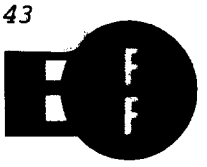
JEGI Doc.-043



**Before the**

**Advisory Committee on Advanced Television**
**Joint Experts Group in Interoperability**

**October 6, 1993**

Electronic Frontier Foundation, Inc.
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# HDTV and the National Information Infrastructure

Affordable Information Appliances Are Critical For the NII:

- The promise of the NII for delivering critical services such as education, healthcare, and federal, state, and local government information will only be realized if citizens have affordable information appliances.

- Affordable information appliances are necessary to avoid the creation of information haves and information havenots.

HDTV Can Play A Critical Role In Promoting Access to the NII for All:

- The ACATS should promote a standard which supports the convergence of information and entertainment services. The goal is what Microsoft's Bill Gates has called the PC/TV.

- The Administration's Information Infrastructure Task Force has stressed the need for interoperability:

  "To assure interoperability and openness of the many components of an efficient, high-capacity NII, standards for voice, video, data, and multi-media services must be developed."

Avoid Unnecessary Expense to Consumers:

- Since consumers will be investing significant resources based on the new standard. the ACATS process should seek a standard which promotes both high-quality entertainment and expanded information access.

- If HDTV standards meet the needs of both business users and consumers, the leading edge business uses can help drive down the eventual cost to residential users.

• • • • •

Electronic Frontier Foundation: EFF is a non-profit, public interest organization, founded in 1990 by Mitchell Kapor and John Perry Barlow. EFF's public policy mission is to insure that the new electronic highways emerging from the convergence of telephone, cable, broadcast, and other communications technologies enhance free speech and privacy rights, and are open and accessible to all segments of society.

# CHANGE:
# Consolidate GA/MPEG2 to 100% MPEG2
# (HP/ML -no AC leak)

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## WHY?

* MPEG does not yet support AC leak

* Multimedia PC's 5M+/yr & rising:
  MPEG enabled

* IBM actively supports MPEG2

## BENEFITS?:

* Gain in cross-platform compatibility

  -- transparent exchange of video
  from computer sources

  -- support for exchange with
  international MPEG community

  -- broadest customer base will be
  most successful & extensible

Michael R. Helm
IBM MICROELECTRONICS
10/6/93

# Summary of Comments and Issues
Wednesday, October 6 1993

Despite the context of terrestrial(-only), HDTV(-only), a lot of progress has been made toward emerging/converging uses of ATV and NII

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Status of PS/WP-4 Recommendations (c. Dec'92)

1. An all-digital implementation based on a layered architecture model
   [ok]

2. The use of universal headers and descriptors
   [MPEG with hooks to universal h/d – registry tbd]

3. Transmission of the signal in progressive scan format
   [still an issue]

4. Use of a flexible, packet data transport structure
   [ok]

5. Viewer transparent channel re-allocation (limited picture and sound while most of the channel capacity is devoted to data transmission for conditional access addressing or other purposes)
   [ok in principle, needs detailed specification]

6. Ability to implement lower performance low-cost ATV receivers (comparable price/performance options to current NTSC receivers)
   [no; but a cost/performance family is possible, driven mostly by display, electronics sets base level; interacts with progressive recommendation]

7. Ability to implement low cost ATV consumer VCR
   [ok, for compressed input; vcr stunt modes an issue with ac leak, camcorder is another problem]

8. System architecture and implementation that will allow improvements and extensions to be incorporated as technology advances while maintaining backward compatibility
   [ok, at a minimum through new packet types given available bandwidth]

9. Square pixels or at least the option to select square pixel presentation
   [addressed by 1280x720, still some open issues with other formats]

10. Compatibility with relevant international standards or commitment to this objective

[actual and required level of conformance with MPEG-2 (video, audio, transport) /ATM /IETF /etc. an issue]

11. Easily implementable and user-accessible "still/motion multi-window transmission"
[feasible via multiplexed program streams; needs further requirements definition]

New Criteria

12. Compressed domain switching and insertions in data stream
[mechanism in place; needs requirements, analysis, and specification]

14. A method to insert (midstream) overlay data that is not in the original picture; both modes: graphics created in receiver or inserted by local station (the tornado warning feature)
[needs requirements and definition]

Context...

