1

Hold for CSPP mtg 4/17

COMPUTER SYSTEMS POLICY PROJECT (CSPP)

FAX COVER SHEET

DATE: March 29, 1996

TO: March 26 Administration Meeting Participants Dana Fuller

COMPANY:

FROM: Beth Inadomi

(CLIENT NUMBER: 173)

No. of Pages: 4 (Including Cover)

FAX NUMBER:

NOTE: If you do not receive all of the attached pages, please call Terri Hough at (202) 393-0220. Thank You.

COMMENTS:

Per our discussion after the Tuesday's meeting with the Administration, attached is a comparison of the CSPP language from our charts and the Administration's response. Please review and let me know if you think it is appropriate to send to the full SEEC, Crypto Team, and Policy Committees prior to Monday's conference call.

CSPP Proprietary

DRAFT 3/28/94

CSPP LANGUAGE

Administration Proposal

Integrated Framework

1. No Controls on Domestic Use or Imports	*Administration agrees*
2. Updating Controls	
-- Based on Foreign Availability	*Rejected*
-- Based on Lack of Controllability	*Rejected*
-- Establish List of Preferred Countries	*Rejected*
-- Expanded List of Preferred Customers	*Rejected*
3. Preserving System Sales	
-- No Prohibitions Based on Interfaces	*Rejected*
4. Industry Standards for Security Access	
-- Trusted Access Keyholder (TRACK)	*(See Below)*
-- Not within Scope of 2 & 3	*Rejected*
5. Prohibition to Terrorist Countries	*Not addressed (Never an issue)*

Trusted Access Keyholder (TRACK) Solution

Product Criteria	
.. No Restrictions on Key Length	*Gradual evolution -- 56 bits at first, then 80 at sometime in future, then maybe unlimited*
.. No secret algorithms	*Not addressed (Administration known to agree with this -- now)*
.. Do not prohibit interoperability of encryption solutions	*Not addressed (Administration known to have problems with this)*

.. Voluntary, industry-led product standards to be set by private international standards organization	*Not specifically addressed, but a NIST product certification system* would be required.

Government to Government Agreements

By January 1997, government to government protocols should be arranged for exchange of keys in accordance with the key access criteria.	*Administration agrees on need for hasty negotiation of agreements. NSA has been given the lead.*

Key Access Criteria

Expectation that Public Telecommunications Networks and financial institutions, as well as other organizations certified by governments will be TRACKs.	*Administration agrees.*
Corporations may self-escrow without certification.	*Not addressed*
Government certification of TRACKs should be limited to a TRACK's ability to guarantee timely access to keys, establish an audit trail where keys have been transferred in accordance with the provisions below, and guarantee the confidentiality of all requests for keys.	*To be addressed in NSA paper.*
Split and partial keys may be escrowed with multiple TRACKs in multiple cooperating countries.	*Not addressed.*
Keys to be accessible by governments only through valid court order (e.g., search warrant, subpoena, or wiretap)	*Not addressed*
Effective liability provisions for unauthorized	*Not addressed*

disclosure or use of keys.	
International exchange of keys would happen only on a government to government basis (i.e., no government requests to be made directly to TRACKs)	*Not addressed*
No informal agreement between TRACKs and governments for providing keys without court order.	*Not addressed*
Government use of lawfully acquired keys should be limited to the scope (such as duration and investigatory scope) of the court order.	*Not addressed*

f: HDTV

****
* DIGITAL *
****

RECEIVED
JUN 26 1989
SAM FULLER

INTER[illegible]EMORANDUM

TO: HDTV Distribution

DATE: 22 JUN 89
FROM: Paul J. Curtin
DEPT: NEW COMPUTING STRUCTURES
EXT: 223-6596
LOCATION: MLO12B/U10
NET ADD:

SUBJECT: DOD (DMB) HDTV Task Force

The Defense Manufacturing Board (DMD) is convening a task force on HDTV. This task force will develop a plan for execution by DARPA, other units of DOD, federal agencies and Congress.

We have been asked to comment on the mission of the task force and the background data which will be provided to them. I have attached the current DOD statements. I will work with Michael Aisenberg to coordinate a response which will be sent from Henry Crouse.

Your input on this is welcome.

