work.

Video tapes and oral presentation were mades of possible technical solution for the work of "MPEG II". Some time was allocated for joint meeting with the test group and the requirement

group. The MPEG video group will contribute to the proposal pachage description, for the series of test to be performed in Fall 1991.

MPEG Demonstration Tape

Simulation results compatible with the MPEG CD were shown at various bit rates. The good quality of the work even at the bit rate of 1.2 Mbit/s let the committee to recommend the generation of a MPEG demonstration tape. Members willing to contribute to the demonstration are invited to send their contributions to Dr. Westerkampf, DTB. Th deadline for contributions is January 15th.

MPEG Video Report

The MPEG-Video CD, was written with accuracy and unambiguity in mind, it is by no means a tutorial on the technology promoted by MPEG. The committee approved the idea that another document, the MPEG-Video report, be put together to complement the CD and provide tutorial and insight to members of the technical community that first encounter the work of the MPEG committee. Unlike the CD, the report will cover technical subjects that are not normative, such as pre- and post- processing, motion estimation and encoding.

Annex VII

MPEG/Audio Berlin meeting report

Source: **Hans-Georg Musmann - Chairman of MPEG/Audio**

1. Opening of the meeting

The Audio Group meeting was held at the "Heinrich Hertz Institut" (HHI) and at the "Institut fuer Fernmeldetechnik, TU Berlin" in Berlin, Germany on December 6-7, 1990. The list of participants is given in Annex I.

2. Approval of the agenda

The Agenda as given in Annex II was approved.

3. Allocations of contributions

Beside the main contribution, the new revision of the CD, there was one document submitted by the Swedish Broadcasting Corporation concerning an amendment of the subjected tests (MPEG 90/336).

4. Communications from the chairman

The chairman reported that statements concerning patents which are relevant to the coding standard being developed have to be submitted to the convener.

The chairman raised the question what the ISO standard means with respect to a specific layer. As a result from the discussions the following proposal was agreed:

"Since a generic audio coding standard is going to be developed and only the decoder is specified one should just refer to the respective Layer number. Application specific standards may be developed later on including specifications of an encoder. Then also measures on quality may be given. For the time being the title of the codec is assumed to be ISO MPEG AUDIO STANDARD.

A decoder may consist of any of the three layers, where either the Layer used has to be specified or all layers have to be implemented." (see also Annex VII)

5. Santa Clara meeting report

The meeting report was approved.

6. Review of CD

During the time between the Santa Clara meeting and the Berlin meeting members of the ad-hoc group "CD Development" met four times for refinement of the CD. The result of these meetings was a new proposal for a refined CD which was distributed within the audio group at the beginning of the Berlin meeting. The major change in the CD was the reduction of the number of possible layers from 4 to 3. Mr. van de Kerkhof and Mr. Brandenburg briefed the audio group about the proposed refinements of the CD.

The major part of this meeting was used to review this new proposal of the CD section by section. Several corrections and modifications have been identified all of which are to be included in the text of the CD. It was agreed that this should be done during the two weeks after the Berlin meeting, so that the originally submitted revision with all corrections, modifications and amendments could be distributed together with this meeting report as document "MPEG 90/265 Rev. 3". Mr. Rabowsky was kind enough to volunteer for review and consistency check. In case of problems, questions or major changes which may have influence on the meaning, Messrs. Stoll, van de Kerkhof, Johnston and Brandenburg offered support. The revised version should then be sent to the chairman in order to distribute it together with the meeting report.

7. Review of software simulation

Mr. Pan reported on the progress of the software simulation group. The current status of this work is summarized in the report of Mr. Pan as given in Annex IV

8. Recommendations of the Berlin meeting

A list of recommendations has been prepared for approval at the MPEG plenary meeting (see Annex V).

9. A.O.B.

- An agenda of the next MPEG/Audio meeting has been drafted, see Annex III.
- An ad-hoc group "Verification Testing" has been arranged to prepare the subjective verification tests with the following members:

Thomas Ryden,	SR	(chairman)
Christer Grewin,	SR	
Ernst F. Schroeder,	DTB	
Gerhard Stoll,	IRT	
Akihiko Sugiyama,	NEC	
Shinji Hayashi,	NTT	
Alain Komly,	TDF	
Karlheinz Brandenburg,	U Erlangen	
Hendrik Fuchs,	U Hannover	

A first informal meeting was arranged on Friday, December 7. The report of this meeting and the planning of the next steps can be found in a separate document written by Thomas Ryden (MPEG 90/). A next meeting - probably in Stockholm - will be scheduled very soon.

- A letter of ANSI (MPEG 90/297) was discussed and a response as given in Annex VI was agreed.
- Because of the verification tests, an additional MPEG/Audio meeting in Stockholm will be necessary for evaluation. Depending on the availability of a Layer I, Layer II and Layer III hardware, the verification tests and the evaluation meeting will be scheduled as soon as possible. Due to hardware implementation problems and the required preparation phase of SR (about 6 weeks), as well as the mandatory fixed testing schedule, there might be some interference with the San Jose meeting. There are two possible solutions: 1. The evaluation meeting will be after the San Jose meeting or 2. The audio part of the San Jose meeting will be held in Stockholm in combination with the test evaluation. The majority of the MPEG/Audio group was in favour of the second solution.
- A discussion on a second phase of MPEG led to the following statements:
  *A phase of thorough research is requested (6 or 8 month schedule)
  *Improvements of the "MPEG I" encoder are requested
  *Goals and requirements should not be defined before the San Jose meeting
  *A second phase should not be started before all the final results of phase I are available
  *The necessity has to be discussed in/after San Jose
  *A request of Mr. Komly (MPEG 90/267) concerning problems of H221 multiplex was assumed to be only a matter of hardware implementation.
- The audio part of the required "demo tape" will be provided by Mr. Stoll (IRT) and Mr. Schroeder (DTB).
- The representative of the MPEG/Audio group in the ad-hoc group on CD 11172 integration will be:

*Mr. Johnston, if the meeting will be held in the United States
*Mr. Senoo, if the meeting will be held in Japan
*Mr. Schroeder, if the meeting will be held in Europe.

