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

Document AVC-3
October 5, 1990

SOURCE : CHAIRMAN
TITLE : PHASE-2 WORK OF MPEG
PURPOSE: Report, Discussion

---

1. What is MPEG

"Moving Picture Experts Group" was established as a subgroup of ISO/IEC JTC1/WG8 in 1988, and became WG11 in 1990. The area of work is defined as "to develop standards for storage and retrieval of moving picture images and of sound for digital storage media (DSM)". See Annex 1 for the terms of reference.

2. Second phase work

Since the first phase work for the 1.5 Mbit/s DSM is close to the end, the second phase work has been initiated. Its target is "coding of moving pictures for Digital Storage Media having a throughput of up to 10 Mbit/s". It is intended to generate a Draft Proposal (DP) in 30 months. See Annex 1.

3. Requirements

The discussion results at the Santa Clara meeting last September are contained in Annex 2.

4. Work schedule

As practiced in the 1.5 Mbit/s work, the first half of the schedule is defined as a "competitive" phase, with a "collaborative" phase followed in the second half. The current plan for the competitive phase is as follows:

December 1990	- Discussion of Proposal Package Description (PPD) - Finalization of Test Sequences
March 1991	- Finalization of PPD - Finalization of Test Procedures
End of May 1991	- Submission of processed pictures to be tested
July 1991	- Subjective tests

Annex 1: Letter to Mr. Yamashita, Chairman of CCITT WPXV/1
(TD 24-XV/1, July 1990)

Annex 2: Report of the discussion on requirements for the second phase work of MPEG in TEST SUBGROUP (MPEG 90/268, September 1990)

TD24 (XV/1)
July 1990

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 N13
JULY 1990

SOURCE: Leonardo Chiariglione
TITLE: Letter to Mr. Yamashita, Chairman of CCITT WP XV/1
PURPOSE: Liaison letter

ISO/IEC JTC1/SC2/WG11 wishes to inform CCITT WP XV/1 that WG 11 has started work on its second work item, which now reads "Coding of Moving Pictures for Digital Storage Media Having a Throughput of Up to About 10 Mbit/s".

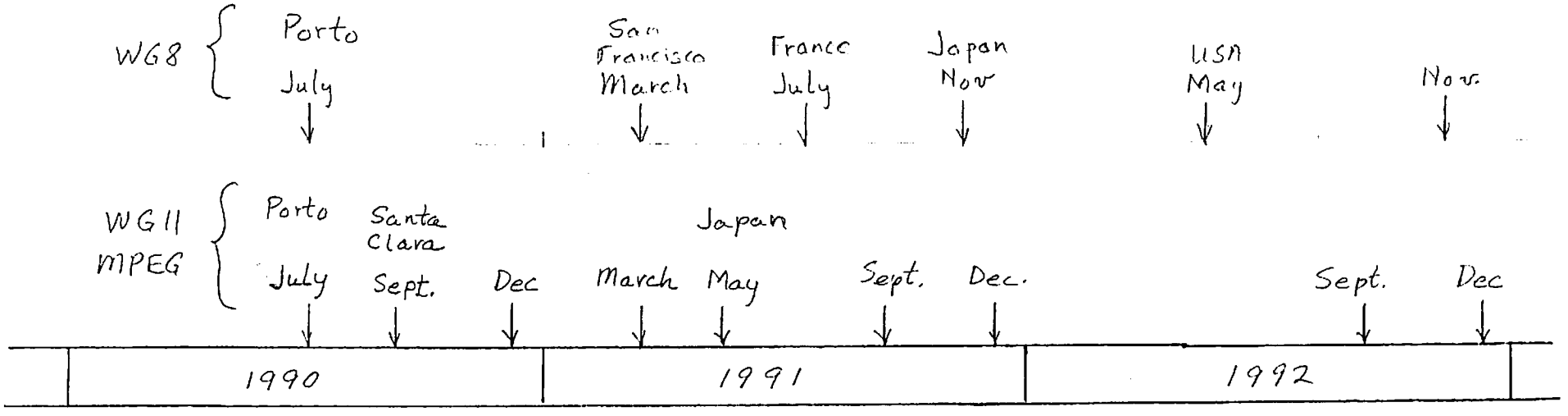
It seems desirable to establish a close relationship between video coding algorithms for digital storage and digital transmission so that efficient transcoding with minimal subjective performance impairment is possible. It is our view that a close relationship may be possible if the work of WG11 and WP XV/1 were to proceed from a common basis of requirements toward a common subjective performance goal.