Regards,

Paul

OFFICE OF THE UNDER SECRETARY OF DEFENSE
DEFENSE MANUFACTURING BOARD
WASHINGTON, DC 20301

ACQUISITION

MEMORANDUM

Monday 19 June 1989

TO: Henry Crouse
Vice President, Strategic Relations
Digital Equipment Corporation
ML010-1/F41
146 Main Street
Maynard, MA 01741

FROM: Dr. Roy L. Beasley
Consultant to the Defense Manufacturing Board

SUBJECT: 1) Terms of reference for the High Definition Systems Task Force

2) Preliminary draft of background briefing on HDTV

As you know, the Defense Manufacturing Board (DMB) of the U.S. Department of Defense (DoD) is in the process of convening a High Definition Systems Task Force on behalf of the Defense Advanced Research Projects Agency (DARPA). Attached find two documents in this regard which will be distributed to the members of the Task Force as soon as their nominations are confirmed. The document describes the mission of the Task Force; the other represents a preliminary draft of a background briefing.

Recognizing your own considerable interest and expertise with regards to issues related to the competitiveness of the U.S. electronics industry, we would greatly appreciate any comments you might have about either document. We are especially interested in suggestions which might improve the background briefing, e.g., corrections of factual errors, misleading statements, omissions of significant concepts or entities, etc.

The Task Force should be convened by the end of next month; hence, the sooner we receive your comments and suggestions, the better. Please address them to:

Dr. Roy L. Beasley
4812 Leland Street
Chevy Chase, MD 20815

Thank you for your support.

Terms of Reference
for the
Defense Manufacturing Board's Task Force on
High Definition Systems

A. Context

A number of recent forecasts have projected that, if current trends continue, domination of the emerging high definition television industry by foreign manufacturers will lead to significant erosion of strategic segments of our economic infrastructure. These pessimistic projections have caused considerable concern throughout Department of Defense (DoD), but especially within the Defense Advanced Research Projects Agency (DARPA). Therefore, in December, 1988, DARPA issued a Broad Agency Announcement signalling its intention to invest approximately $30 million in research and development in two areas: high definition displays and display processor/receivers. These projects are designed to yield dual usage technologies having commercial applications in high definition television (HDTV).

B. Mission

It is unlikely that DARPA's initiatives alone will provide a sufficient base for U.S. manufacturers to become significant players in the HDTV market. DARPA's actions will undoubtedly have to be coordinated with actions undertaken by industry's management and labor leadership, and with comparable initiatives by other units within DoD, other Federal agencies, the Congress, and, perhaps, the President.

Accordingly, the mission of this Task Force will be to develop an affordable, comprehensive plan whose execution by DARPA, its immediate client, and by the other relevant entities in the public and private sectors to assure that national security is not jeopardized by HDTV development. In other words, the final report should specify who should do what and when.

Recognizing the fragmented nature of our system, the Task Force should try to function as a forum for the development of the broadest possible consensus on its recommendations. In particular, it should invite all of the relevant entities in the public and private sectors

to provide input to its deliberations. However, its final report should note the significant points on which consensus was not achieved.

C. Operations

The Task Force will be chartered for one year, will hold regular meetings on, at least, a quarterly basis, will submit a written, interim report to the Defense Manufacturing Board (DMB) within six months, and will submit its final report through the DMB by the end of its charter period.

The chairman of the Task Force will subdivide its members into working committees which will accomplish their tasks via methods of their own choosing, i.e., additional meetings, written communications, electronic mail, conference calls, etc. Each committee will select its own chairman and will submit written reports of its activities to the full Task Force at the quarterly meetings. An Executive Committee -- consisting of the chairman of the Task Force, the committee chairmen, and a few other members selected by the chairman of the Task Force -- will coordinate the activities of the working committees.

Finally, the chairman of the High Definition Systems Task Force and one other member designated by the chairman will act as liaisons with the DMB's Industrial Strategies Task Force.

D. Composition of the Task Force

Members of the Task Force were suggested to facilitate the production of comprehensive, industry-led strategies. In particular, no government officials were identified; all members are from the private sector, specifically, from the highest ranks of management, labor leadership, and academia. On the other hand, the members were also suggested to represent the full range of technologies relevant to the development and manufacture of high definition systems having demonstrably superior quality to the products of our foreign competitors.