- After the chairman had to leave the meeting, there have been some more discussions about the integration of ms-stereo in Layer I and II, conducted by Prof. Noll. The conclusions of these discussions are summarized in Annex VII.

10. 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.

Annex I

List of Participants (MPEG/Audio)

(Berlin, Germany, 6-7 December 1990)

W. Andriessen	BASF (IEC SC 60 A chairman, Observer)	D
E. Schroeder	DTB Deutsche Thomson-Brandt GmbH	D
H. Gerhaeuser	FhG Fraunhofer Gesellschaft	D
P. Noll	Universitaet Berlin	D
H. Musmann	Universitaet Hannover	D
H. Fuchs	Universitaet Hannover	D
K. Brandenburg	Universitaet Erlangen	D
G. Stoll	Institut fuer Rundfunktechnik GmbH	D
Y. Dehery	CCETT	F
A. Komly	TDF	F
T. Senoo	Matsushita	J
N. Fuchigami	JVC	J
A. Sugiyama	NEC	J
H. Suganam	NHK	J
Y. Oikawa	Sony	J
L. van de Kerkhof	Philips CE	NL
P. de Wit	Philips CE	NL
C. Grewin	Swedish Broadcasting Corporation	S
T. Ryden	Swedish Broadcasting Corporation	S
G. Carter	Dolby Laboratories, London	UK
B. Aspromonte	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
D. Pan	Digital Equipment Corporation	USA
I. Rabowsky	Hughes CI	USA
S. Sutardja	Integrated Information Technology, Santa Clara	USA
D. Hartley	Motorola	USA
R. Beaton	MPR Teltech Ltd	USA
W. J. Carter	PRISM Interactive Products Company (GCT)	USA
F. Laczko	Texas Instruments, Dallas	USA

Annex II

Agenda (MPEG/Audio)

(Berlin, Germany, 6-7 December 1990)

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. Recommendations of the Berlin meeting
9. A.O.B.
10. Close of the meeting

Annex III

Draft of the next MPEG/Audio Meeting Agenda

1. Opening of the meeting
2. Approval of the agenda
3. Allocations of contributions
4. Communications from the chairman
5. Berlin meeting report
6. Report of the Audio ad-hoc group "Verification Testing"
7. Review of CD
8. Review of the software simulation
9. Recommendations of meeting
10. A.O.B.
11. Close of the meeting

Annex IV

Report of the Audio Ad-hoc Committee on Software Verification

Source: **Davis Pan (DEC)**

The ad-hoc committee on software verification was formed by the MPEG/Audio committee during the last MPEG meeting in Santa Clara, California. The goal of this ad-hoc committee is to implement layers 1 and 2 of MPEG/Audio coding algorithm, as described in the draft proposal, in the C programming language. Due to a number of remarkable contributions by a few key members (most notably Douglas Wong of General Instruments), I am happy to be able to report the following progress:

I.The MPEG/Audio layer 1 and 2 decoder is complete and almost completely debugged. It is able to decode the the encoded test bit stream provided by Leon van de Kerkhof of the MUSICAM development group. It is believed that a time-delay discrepancy causes a mismatch between the decoded outputs of the software version of the decoder and the MUSICAM hardware-based

decoder. Currently the committee is working to improve the software decoder to make its operation more understandable and the code more machine independent.

II.The code for the MPEG/Audio layer 1 and 2 encoder is complete but not fully integrated. Because of the complexity of the encoder, the programming task was divided into three parts: 1. the filter bank, quantizer and bit stream encoding section; 2. the psychoacoustic model; and 3. the bit allocation section. Each of these three parts have been written. All sections will compile without errors and two out of three of the sections have been verified to work according to specification. In the past two days in Berlin, the ad-hoc committee has been able to successfully integrate two of the sections. It is our hope to have a completely functional computer software implementation of the MPEG/Audio encoder in the very near future.

Future work of this committee include the implementation of stereo redundancy coding, update the code to reflect the most recent changes to the committee draft, and add the remaining layer3 of the MPEG/Audio compression standard.

Annex V

Recommendations of the MPEG/Audio group

Berlin Meeting, Dec 7, 1990

- to approve the third version of the committee draft *
- * Use of ms-stereo coding in Layer I and II has been proposed and is still under discussion.
- to approve the set up of a new ad-hoc group on verification testing
- to approve an additional meeting of MPEG/Audio in Stockholm

Annex VI

Response of MPEG/Audio group to ANSI letter

Concerning the five statements in the ANSI letter of October 5, 1990 the MPEG/Audio group agreed on the following answers:

1.There is consensus within the MPEG/Audio group that a 3 layer solution is adequate.
2.Improvement of playback quality was the main goal during the merging process.
3.The aspects of statement 3. are considered by the MPEG/Audio group.
4.The aspects of statement 4. are considered by the MPEG/Audio group.
5.The MPEG/Audio group is going to perform tests but the time may be too short to perform thorough tests of joint stereo coding. Nevertheless, joint stereo coding will be included in the CD, but only as an option. Provision will be made in the document for efficient implementation of joint stereo coding.