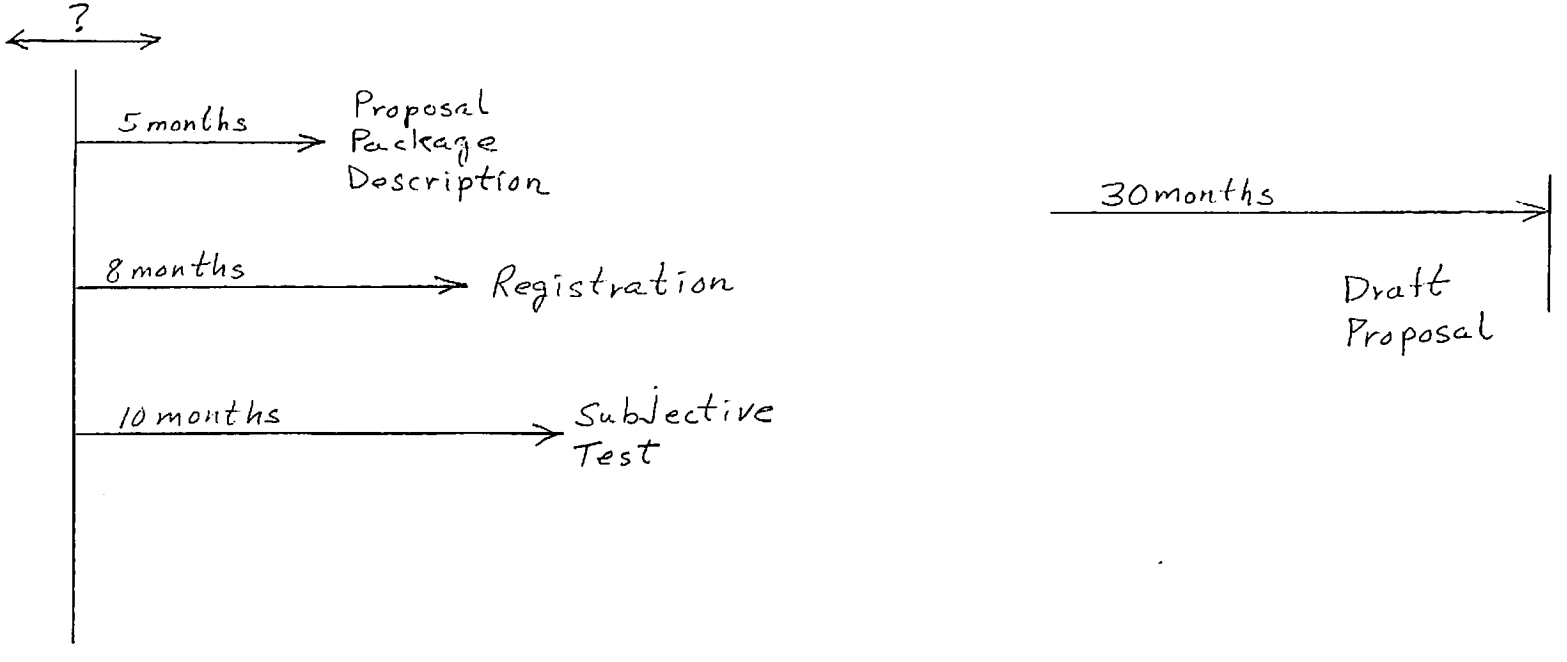
While we understand that there may be specific considerations related to coding for ATM networks, we believe the highest possible degree of commonality should be achieved. A plan of work for MPEG is attached. WP XV/1 is invited to consider how to establish a close liaison with MPEG possibly including participation by members of the proposed Video Experts Group in the work of MPEG.

In particular, it would be very appropriate to have WP XV/1 participants in the early meetings to discuss plans for subjective performance evaluation and the requirements resulting from media characteristics.

WG 11 looks forward to a reply addressing the possibility of close cooperation and advising us of the terms of reference and work plan of the proposed WP XV/1 Video Experts Group.

WG11 nominates Mr. Milton Anderson as liaison to WP XV/1.





INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONALE DE NORMALISATION
ISO/IEC JTC1/SC2/WG8
CODED REPRESENTATION OF PICTURE AND AUDIO INFORMATION

ISO-IEC/JTC1/SC2/WG8 N
MPEG 88/001
October 1988

Source:	**Leonardo Chiariglione** **Chairman of Moving Picture Experts Group (MPEG)**
Title:	**Terms of reference**
Purpose:	**Define terms of reference**
Desired actions:	
Status:	**Approved by JTC1/SC2**

Terms of reference of Moving Picture Experts Group (MPEG)