- ATV is happening: digital HDTV, digital SDTV,...
- NII is happening: Internet, conferencing, radio,...
- Desire for universal access (to information services in the public interest); but the market incentive is unclear
- Agreement on goal of NII compatible consumer products, the discussion is on tactics of how we get there (market drive and technology); design of ATV should not inhibit earliest access to NII services; what design features of ATV would foster earliest access to NII services

Recurring Issues (What do we do? How do we make it actionable?)

1. MPEG-2 Compatibility
   a. Super/sub/side-set
   b. Audio compliance
   c. AC leak

2. Interlace & Progressive vs Progressive-only
   a. Conversion from all transmission formats to likely display formats must be within acceptable quality limits (limits need definition)

3. Multiple formats, benefit vs cost

4. Square Pixels
   a. Required for 1K line format? 24/30/60?
   b. Coding or filtering?

5. 1080 vs 960

6. Migration Path, to target ~1920x1080/60/1:1
   a. Does migration preclude need for 720 initially?
   b. If interlace, then if and when is ATV interlace retired? [with NTSC broadcast?]
   c. What are the migration path objectives
   d. FCC does not (will not?) set interim standards
   e. Interlace in the transmission channel leads away from the target

7. Other issues?

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480 x analog } 3:2
720 x 1280 } 3:2
1080 x 1920

"Square pixel" = "Square sample distribution"

Define interface at 720 x 1280 & 1080 x 1920

"Allow" internal use of lower H resolution if needed for ease of compression (like 1440). The interface would still be 1920 in this case.

Picture rates of 23.97/24, 29.97/30, 59.94/60. Switchable at studio, automatic in receiver.

Want MPEG-2 compatibility. Want highest quality. If MPEG is wrong, fix it.

"Allow" interlace transmission. If an application requires progressive, use progressive.

"Allow" interlace display. If an application requires progressive, use progressive.

Inclusive not Exclusive.

R. Hopkins
6 Oct 93

Dr. Larry Smarr
Director, National Center for Supercomputing Applications
University of Illinois at Urbana-Champaign

Position:

The rapid convergence of networking, television, video games, and telephone is leading to the requirement for a standardized "window into information space". The interoperability between computer screens and televisions is a critical technology to support this effort to build a National Information Infrastructure.

In this regard, I are very excited about the formation of the Grand Alliance proposed standard. However, I believe that the standard should have as a minimum PROGRESSIVE SCAN and SQUARE PIXELS.

The end users of NII include not only personal computer, workstation, and supercomputer users, but also the emerging markets of small business, industrial corporations, K-12 and college education, and particularly digital libraries. The home market inself will be using these multimedia digital libraries over both cable tv and fiber within the next 12 months. This vast market will benefit enormously by a single digital image standard.

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# Questions on Interoperability

Didier J . Le Gall

C-Cube Microsystems

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# Video: GA - MPEG 2 Inter operability

**GA Document Shows Transcoding Box to ensure decodability of GA bitstream by MP@HL MPEG 2 decoder**

**Are the pain and the cost worth it ?**

C-Cube Microsystems
*Highest Image Quality*

# The "AC Leak" Issue

What Problem does it solve ?

How does it solve it ?

What are the problems with the solution ?

C-Cube Microsystems
*Highest Image Quality*

DJL 10/05/93

# The Problem

## Random Access (Channel Change)

C-Cube Microsystems
*Highest Image Quality*

DJL 10/05/93

# The Solution

Lossy DPCM (on AC term only)

Frequent refresh (e.g. every 6 pic) of DC term.

With appropriate leak factor Picture should converge in a few recursions (about 10). Effect is unevenly appreciated.

C-Cube Microsystems
*Highest Image Quality*

# Behavior of The Solution

Phase 0: Modem resynchronizes freeze frame

Phase 1: freeze frame until the DC refresh is received. Worse case 1/5 second.

Phase 2: Picture starts as blocks but get progressively better in about 10 iterations.