E. Prior Considerations

In order to minimize the risk of the Task Force reinventing the wheels of prior discussions of HDTV, it has been suggested that its members review some of the issues identified by those prior inquiries before beginning their own deliberations. Hence, a partial list of these issues appears below:

1. General Issues

- What is a "substantial share" of the HDTV market?
- In the absence of government investment (such as DARPA's programs), what level of private sector investment is likely to occur in the relevant product technologies and manufacturing process technologies? Why would the private sector under invest in any of these technologies?
- What are the implications of participation by foreign manufacturers in government sponsored programs? What is a "foreign" manufacturer?

2. Government Policies/Programs

- What are the essential elements of a legislative agenda which would enhance the efforts of U.S. firms to become world class manufacturers of high definition systems?
- How can anti-dumping laws be enforced more effectively?
- What clarifications or modifications to current anti-trust laws, if any, are necessary to facilitate joint manufacturing by U.S. firms?
- How can the intellectual property rights (copyrights, patents, and trade secrets) of U.S. manufacturers be protected more effectively?
- What kinds of legislation would facilitate the establishment of consortia focusing on the product technologies and

manufacturing process technologies related to high definition systems?

3. Standards

- Which production standard(s) would confer the largest competitive advantages on U.S. firms?
- Should HDTV transmissions be compatible with existing NTSC receivers? If so, for how long?
- Under what circumstances would delaying the adoption of HDTV transmission standards confer competitive manufacturing advantages on U.S. firms?
- Should all transmission media encode/decode their signals in the same way, or should each medium be allowed to adopt its own internally optimized standards?

4. Development Strategies

- Which weaknesses in product technologies and in technologies should U.S. firms overcome through their own R&D? Which technologies should they license from foreign sources?
- Should the HDTV processor/receivers be "open", "closed", or something in-between? And at which level: the factory or the consumer's home?
- Should the display processor/receiver be designed from "day one" with the expectation that it would receive information from fiber, or the bandwidth equivalent?
- How could the U.S. exploit its leadership in digital signal processing for the design of processor/receivers? How could the U.S. exploit its leadership in parallel processing? And how could the U.S. exploit its leadership in software? Could these competitive advantages also be applied to transmission specifications, e.g., via parallel processing of signal compression/decompression algorithms?

- Although U.S. firms currently dominate the workstation market, they don't manufacture high resolution workstations, i.e. workstations having flat panel displays with 35 mm film quality.

  -- Should U.S. manufacturers try to produce competitive high definition televisions as soon as possible?

  -- Or could they proceed from strength, first by developing high resolution workstations, then by adapting their designs and manufacturing processes to the production of digital high definition televisions -- e.g., by adding required processor/receiver logic and by removing unnecessary data processing logic?

F. New Paradigms

Perhaps the greatest benefit of President Kennedy's space program was its revival of our faith in our capacity to cope with significant national challenges. For a longtime afterward, we used to say: "If we can put a man on the moon, why can't we . . . build more efficient cars? . . . conserve energy? . . . Protect the environment? . . . wipe out cancer?" Then we would roll up our sleeves and enact imaginative programs which made decisive progress towards those other national objectives.

Today, on the threshold of a new millennium, our economic survival is threatened by relentless trading partners and undermined by our crippling doubts about our capacity to meet their challenge. We need new paradigms, new fables of national success which can inspire our efforts to prevail against the many other challenges of this new era.

Given the extraordinary depth of talent represented on this Task Force, there is ample reason to be confident that it will accomplish its assigned mission to devise affordable, industry-led strategies for getting our manufacturers back into the color television business. Hopefully, their recommendations will also display such impressive scope and scale as to provide stimulating models for our efforts to regain our competitive status in other troubled industries.

draft ... draft ... draft ... draft ... draft ... draft ... draft

Notes on HDTV

(6/9/89)

A. Fundamentals

1) NTSC

At the present time, American television is mostly received via terrestrial broadcast (or cable) conforming to a technical format specified by the National Televison System Committee (NTSC) in the 1940's and revised for compatibility with color and stereo signals in the 1950's. NTSC uses 525 lines per frame, 60 fields per second, a 4:3 aspect (width-to-height) ratio, and is restricted by the FCC to a band-width of 6 megahertz. At the present time, Japanese and Canadian television also conform to this standard, but some European television adheres to the 50 field/second French (SECAM) or German (PAL) standards, which are incompatible with NTSC.