1. Title
Coded Representation of Moving Picture Information

2. Area of work
To develop standards for storage and retrieval of moving picture images and of sound for 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
- Define relevant input picture material and output image devices
- Define relevant digital storage media
- Cooperate with other standardisation bodies dealing with similar applications
- Consider requirements for interworking with telecommunications applications
- Consider requirements for interworking with other picture coding algorithms defined by other WG8 subgroups
- Consider interaction between moving picture images and sound; and the implications of the coded representation of sound
- Define and produce digital test sequences
- Develop and test efficient and easily realisable co-decoding algorithms
- Propose one algorithm and corresponding coded representation for proposed standardisation

4. List of work items
- Coding of moving pictures for DSM's having a throughput of 1-1.5 Mbit/s (1988-1990)
- Coding of moving pictures for DSM's having a throughput of 1.5-5 Mbit/s (1990-1992)
- Coding of moving pictures for DSM's having a throughput of 5-60 Mbit/s (to be defined)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANIZATION INTERNATIONALE DE NORMALISATION

ISO-IEC JTC1/SC2/WG11

CODING OF MOVING PICTURES AND ASSOCIATED AUDIO INFORMATION

ISO/IEC JTC1/SC2/WG11
MPEG 90/268
September 14, 1990

Title : Report of the discussion on requirements for the second phase work of MPEG in TEST SUBGROUP
Source : Sakae OKUBO (NTT)

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 follows:

Objective

To identify requirements for coding of moving pictures and associated audio at bit rates 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 clarification followed:

MPEG 90/216 Issues which Hughes Aircraft Company wishes to have considered during work on MPEG Work Item 2-MPEG II (Hughes)
/228 Application and requirements for the second phase of MPEG (Philips CE et al)
/231 Proposal of work items for MPEG 2 (PCE)
/233 Consideration of Phase-2 of MPEG work (Matsushita)
/236 Requirements for MPEG 2 (BT)
/240 The second work item and its work method (NTT)
/258 Requirement for MPEG Phase 2 (IBA)
/259 Applications an requirements for a low bit rate broadcast quality video coding system (RAI)
/260 Feature sets for interactive images (Lippman)
/261 Requirements on a 10 Mbit/s MPEG codec (Siemens)

/262 Comments and Proposal for next work of WG11 (JVC)
/ Considerations for harmonization of digital video standards (Architecture Working Group - Committee on Open High Resolution Systems)

3. Discussion results

3.1 Prospect for the second phase work

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

3.2 Target bit rates

It was a consensus to define the target bit rates not at specific fixed values but as a range. The upper bound is 10 Mbit/s. 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 bit rate ratio for video coding is practical and that it should cover the range above the first phase MPEG video bit rate. 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) as indicated in Figure 1 which will be commonly applied to various applications. Adaptations to application oriented media/channels (II) need specific standards according to the applications.

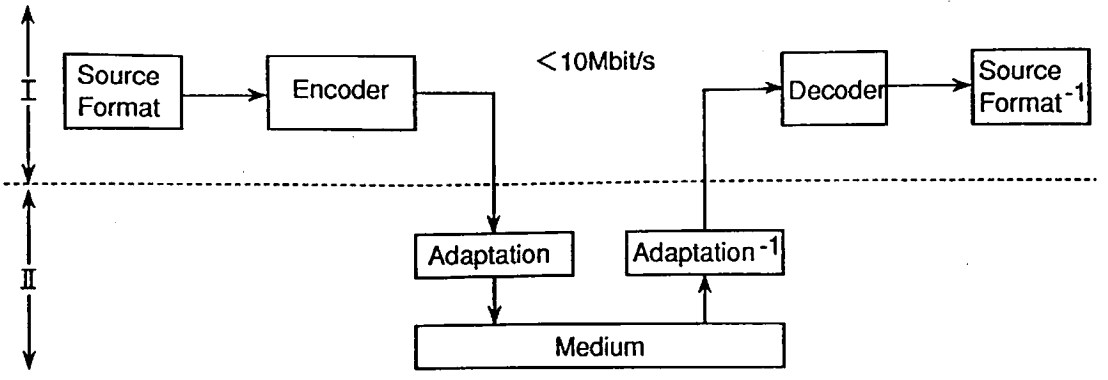


Fig.1

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.

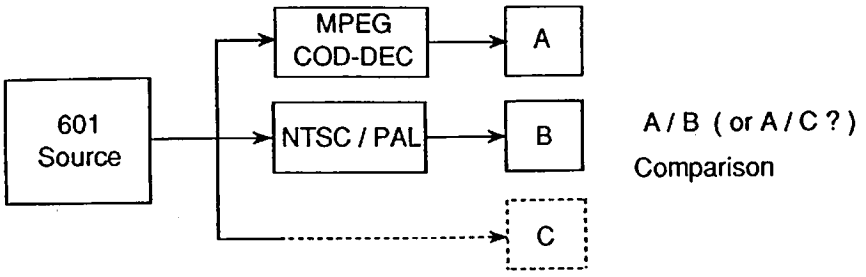


Fig. 2

It is pointed out that the bit rate(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 further clarification.