C-Cube Microsystems
*Highest Image Quality*

# Problem with the Solution

- Does it solve the problem better than other solution ?
  - Not overwhelmingly convincing
    - Not when B-pictures are used i.e on progressive sources.
- Effect on Compression Efficiency
- Limit Cycle issue not resolved
- Incompatible with VCR Applications

C-Cube Microsystems
*Highest Image Quality*

Computer Systems Policy Project

John Sculley Apple

Robert E. Allen AT&T

Eckhard Pfeiffer Compaq

James E. Ousley Control Data Systems

John F. Carlson Cray Research

Ronald L. Skates Data General

Robert B. Palmer Digital Equipment

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JEGI Doc.-049

May 20, 1993

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The Honorable James H. Quello
Chairman, Federal Communications Commission
1919 M Street, N.W.
Washington, D.C. 20554

Dear Chairman Quello:

As the Federal Communications Commission approaches a critical crossroads in its Advanced Television System (ATV) standards process, the Computer Systems Policy Project (CSPP) urges you to establish a technical framework for ATV based on maximum interoperability. Such a decision will accelerate U.S. leadership in information technologies and stimulate the deployment of an enhanced National Information Infrastructure (NII).

CSPP described its vision of the NII, potential applications in healthcare, education, manufacturing, and access to information, and key policy principles for achieving the NII in its January 1993 report, Perspectives on the National Information Infrastructure, which I am enclosing. In that report, we noted that interoperability of applications and technologies across sectors is the key to successful implementation of the NII. A well designed ATV standard that will allow interactive information to be easily conveyed, viewed, and manipulated across a variety of consumer and professional settings and applications is essential to the development and wide deployment of the applications that will bring the benefits of the NII to people and businesses.

I am attaching a brief description of the key technical requirements for an interoperable ATV standard that will support the applications described in CSPP's paper and accelerate the development of a wide range of new information-based products and services. In brief, we believe that progressive scan transmission and square pixels are two of the critical factors necessary to achieve a fully interoperable ATV.

The Commission has an opportunity to select an interoperable ATV standard that all sectors can embrace. If a non-interoperable standard is selected, even on an interim basis, this may delay the widespread adoption of ATV by initiating a process to develop a

second standard that all industries would be able to use. It is quite possible that many broadcasters would wait for the completion of this second, superior and more useful standard.

The Computer Systems Policy Project urges you to support maximum interoperability for ATV by adopting a standard based on progressive scan transmission and square pixels.

Thank you for your consideration.

John Sculley
Chairman
Computer Systems Policy Project

Enclosures

cc: Representative Ed Markey
Representative George Brown
Representative John Dingell
Senator Ernest Hollings
Senator Daniel Inouye

# KEY REQUIREMENTS FOR AN INTEROPERABLE ATV STANDARD

The Computer Systems Policy Project

May 20, 1993

The findings from the interoperability review conducted by the Federal Communications Commission's Advanced Television Advisory Committee point out that progressive scan and square pixels are critical factors to achieve a fully interoperable ATV.

## Progressive Scan (non-interlace)

The computer industry tried to use interlace scan years ago, but found that the display flicker produced on fine text, lines, and graphics rendered it unusable. We learned that ergonomically acceptable information displays require progressive scan. Interoperability will be made unnecessarily difficult and expensive -- and less effective -- if interlaced ATV images have to go through a scan conversion process whenever they are used outside the entertainment domain. Likewise, flicker problems on interlaced ATV receivers connected to future information highways will severely compromise their ability to display text, line, or graphics information. For these reasons, progressive scan transmission is essential for interoperability.

The use of interlace in advanced television systems, as some propose, could cause a serious dilution of the renaissance of a new U.S. digital video communications industry. On the other hand, a system based on progressive scan would stimulate a new array of products and services.

An interoperable, long-lived standard at a minimum requires the transmission signal to be progressive scan -- regardless of whether in the short term the two extreme ends of the delivery chain (cameras and displays) remain interlace with de-interlacing occurring in or near the camera before transmission and with scan reduction occurring at the display.

## Square Pixels

The computer and information industries have standardized on square pixels. Square pixels allow lines and shapes to appear smooth and well formed when manipulated by digital circuitry. The conversion process for square/non-square pixel representations is inexact and inefficient and degrades image quality. Any ATV system that uses non-square pixels will seriously compromise interoperability.