Annex VII

Addendum to Report of MPEG/Audio Meeting

(Friday, 7.12.90, chaired by Prof. Noll)

Source: **Peter Noll**

The use of ms-stereo in Layer 1 and Layer 2 has been suggested.

The following proposal addresses the Layer 2 modifications. An additional layer (Layer II - ms) is defined. For the use of the extension bit alternatives (1 and 2) have been suggested.

PROPOSAL:

I. Add a new section 2.4 to section 2 Background of the CD:

2.4 Compliance Requirement

Any decoder that is able to accept all bitstreams from all layers up to and including Layer N, and which is also able to decode the bitstream according to the appropriate sections of the standard shall be deemed an "MPEG Audio Layer N Decoder".

Any decoder, and only those decoders, that accept all bitstreams defined in all layers of the standard, shall be deemed an "MPEG Audio Decoder".

II. Add/Modify the following descriptions in section 3.3.3 Header:

- **Layer**

"00" Layer III
"01" Layer II - ms
"10" Layer II
"11" Layer I

- **extension bit** (is used in Layer II - ms in joint stereo mode, reserved otherwise)

"0" subbands which are not in intensity stereo are in normal stereo
"1" alternative 1:
subbands which are not in intensity stereo are in ms - stereo
alternative 2:
subbands 0...3 are in ms - stereo

III. The following changes in the bitstream and decoder have to be inserted in the CD text where appropriate:

- Bitstream

Those parts of the bitstream that refer to the left channel (bit allocation, scale factors and quantized samples) are redefined as the "sum" allocation, scale factors and quantized samples. Those parts of the bitstream that refer to the right channel are redefined as above for the difference signal. The ms mode indicates that only frequencies below the ms bound are coded in ms. Frequencies above that bound are intensity stereo, as defined elsewhere.

- Decoder

In the decoder, those samples designated as sum and differences are decoded as before. After the samples are reconstructed, sum + difference is provided to the left channel of the filter bank, and sum - difference to the right. All other parts of the decoder are unaffected.

Annex VIII

MPEG/System Berlin meeting report

Source: **Juan Pineda (Apple) on behalf of**
Al Simon - Chairman of MPEG/Systems

The last meeting in Berlin was a successful one. The group worked hard through out the week and we produced revision 7 of the CD. We made progress on two major issues: 1) time stamps were moved into the packet layer, thus resolving the objections of the audio group to putting time stamps in the audio syntax, and 2) the multiplex BFM issue was better understood and two fields were added to solve the problem. Unfortunately, we did not come to complete closure on this issue, and it is the major area of work for the next meeting.

Through the late night efforts of member of the committee, a very concise revision of the CD was edited and submitted to WG11.

Attendance list

Name	Company	FAX	Email
Allen Simon	Intel	+1 609 936 7900	ahs@provax.intel.com
Mike Nilsson	BT	+44 473 643 791	
Erik Schylander	Philips	+31 40 735919	
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Sehat Sutardja	IIT	+1 408 980 0432	
David Taylor	Cypress	+1 408 943 2701	
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G. Meazza	Olivetti	+39 81 853 3617	meazza@iconet.ico.olivetti.com

Agenda

1) Distribution of CD revision 3
2) Collection of Contributions
3) Target schedule for WG11:
   Balloting of integrated CD by WG11 in March
   First integrated CD 12/7/90?
4) Goal of meeting:
   Functionality Freeze
   Essential Functionality
   Rev 4 + Documented and reviewed
5) Joint meeting with Audio Group
6) Editorial process
7) Agreement on essential functionality for freeze
   Multiplexor buffer fullness
   Placement of time stamps in packet layer

8) Presentations of contributions
E. Schylander
J. Pineda
M. Veltman
Y. Yamada
9) Decisions on Multiplex BFM
10) Resolution of other issues
11) Communications
12) Recommendations
13) Verification

Agreements

The following agreements were made on substantive changes to the CD. Agreements 1-3 may need to change in the future.

1) Time stamps were moved to the packet layer so that they are no longer encoded in the elementary streams:

```
packet() {
    packet_start_code                          32 bslbf
    start_up_delay                             16 bslbf

    if (nextbits() = = "0000 001") {
    packet_time_stamp_flag                     7 bslbf
    packet_time_stamp                          33 bslbf
    }
    else {
    "0000 0000"                                8 bslbf
    }
    data_length                                16 uimsbf
    coded_data[data_length] data_length *      8 bslbf
    }
```

2) a 16 bit start up delay parameter was added to each packet.

3) a time stamp was added to the pack header for initialization of the STC and buffer management:

```
pack() {
    pack_start_code                            32 bslbf
    system_clock_reference                     40 bslbf
    while (nextbits() = = packet_start_code) {
    packet()
    }
    }
```

4) Agreements were made on changes to the pack formation:
Video stream zero need not be present
A multiplex with no streams is allowed
Multiplex interval must be constant and 2ms
Audio is prorated with a tolerance of +/- 18 ms
Video and other streams are prorated with a tolerance of +/- 1/2 access unit.

5) Text of revision 7 of the Systems CD.