2) ATV and EDTV

Advanced television (ATV) is anything demonstrably superior to current standards; whereas, extended or enhanced definition television (EDTV) is anything superior to current standards, but not as advanced as HDTV, e.g., the David Sarnoff Research Center's "Advanced Compatible Television I" (ACTV-I).

3) HDTV

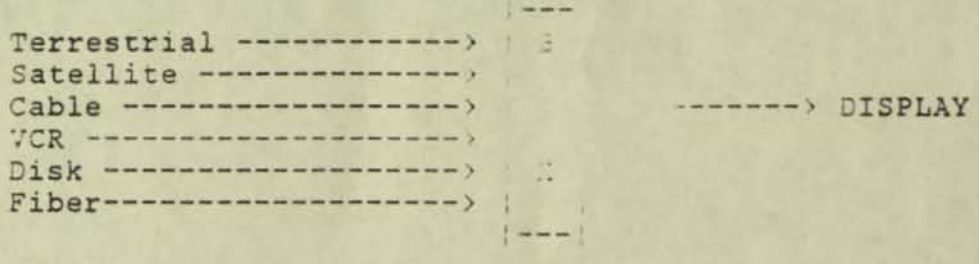
No single standard or set of standards for HDTV has been universally adopted yet; however, it is generally accepted that a system should not be called "HDTV" unless its perceived quality is comparable to 35 mm film. Hence, all proposed systems have more lines per frame and a wider aspect ratio than NTSC. For example, the Japan's NHK MUSE format has 1125 lines per frame, 60 fields per second, a 16 to 9 aspect ratio (vs the NTSC 4 to 3, i.e., 12 to 9), and requires a bandwidth of 8.1 megahertz (MHz).

4) Transmission Media

In principle, HDTV could be deliv[illegible] a consumer's home through a variety of media, e.g., [illegible]rrestrial broadcast, direct broadcast satellite (DBS), cable, VCR's, video disks, and fiber. For the purposes of this discussion, the "processor/receiver" will be defined as the "box" which stands in between the transmission medium and the display. The principal components linking the producer's studio and the consumer's display are noted in the following, simplified system diagram:

PRODUCTION----›TRANSMISSION----›"BOX"----›DISPLAY
MEDIUM

For example, plugging the coaxial cable from a rooftop antenna into back of the processor/receiver "box" would enable a consumer to view HDTV via terrestrial broadcast; whereas plugging in the cable from a VCR would enable a consumer to view HDTV selections recorded on magnetic tape. (See figure, below.)



5) Standards

One has to distinguish between proposed "production" standards for HDTV and proposed "transmission" standards. Production standards determine the manner in which audio and visual information is recorded by studio cameras and studio video tape. Historically, the universal de facto production standard has been 35 mm film.

Transmission/reception standards determine how this information is delivered to consumers; hence they govern the design of transmission equipment (e.g. satellites, broadcast towers, and VCR's) and the consumers' HDTV receivers. Most transmisson media have less bandwidth than the 100 megahertz available to studio facilities; hence, their formats require the application of signal processing and data compression techniques in partial compensation for this limitation.

6) Architecture/design

HDTV will be expensive, at least initially. Therefore, common sense strongly suggests that consumers will only want to buy one "box", just as forty years ago they only bought one expensive TV set. Furthermore, at any point in time, the "box" in any particular consumer's home will have a specific set of features which may have been installed at the factory (like car options) or installed by the consumer (like PC add-in boards or Nintendo cartridges), depending on the architecture of the "box", i.e. "open", "closed" or something in-between.

As for the displays, it is generally accepted that sooner or later, HDTV will be delivered to large (3 ft by 5 ft?) flat panel displays, so that consumers can derive maximum pleasure from its higher resolution and its wider aspect ratio.

B. Controversial Issues

Most controversies about HDTV can be [illegible] into three related categories: standards, processor/receiver [illegible]chitectures, and strategic impact.

1) Standards

a) Production Standard(s)

Issue: Maintain current U.S. support for the NHK (Japanese) 1125/60 standard before the CCIR, i.e., 1125 lines, 60 fields per second.

Pro: One world-wide standard would help the U.S. to continue to enjoy a large ($3 billion) export surplus in movies and television shows.

[E.g., until recently, this position was advocated by the U.S. State Department, the American National Standards Institute (ANSI), and the American Television Systems Committee (ATSC).]