## Other Factors

We recognize that the development of ATV continues to make progress and that all proponents continue to improve their systems. The proposed standards are all digital, and all remaining proponents have committed to a flexible packetized data transport structure and universal headers/descriptors. This approach is necessary for the long term success of the standard. Only a digital ATV solution that is flexible, with open interfaces, will provide benefits to both the computer and television industries. There must be no obstacles in the form of proprietary components in the standard.

Because ATV systems consist of several components, considering these components separately will make it easier for the U.S. to influence worldwide standardization. Five components that must be defined with open interfaces are: 1) audio/video capture; 2) audio/video data compression; 3) signal distribution; 4) audio/video data decompression; and 5) displays.

In addition, there are other interoperability and extensibility issues, identified in the Advisory Committee's interoperability review, which the Commission should address in conjunction with the computer industry in the near future.

## Interoperability Is Important to Stimulate Wide Adoption

The computer industry and other imaging industries -- including suppliers to the healthcare industry and the education community -- are willing and able to invest immediately in progressive scan technologies. Many of these communities are already using or adopting high resolution systems well in advance of the television industry. The wide application of such systems will generate economies of scale that will reduce or eliminate the high cost of converting signals across disparate environments. Such wide adoption will make its application more affordable for broadcasters in the future. If the Commission establishes a standard broadcast image framework that will allow many industries to share the economies of scale of sub-component systems, such a system will be widely adopted. If a broadcast standard is chosen that is not interoperable, most certainly another process will have to be initiated to develop a harmonious architecture.

## Summary

By taking the above considerations into account when selecting an ATV standard, including an interim standard, the Commission will ensure the adoption of a forward-looking standard that will be broadly extensible to many industry sectors and applications and will accommodate future technology trends that we cannot predict today.

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# DIRECTV COMMENTS ON INTEROPERABILITY ASPECTS OF THE GRAND ALLIANCE HDTV SYSTEM

OCTOBER 6, 1993

DIRECTV GENERALLY SUPPORTS THE TECHNICAL PROPASALS OF THE GRAND ALLIANCE AND COMMENDS THE GROUP FOR THEIR EXCELLENT WORK

WE BELIEVE THAT THE AVAILABILITY OF LOW-COST CONSUMER EQUIPMENT AND PROFESSIONAL EQUIPMENT PRICED APPROXIMATELY 20% ABOVE CURRENT LEVELS WILL ACCELERATE THE AVAILABILITY OF HDTV

THE INCLUSION OF B-FRAMES MAKES A SIGNIFICANT ENOUGH IMPROVEMENT TO WARRANT THEIR INCLUSION IN THE FORMAT

HEADERS/DESCRIPTORS PROVIDE NEEDED FLEXIBILITY IN THE USE OF THE DATA FOR NUMEROUS FORMATS

THE MUSICAM AUDIO CODING IS OUR PREFERRED IMPLEMENTATION OF AUDIO

PACKETIZED DATA IN THE MPEG-2 FORMAT OFFERS THE BEST ECONOMIC AND PERFORMANCE TRADE-OFFS TO INSURE READY ACCEPTANCE AND AVAILABILITY OF CHIP SETS

D. Baylor

# AGENDA

Interoperability Review of Grand Alliance Proposal

Georgetown University Conference Center

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**October 6**

| | |
|---|---|
| 8:00-8:30 | Coffee - Continental Breakfast |
| 8:30-9:00 | Introduction, Meeting Expectations and Process<br>(R. Wiley, I. Dorros, R. Sanderson, M. Liebhold) |
| 9:00-12:00 | Grand Alliance Interoperability Report<br>(brief clarification Q&A after each presentation section)<br><br>(10:15-10:30) Break |
| 12:00-1:00 | Lunch |
| 1:00-5:00 | Formal Statements and Questions<br>Interoperability Panel and Joint Experts Group<br>(five minutes each)<br>(one page written summary required) |
| 7:30-8:30 | Joint Experts Group Meeting<br>(review comments — structure for discussion Oct 7) |

**October 7**

| | |
|---|---|
| 8:00-8:30 | Coffee - Continental Breakfast |
| 8:30-12:00 | Structured Discussion (section by section of GA report) |
| 12:00-1:00 | Lunch |
| 1:00-3:00 | Final Contributions/Adjourn |
| 3:00-5:00 | Joint Experts Group Meeting<br>(summary report outline and drafting) |