Multiplex BFM

Most of the meeting revolved around this issue. Agreements 2&3 reflect the progress that was achieved in this area. There was discussion on the following topics:

1) Include SCR field in pack header.
2) Include start up delay parameter.
3) Are both start up delay (SUD) and time stamps needed?
4) Should SUD be encoded absolute, modulo or relative to SCR?
5) What is the definition SUD? Where does it start and where does it end?
6) Should SUD or time stamps refer to time before or after frame reordering?
7) Chip partioning implications of different choices for SUD and time stamps.

Much of the difficulty in resolving issues came from the fact that there was little evidence presented supporting the benefit or problems with some of these choices. For example, while we discussed the potential VLSI cost of different time stamp encodings, we did not have an implementation block diagram with accompanying timing diagram to support the analysis. Without this kind of evidence, choices become subjective and no conclusion is possible, and even if the group were to make a choice, it may be the wrong choice.

In order to make our decisions more objective, we really need system models with block diagram and timing diagram. The diagrams should include both encoder and decoder. These diagrams should illuminate five issues:

1) Initial start up on random access
2) Phase locking of DSM and sample clocks
3) Synchronization of stream presentations
4) Buffering requirements
5) Chip partitioning.

But there are many implementations. For example, some implementations would have fixed decoder delays, while others may not. For this reason, I suggest that each individual that has a specific implementation in mind, submit a contribution to the group on a system model. We can then objectively test our conclusions on issues against these system models.

For this purpose, these system models should reflect the contents of the CD at the current revision (number 7). We can then test changes to the CD against the models. Ideally the choices that we make should be general and should work well in different implementations.

I propose the following two step methodology for resolving the open issues before the next meeting in San Jose.

Jan 31document system models

Feb 31 propose solutions to open issues by validation against system models

Because we have no ad hoc meeting scheduled before the next meeting, communication must be done by FAX and Email. If you will be contributing to this work, please let me know by FAX so that I can add you to the FAX list for these communications.

Communications to Audio & Video group

Time stamps have been moved to the packet layer. The Video and Audio syntaxes need not include time stamps.

Communications to the VLSI Group

1) Request assistance in assessing the implementation differences between time stamp proposals: 33 bit absolute, 16 bit absolute and 16 bit relative.

2) Request assistance in assessing the implementation differences between 32 bit and 33 bit STC, SCR and TS.

Recommendations

The systems group recommends the adoption of revision 7 of the systems CD.
Authorize distribution of revision 7 outside of WG11.

Schedule of Work

1) Editorial committee is composed of Greg McLaughlin, Mike Nilsson and J. Pineda. Editorial committee is empowered only to make editorial changes to reflect new agreements or to make clarifications. Substantive changes, even to fix known problems will not be made by editorial committee.

2) Two members of the editorial committee will added CD integration ad hoc meeting.

3) The following work items were assigned. Contributions are due on January 31st by FAX to the systems group. Each contributor is responsible for FAXing documents to the group.

A. Text for CD: Hypothetical system model (Schylander, Van Der Meer)
It was agreed that a system model was needed in order to explain the system CD. A timing diagram showing the relationship of different parameters such as time stamps, system clock reference, start up delay should be part of the model. A block diagram showing buffering and multiplex/demultiplex switches would probably be necessary as well. The text should reflect the agreements as documented in revision 7. This text will be used by the editorial committee to make non-substantive changes to the CD.

B. Text for CD: Definition of pack (Nilsson, Veltman)
The text for pack definition needs revision. We've made a number of agreements relaxing the prorating rules and these need to be reflected in the text. This text should reflect the substantive text in revision 3 with the addition of the agreements on pack formation that were made at the Berlin meeting. This text will be used by the editorial committee to make non-substantive changes to the CD.

C. Proposal needed: version number (Simon)
It is recognized that a version ID would be useful in the specification. A proposal is needed for this function.

D. Proposal needed: Buffering bounds/start up delay
The present CD says nothing about buffering bounds and the value of the start up delay. A proposal is needed for what these values are.

E. Analysis: Tradeoffs on three time stamp proposals
Two new time stamp encodings were proposed. An analysis is needed for the relative advantages of the different encodings.

Annex IX

MPEG/Test Berlin Meeting Report

Source: **Dietrich Westerkamp (TCE/DTB)**
for T. Hidaka (JVC), Chairman of MPEG/Test

1. General

The MPEG/Test meeting took place at HHI, Berlin in three short sessions (5.12.90, 11.00-12.00, 5.12.90, 16.00-18.00, 6.12.90, 14.00-16.00). It was chaired by D. Westerkamp (TCE) replacing T. Hidaka (JVC) who could not attend. The requirements for MPEG phase 2 were discussed separately under the chairmanship of S. Okubo (NTT).

2. Approval of agenda

The proposed agenda was modified according to the time schedule and agreed in the following form:

1. Opening
2. Approval of agenda
3. Allocation of contributions
4. Santa Clara meeting report
5. Selection of test sequences
6. Review of the proposed subjective assessment procedure on the high-transfer-rate MPEG video
7. Discussion on format for the proposed D1 tape
8. Schedule for the Kurihama tests
9. Recommendations from the Berlin Meeting
10. AOB

3. Allocation of contributions

The following contributions with relevance to the matters discussed were identified.

Doc.	Author	Title
292	Haskell (AT&T)	no title
310	Hepper (TCE) Yamada (JVC)	Test Sequences for MPEG 2
311	Hepper (TCE)	625/50 Demo Tape of Proposed Test Sequences for MPEG 2
329	Hidaka (JVC)	Format of MPEG 2 D1 Test Tape

4. Santa Clara meeting report

The Santa Clara meeting report was accepted with the slight change that Mr. Hepper (TCE) did not give any committment to distribute the test sequences for MPEG 2 in Europe.