It is also pointed out that tradeoff among quality, bit rate and hardware cost should be carefully considered when evaluating 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
  720 x 240 x 2 x 30; 720 x 288 x 2 x 25
  Coming EDTV format (16:9 aspect ratio)
  960 x 240 x 2 x 30; 960 x 288 x 2 x 25
  Progressive scan format
  e.g. 960 576/480 1 24/25

- Interlaced pictures are to be coded (inter-frame and inter-field prediction?).
- System for multiple screens/multiple images is to be considered.
- Broadcast television and scalable window system are to be considered.
- Raster format and quality are to be independently considered.

2) Statistical multiplexing

- Utilization of MPEG bit stream properties
- Buffering and rate control for multichannels

3) Short decoding delay from an arbitrary point of the program

- Random channel selecting in broadcasting reception
- Granularity of random access

7
AVC-3

Table 1

	Application	Required performance	Bit rate (Mbit/s)	MPEG 1 Compati-bility	CCIR601 input / output format	Start from an arbitrary point	Special playing modes	Symmetry in allowed complexity	Notes
a	Digital video disk/VTR		3-5	yes			yes	C≃D	
b	Advanced videotex through B-ISDN or quasi distributire network			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 ~CCIR601			yes	yes		C≫D	· constant quality per ch. · statistical multiplexing · BER<10^{-4}
e	Reception / transmission of TV programs via CATV		<10		yes	yes		C≫D	
f	Recetion / transmission of TV programs via B-ISDN				yes	yes		C≫D	
g	ENG / SNG							C≪D	
h	Interpersonal audiovisual communications through B-ISDN							C≃D	
i	High quality multimedia applications involving trasmission of live video via computer networks (including FDDI) or distribution of stored information		~5					C≃D or C≫D	

4) Signal encryption/scrambling

- for authorized reception

5) Error protection for different channels

- Selective protection for headers etc.
- More frequent synchronization words for noisy channels

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

7) Wider range of motion compensation

8) Adaptation to ATM transmission

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

3.7 Symmetry of coding and decoding

There are three cases of different symmetry in terms of allowable complexity:

- Decoder << Coder
  e.g. broadcasting reception
- Decoder $\simeq$ Coder
  e.g. VTR, visual telephony
- Decoder >> Coder
  e.g. ENG/SNG

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

3.8 Audio coding

The audio coding experts who participated in the discussion summarized the current state of the art as follows:

- production quality at 192 kbit/s per channel
- close to transparent at 128 kbit/s per channel
  (comparable to Compact Disc quality)

There were opposing views whether the second phase audio coding standard(s) is required or not. This matter should be decided by AUDIO SUBGROUP and reported back at the next meeting. It was pointed out that multi-language program may require several channels, thus their aggregate bit rates may affect video performance.

3.9 Compatibility

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

9
AVC-3

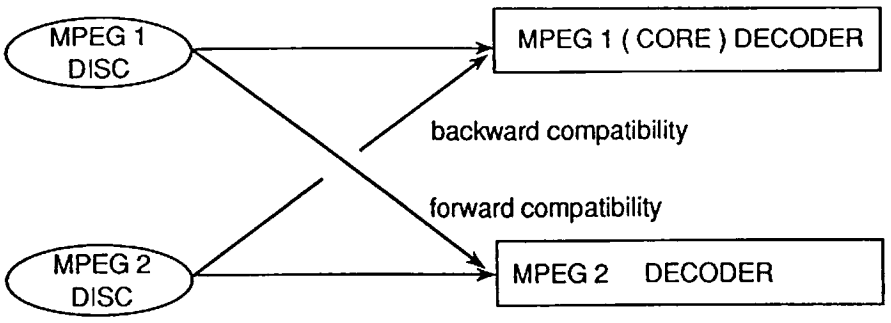


Fig. 3

The meeting felt that the 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 obtained, the second phase work loses ground.
- if compatibilities are not guaranteed, the first phase product will not be accepted.
- software and hardware implementations 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 further 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 further discussed

1) Definition of the lower bound of the target bit rate range

2) Clarification of quality objective's

e.g. by using CCIR 5 grade scale?

3) Symmetry of encoding and decoding

4) Forward and backward compatibilities

5) Harmonization with CCITT, CMTT

END

10
AVC-3