# FCC Advisory Committee on Advanced Television Service

## Screening for
## Joint Experts Group on Interoperability

October 5, 1993

ADVANCED TELEVISION TEST CENTER
Alexandria, Virginia

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# Part I

## Examples of Artifacts*

## A. Transmission Impairments into NTSC

| Cut # | Image | Artifact |
|---|---|---|
| 1 | *"Texas Dude"*** | *Random-like Noise into NTSC* |
| 2 | " " | *Impulse-like Noise into NTSC* |
| 3 | " " | *NTSC into NTSC* |
| 4 | " " | *Analog ATV into NTSC* |
| 5 | " " | *Digital ATV into NTSC* |

## B. CCIR Impairment Levels for *NTSC*

| Cut # | Image | CCIR Level |
|---|---|---|
| 1 | Girl with Toys | CCIR 5 ***Imperceptible*** |
| 2 | " " " " | CCIR 4 ***Perceptible, But Not Annoying*** |
| 3 | " " " " | CCIR 3 ***Slightly Annoying*** |
| 4 | " " " " | CCIR 2 ***Annoying*** |
| 5 | " " " " | CCIR 1 ***Very Annoying*** |

* Content determined by FCC Advisory Committee
**The official name of this image is "Co-channel".

## C. Coding & Transmission Impairments into *ATV*

| | Cut # | Image | Artifact |
|---|---|---|---|
| **Reference** | 1 | Lamp | *1125 Reference* |
| " " | 2 | Den | " " " " |
| " " | 3 | "Texas Dude"* | " " " " |
| " " | 4 | Fax Machine | " " " " |
| " " | 5 | Mannequins | " " " " |
| " " | 6 | Paint Store | " " " " |
| " " | 7 | Rotating Pyramids | " " " " |
| " " | 8 | "Cheshire Cat" | " " " " |
| " " | 9 | Metal Table & Chairs | " " " " |
| **Coding** | 10 | Fax Machine | *Edge Busyness* |
| " " | 11 | Den | " " " " |
| " " | 12 | Mannequins | *High Saturated Flat Field Texture Noise* |
| " " | 13 | Paint Store | *Loss of Resolution due to Motion* |
| " " | 14 | Den | *Loss of Resolution due to Motion* |
| " " | 15 | Rotating Pyramids | *Blockiness* |
| " " | 16 | Rotating Pyramids | *Blockiness* |
| " " | 17 | Metal Table & Chairs | *Motion Artifacts in a Still Picture* |

***(More)***

*The official name of this image is "Co-channel".

## C. Coding & Transmission Impairments into *ATV* (continued)

| | Cut # | Image | Artifact |
|---|---|---|---|
| **Transmission** | 18 | Lamp | *Minor Hit* |
| " " | 19 | Den | *Major Hit* |
| " " | 20 | "Texas Dude"* | *Analog TOV (just beyond TOV)* |
| " " | 21 | " " " " | *Analog POU (just before POU)* |
| " " | 22 | " " " " | *Digital TOV (just beyond TOV)* |
| " " | 23 | " " " " | *Digital POU (just before POU)* |
| " " | 24 | "Cheshire Cat" | *Blocks* |
| " " | 25 | Den | *Severe Mottling* |
| " " | 26 | "Texas Dude"* | *Panel Wipe Hit* |
| " " | 27 | Rotating Pyramids | " " " " |

*The official name of this image is "Co-channel".

## D. CCIR Impairment & Quality Levels for ATV

| | Cut # | Image | CCIR Level |
|---|---|---|---|
| **Impairment Scale** | 1 | Den | CCIR 5 ***Imperceptible*** |
| " " | 2 | " " | CCIR 4 ***Perceptible, But Not Annoying*** |
| " " | 3 | " " | CCIR 3 ***Slightly Annoying*** |
| " " | 4 | " " | CCIR 2 ***Annoying*** |
| " " | 5 | " " | CCIR 1 ***Very Annoying*** |

| | | | |
|---|---|---|---|
| **Quality Scale** | 6 | Den | ***Excellent*** |
| " " | 7 | " " | ***Good*** |
| " " | 8 | " " | ***Fair*** |
| " " | 9 | " " | ***Poor*** |
| " " | N/A | N/A | ***Bad*** |