5. Selection of Test Sequences

Following the preselection at the Santa Clara meeting two full proposals were made and shown by a D1 tape: the first by Haskell (AT&T) and the second jointly by Hepper (TCE) and Yamada (JVC). Both contained the six test sequences as agreed in Santa Clara, but with different

sequence lengths and takes. The first had two additional sequences and the second one additional. A discussion that followed came to the conclusion that both proposals were not fully covering the "average TV picture material". The following list of missing items was compiled:

Picture material not covered in the test sequences:

- sense of depth (i.e. CCIR Test sequence TREES (60Hz))
- dissolve (cross-fade)
- rapid motion
- special effects
- rolling captions

The meeting agreed that a 100% coverage would not be possible in any case and agreed to use the following set of test sequences (the time codes with respect to the CCIR library tapes are given in annex 2):

1. Flower Garden	5 seconds
2. Suzie	5 seconds
3. Popple	5 seconds
4. Table Tennis	5 seconds
5. Mobile and Calender	5 seconds
6. Tempete	5 seconds
7. Edit	5 second
8. Football	2 seconds (60 Hz!!)

The first six sequences were taken from the ones agreed in Santa Clara. Sequence 7 is taken from the proposal by Hepper and Yamada. Sequence 8 is taken from the proposal by Haskell. Since this sequence is available in 60 Hz only it was agreed to generate a 50 Hz version by adding grey bars on top and bottom in order to change the number of lines from 480 to 576. This task was taken by Mr. Vial (Thomson/LER). The sequence length is different, however, the need to have a sequence with rapid motion was agreed and for algorithm development this modified sequence can be used.

The final selection of which takes from the sequences to use for the Kurihama tests was postponed to the March meeting.

For having an overview on how many laboratories would need a copy of the test sequences the chairman inquired a list of possible proponents. The list as compiled by the end of the meeting goes as annex 1 with this report. This is by no means exhaustive and serves only to ease the logistics.

There was a discussion on what media to use for exchange of picture sequences. The methods identified were either to use D1 cassettes or EXABYTE tapes. Both seem to have certain problems with reliability. In general there exists the possibility to directly grab the sequences from the CCIR library tapes if available.

For the logistics of distributing the test sequences three volunteers for the three main areas of the world have been found from whom everybody can ask a copy of the test sequences on one of the two media identified. These gentlemen are:

for Japan:	Mr. T. Hidaka	(JVC)
for USA:	Mr. D. Mead	(Hughes)
for Europe:	Mr. G. Dimino	(RAI)

The chairman would like to take the opportunity to thank these gentlemen for the effort they are offering.

6. Review of the proposed subjective assessment procedure

It was agreed to use the double stimulus method for testing. This method has proven its effectiveness in numerous tests worldwide and the picture quality expected does not need special precautions in the testing procedure as was necessary last time because of the low quality of the candidate algorithms.

After lengthy discussion the following items were agreed:

- The algorithms will be tested at two different data rates. These will be 4 Mbit/s and 9 Mbit/s.
- The maximum delay allowed for random access will be 0.4 seconds. The coding delay is to be specified.
- The picture quality in forward/reverse search modes must be demonstrated. This quality will not be tested.
- Pre-/Postprocessing is allowed only in a complementary forward/inverse pair (e.g. subband filtering). The resulting complexity must be taken into account when compiling the complexity figure. "Pre-conditioning" by pre-filtering only is not allowed, nor is "polishing" by means of post-processing.
- If compatibility to MPEG 1 is claimed the resulting picture quality must be demonstrated.
- If a maximum coding delay of 150 msec is claimed by changing parameters, the resulting picture quality must be demonstrated.

It was agreed that the picture quality in normal playback is the most important decision criterion. A further list of possible decision criteria was compiled as follows (there is no order of priority nor is this list exhaustive):

compatibility
complexity of decoder/encoder
encoding delay
scalability
random access
error robustness
cascading
editability

All further details for exact specification of the test conditions were postponed to the March meeting.

All participants are requested to reflect their thoughts on compatibility and on possible decision strategies suited for MPEG2 in documents for the next meeting.

7. Discussion on Format for the Proposed D1 Tape

There was no further discussion on this topic. However, the chairman stressed the need for such a level of standardization. For more information please refer to the document by T. Hidaka (JVC). Final details need to be specified at the March meeting.

8. Schedule for the Kurihama Tests

At the end of the MPEG/Test meeting the recommendation of the group was to retain the original timing. However, the final plenary decided to postpone the tests to the period 2.-6.9.1990 thereby compromizing with the timing of the CCITT Experts Group on ATM video coding.

9. Recommendations from the Berlin Meeting

The final reporting to the plenary was kindly taken over by K. McCann (IBA) because the chairman could not attend.

The following recommendations were given:

- Distribution of the test sequences as soon as possible.
- Final selection of the takes to be used for the Kurihama tests to be specified at the next meeting.
- Bitrates for testing: 4 Mbit/s and 9 Mbit/s.
- A call for proposals should be issued as soon as possible because the number of proposals to be tested is urgently needed for the final set-up of the Kurihama tests.

10. AOB

There were no issues to discuss.

D. Westerkamp, 17.12.1990

Annex 1

Provisional List of Proponents

Company	Representative	D1	EXABYTE	CCIR
AT&T	Haskell	X	X	X
Apple	Yung	X	X	?
BBC	Wells	X	X	X
Bellcore	Wong	X	X	?
British Telecom	Morrison	X	X	-
Brooktree	Wise	-	X	-
CCETT	Henot	X	X	X
C-Cube	LeGall	(1/2)	(X)	-
Columbia University	Anastassiou	(X)	X	-
CSELT	Guglielmo	X	-	X
Dutch PTT	Koster	-	X	-
Hughes	Mead	X	X	X
IBA	McCann	X	-	(X)
IBM	Gonzales	X	?	-
ITT	Butera	X	X	-
JVC	Yamada	X	-	X
Matsushita	Senoo	X	-	X
MIT	Stampleman	-	X	?
NEC	Ohta			
Norwegian Telecom	Bjontegaard	X	-	-
NTT	Kamikura	X	-	-
Philips	van der Meer	X	X	-
RAI	Barbero	X	X	X
Siemens	Hammer	-	X	-
Sony	Yonemitsu	X	-	X
Telenorma	Kummerow	-	(X)	-
Thomson CE	Hepper	X	X	X
Thomson/LER	Tourtier	X	X	X
UCL	Poncin	X	-	X

Annex 2

List of test sequences with the timecodes on the CCIR library tapes

The following table summarizes the above specifications of 5-seconds cuts of test sequences. Time codes are given as hh:mm:ss:ff - ss:ff.

Sequence	50 Hz	60 Hz
Table Tennis frames of 10 seconds already used time code	1 - 53 + 74 - 102 + 121 - 163 01:28:00:00 - 02:02 + 04:17 - 05:20 + 12:15 - 14:07	1 - 67 + 90 - 119 + 149 - 201 01:28:00:15 - 02:21 + 05:07 - 06:06 + 13:04 - 14:26
Flower Garden	01:14:23:08 - 28:07	01:14:17:17 - 22:16
Susie	01:15:06:00 - 10:24	01:15:07:00 - 11:29
Popple	01:27:05:00 - 09:24	01:27:05:00 - 09:29
Mobile&Calendar	01:29:19:00 - 23:24	01:29:17:15 - 22:14
Tempete without + with noise	01:43:07:00 - 09:12 + 44:11:00 - 13:11	01:43:07:00 - 09:15 + 44:07:00 - 09:13
Football	suppl. by Thomson/LER	01:37:13:23 - 15:23
Edited sequence:		
Table Tennis	frames 1 - 23	frames 1 - 29
+ Flower Garden	1 - 29	1 - 31
+ Susie	1 - 23	1 - 29
+ Popple	1 - 29	1 - 29
+ Mobile&Calendar	1 - 21	1 - 32

Annex X

Berlin meeting report

Source: Geoffrey Morrison - Chairman of Implementation Studies Group

The VLSI group met on 6 Dec 1990 (1000-1300 and 1415-1650) and in a joint meeting with the Video group later that afternoon (1730-1615).
The participants were:

Geoff Morrison,	BTRL (chairman)
Adrian Wise,	Brooktree
Leo Warmuth,	Philips Components
Edward Ward,	GCT
Thorsten Selinger,	HHI
Peter Ransome,	Symbionics
John Gooding,	ST/INMOS
Leonardo Chiariglione,	WG11 convenor

1. The chairman had received no comments on the reports of the Porto and Santa Clara meetings. There were no comments made at this meeting. The two reports were therefore regarded as approved.

2. The group considered the comments on the Video parts of the CD made in faxes and documents since the Santa Clara meeting in September. Of these, 8 items were identified as having implementation ramifications and the group formed views on them to take into the joint session with the Video members.

2.1 A Wise had drawn attention to the fact that some of the VLC tables for macroblock types had not been constructed in the same way as the other VLC tables in the Video CD. He proposed new tables which permitted decoding by arithmetic procedures. There would also be a small coding gain as some of the codes were shorter and none were longer. The group agreed to propose the adoption of the revised tables.

2.2 The Santa Clara version of the Video CD had added an optional downloadable quantizer weighting matrix for non-intra pictures. The multiplex syntax for this had 64 elements whereas the intra equivalent had 63. The group agreed to propose that both be 64 bytes and the first in the intra table have the value 8. The reasons were to give consistency in the syntax, to have the counters going to 64 like other counters and to make the dequantization slightly easier.

2.3 It had been noted (MPEG 90/231) that with the removal in Santa Clara of separate weighting tables for luminance and chrominance coefficients, the only difference in decoding luminance and chrominance blocks up to the output of the inverse DCT was the slightly different VLC tables for the size of the intra dc coefficients. The Video group had not investigated the effect on picture quality of using one common table. Such use of only one table would reduce the number of ROM tables and simplify control structures. The VLSI group therefore agreed to propose that this should be considered by the Video Group.

2.4 There had been comments from Morrison and Morris (MPEG 90/231) on the length of some variable length codes being 17 bits and doubts cast on the actual benefit from them. The last bit could be considered as the sign bit and therefore the codewords could be decoded in two parts, one of 16 bits and one of 1. However, there was likely to be a time overhead when moving the VLC

decoder from one symbol to the next and therefore the maximum decoding speed could be affected. The alternative method of considering the codewords as being single ones of 17 bits would require twice the ROM size.

On balance, the group decided that the issue was minor and they would not pursue it.

2.5 A contribution from Devlonics (MPEG 90/307) had proposed reorganising the VLC table used for transform coefficients. The original set had been inherited from H.261 where an irregularity had been deliberately introduced to avoid StartCode emulation. MPEG had extended the StartCodes and emulation would no longer be a problem. The view of the group was that since many chipsets would support both MPEG and H.261, the effect of making the proposed change would increase the complexity because both versions of the table would be incorporated in them. Weighing this up against the small benefit to be had for MPEG-only decoders, the group decided not to support the change.

2.6 There had been an idea documented in MPEG 90/294 by Astle concerning extra_picture_information. The last '0' could be removed because the next item is a StartCode beginning with '0'. However, the overlapping of symbols in this way complicates the decoding procedure in return for a trivial saving in bit consumption. The group agreed not to support this modification.

2.7 We noted that the Santa Clara version of the Video CD seemed to test only for byte aligned StartCodes within extension data. We decided that extension data or user data should not be permitted to emulate the StartCode header (23 or more consecutive '0's followed by a '1') at any phasing of this pattern with respect to byte boundaries.

2.8 There had been proposals from Astle (MPEG 90/294) to shorten the macroblock escape codeword and to remove the macroblock stuffing facility. We rejected the first of these on the grounds of H.261 compatibility as in 2.5 above. The macroblock stuffing facility could indeed be removed from MPEG with no effect on MPEG + H.261 chips. Other padding mechanisms are possible in MPEG. However, there would be no saving for MPEG + H.261 decoder chips and there would be a small loss in flexibilty open to encoders to prevent decoder buffer overflow. Therefore we agreed to retain the stuffing codeword in the syntax so that decoders must accommodate it. Encoders, however, may chose not to incorporate it.

3. The terms of reference for the group in the second phase of MPEG were sought by discussion. The MPEG convenor contributed to this part of the meeting. Some participants strongly expressed concerns about the usefulness of the VLSI group to MPEG and to the members who participate in the VLSI sessions.

The group concluded that it would not be possible to obtain any implementation scores for competing algorithms with sufficient accuracy or absolute value to allow meaningful collation with the picture quality scores from the subjective tests. Therefore the performance versus complexity compromise will have to be made in MPEG in the same way as in real life - a value judgement based on experience and instinct.

To achieve consensus decisions in MPEG would require that the vast majority appreciate both coding and implementation issues. There is evidence that the implementers have made efforts to learn about picture coding and are catching up fast. The VLSI group saw little evidence that the picture coding simulators who form the largest part of MPEG are becoming knowledgeable about making practical things. This situation is unlikely to change if the VLSI group continues to be regarded as subservient consultants in MPEG.

It was proposed that Video members be strongly encouraged to learn about implementation matters by attending meetings of the VLSI group, and that the schedule permit this by reducing the amount of parallel separate sessions time.

It was also suggested that the name of the group is too narrow. The best suggestion was "Implementation Studies".

4. We also discussed hardware verification of the CD and queried the added value of this being organised under formal MPEG guidance. The participants were conscious of the fact that they are chip makers and would not likely be able to construct complete systems necessary for field trials.

5. In the joint meeting with the Video group, the 8 items listed under section 2 above were handled.

5.1 The combined meeting accepted the view of the VLSI group to modify the macroblock VLCs under discussion.

5.2 The combined group agreed that both downloadable weighting matrices comrise 64 bytes and that the first one for intra be explicitly set to 8 in the bitstream.

5.3 A small number of video coding members did not wish to consider further the possibility of using only one table for intra dc coefficient sizes. According to the MPEG video rule that changes be unanimously supported, the request of the VLSI group was rejected.

5.4 The 17 bit VLCs were not an issue as the VLSI group had decided not to pursue this and the Video group was still content with them.

5.5 Both the VLSI and Video groups did not support changing the VLC table for coefficients.

5.6 Both the VLSI and Video groups did not support removal of the last '0' in extra-picture-information.

5.7 Both the VLSI and Video groups wished that StartCode emulation in non-byte-aligned positions be precluded.

5.8 Both the VLSI and Video groups did not support modications to the macroblock addressing VLC table.

Annex I

Implementation Studies group Terms of Reference

To ensure that technological opportunities and constraints are fully taken into account by MPEG so that future CDs are attractive in functionality, performance and implementability and are thus are likely to be widely supported.

The activity of the Implementation Studies group to achieve the above will be:

1. Examination of proposed algorithms from the respective investigation group.

2. Formation of consensus views on the results of the above step.

3. Feedback of changes which would be beneficial from the implementation viewpoint.

4. Decide jointly with algorithm investigation group the solution to be adopted.

5. Iterate above steps.

Annex II

VLSI Group Recommendations, Berlin, Dec 1990

1. That MPEG approve the change of title to "Implementation Studies"

2. That MPEG approve the terms of reference of the Implementation Studies group.

3. That MPEG confirm the relevance of the Implementation Studies Group and acknowledge that it has equal rights in the formation of CDs.

4. That MPEG strive to increase the understanding of implementation issues by all its participating organisations.

Annex XI

MPEG/DSM Berlin meeting report

Source: **Takuyo Kogure - Chairman of MPEG/DSM**

1. Review of previous meeting

Minutes of previous meeting were confirmed

2. Discussion on DSM meeting status

Because of the small number of participants, chairman asks Mr. Chiariglione what is the status of DSM meeting and then tries to confirm the target of DSM meeting.

After considerable discussion, chairman announced that the DSM meeting should make the "Recommendation" regarding suitable DSM for MPEG-2 standard, and also "Recommendation" of DSM to MPEG-2 bitstream interface.

Status of DSM meeting is "consultant" of other MPEG meetings, regarding DSM matters.

3. Items to be discussed at the enxt DSM meeting

1) Features for MPEG-2
2) Specifications of features of algorithms suitable for MPEG-2
3) Possible Storage media for 1) and 2) above

4. Conclusions

Following items are confirmed for DSM meeting activity report
1) what MPEG/DSM meeting is
2) what has done before
3) what is doing now
4) Give a list of recommended features to be considered by DSM people
5) Survey of announced DSM technology as a reference for making DSM recommendation.

Annex XII

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
CODED REPRESENTATIVE OF PICTURE AND ASSOCIATED AUDIO INFORMATION

Title :Discussion Guide of DSM Group
Source :Takuyo Kogure / Matsushita Electric
Status :DSM Group Chairman Proposal

ISO/IEC JTC1/SC2/WG11
MPEG 90/309

Followings are proposals from the DSM chairman .
These out-lines are already confirmed at the previous DSM group meeting in Santa Clara. Details will be discussed in this coming meeting.

[1] Present State of DSM Hardware

(1)List of possible DSM

[Disc Media]

Magneto-optical Disc (erasable)
Phase Change Optical Disc (erasable)
Other Optical Disc (erasable)
Write-Once Optical Disc
ROM Optical Disc (CD etc)
Hard Disc
Floppy Disc

[Tape Media]

VCR Tape
DAT Tape
Compact Cassette Tape
Open Reel Tape 1/2",
Cartridge Tape 1/2" 1/4"

[Card Media]

Optical Card
IC Card

(2)List of Evaluation Items

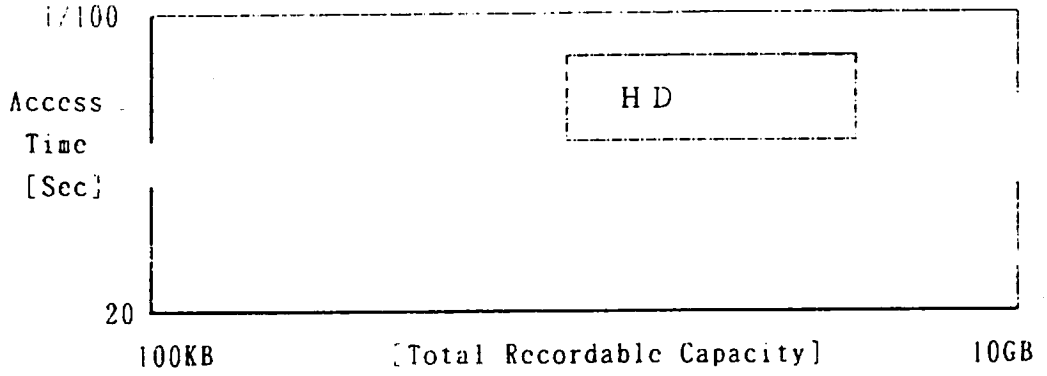
Total Recordable Capacity
Recording Density
Transfer Bit Rate
Random Access
Erasable
Media Changeability
Cost / bit
System Cost
Data Store Cost / bit
Handling Capability
Durability
Reliability
Exchangeability

(3) Make a Comparison Table regarding above DSM

	Magneto Optics	
Total Capacity	◎○△X	
Exchangeability		

◎:EXCEL
○:GOOD
△:AVR.
X:LOW

(4) Make a [Capacity vs Access Time] Chart of DSM



[2] Topics of DSM

(1)Disc

*30cm LD can play 115min./side(double higher density)
*12cm Write Once CD Recorder (recording time is 64 min.)
*12cm Optical write once disc 7GB capacity
(track pitch 1.5u, edge recording)
*8cm CD can play 80 min. (four times higher density CD)
*3.5"Magneto-optical Disc can store 128MB
(data transfer rate is 4.4Mbit/sec)
*3.5"HD can store 419GB/7discs
(seek time 16.8m sec, data transfer bit rate is 2MB/sec)
*3.5" HD can store 122MB/2discs
(seek time 18ms,data transfer rate is 1.52-1.87MB/sec)
*3.5" FD can store 2MB
*2.5" Glass-type HD can store 60MB
*2.5" HDD, can store 80MB

(2) Semi-con Laser

*20mW Red(680nm)single side mode.
(1.5 times higher density)
*40mW Infrared (840nm)
*50mW Infrared (780nm)
(recording time is 4 times faster)

[3]Discussion on "Making a Recommendation"

(1)Recommended [DSM Hardware] Specifications

Making recommendable specification sheets, based on this group discussion.

Items and data of this specification will be obtained from this group discussion.

The following two sheets will be prepared.

#1; For 5 Mbps

#2; For 10 Mbps

(2)Recommended [DSM Interface] Specification

Making recommendable specification sheets, based on this group discussion.

Consider applicable Existence Interface, ex. SCSI.

The following two sheets will be prepared.

#1; For 5 Mbps

#2; For 10 Mbps

[4] Schedule Confirmation

Schedule proposed during the Santa Clara MTG will be discussed again and confirmed..

Dec.1990	WG11,Berlin	Meeting	Call for Proposal
Mar.1991	WG11,Cal.	Meeting	Discuss about Proposals
Jul.1991	WG11,XXX	Meeting	Draft proposal,version 1.0
Dec.1991	WG11,XXX	Meeting	Submit the Recommendation