Con: The Europeans have [illegible]de it categorically clear that they will [illegible]dhere to the Japanese standard, but will [illegible]velop their own (incompatible) standard HD-[illegible] which uses 50 fields per second, as do their current TV transmission standards, and 1250 lines. They are following this path, not just for technical reasons, but as a matter of deliberate industrial policy; hence, the U.S. should also adopt a standard that would serve its own broader industrial interests.

[E.g., Zenith, Prof. Schreiber (M.I.T.), Capital Cities/ABC, David Sarnoff Research Center]

b) Spectrum Availability

Issue: Allocate more spectrum to land mobile services, e.g., cellular phone units (hence, less to TV broadcasters) vs allocate more spectrun to TV broadcasters for advanced television services (hence, less to land mobile services). In other words, given the fixed capacity of the broadcast spectrum, the HDTV technical dispute is also part of a classic battle for economic

"turf".

Action: In 1987, the Federal Communications Commission (FCC) decided to freeze the spectrum, thereby declaring a temporary truce, pending the outcome of tests designed to determine whether HDTV could be implemented effectively within the spectrum currently available to broadcasters.

In 1988, the FCC tentatively determined that any additional spectrum capacity required for HDTV would have to come from the existing TV broadcast spectrum allocation, thereby challenging the broadcasters to develop new engineering solutions.

c) Compatibility with NTSC

Issue: Should HDTV transmissions be compatible with existing NTSC receivers?

Action: In September, 1988, the FCC determined that HDTV transmissions must be receivable on existing U.S. TV sets, at least during a transition period, so as not to cause the American public to suffer disruptions in its television services

Although this compatibility requirement was consistent with a similar compatibility requirement imposed in the 1950's when the original black and white NTSC standard was enhanced to include color and stereo sound, many Japanese observers regarded it as a major blow to their NHK MUSE format.

d) Broadcast Standard(s)

Issues: Should the FCC adopt one HDTV standard for U.S. broadcasting, as was done earlier for NTSC? Or should it accept more than one standard? Which standard or standards should be adopted?

Options: The FCC has taken no decision yet, pending the outcome of extensive comparative tests. Three of the more prominent candidates are noted below. MUSE has been thoroughly tested; the other two are still under development.

NHK MUSE: Origin[illegible]eloped by Japan Broadca[illegible]tany (NHK) for direct broadcast[illegible]te (DBS) and adapted to terrestrial broadcasting.

16:9 aspect ratio (width to height), 1125 lines, 60 fields per second, one 8.1 Megahertz (MHz) channel; requires a converter to display a degraded signal on an NTSC receiver.

HDS-NA: Developed by North American Philips Corporation (NAPC)

16:9 aspect ratio, 1050 lines, 59.94 fields per second; requires two 6 Mhz channels, one for the regular NTSC signal and one for additional HDTV information.

NOTE: Although the NTSC format was originally specified as 60 fields per second, it was modified to 59.94 in the 1950's to accomodate color signals. However, the frequency is usually quoted as "60".

NYIT: Developed by Dr. William Glenn at the New York Institute of Technology.

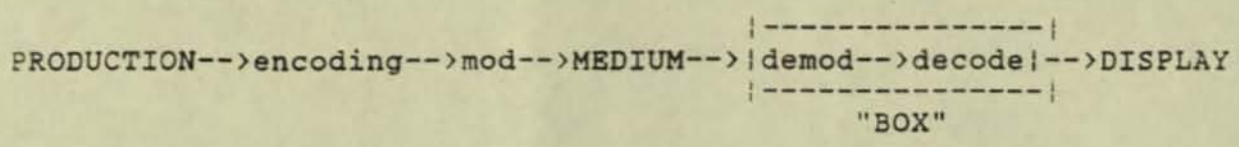
16:9 aspect ratio, 1125 lines; requires two channels, one (6 MHz) for the regular NTSC signal and another (approx 3 MHz) for the additional HDTV information.

ACTV-II: Developed by the David Sarnoff Research Center.

16:9 aspect ratio, 1050 lines; requires two 6 MHz channels, one for ACTV-I (EDTV) signal which is compatible with NTSC, and a second for the additional HDTV information.

e) Compatibility Across Media

A somewhat more detailed version of the simplified system diagram presented earlier (Part A, paragraph 4) appears below:



The new diagram indicates that an HDTV signal leaving a production studio is first encoded for transmission -- e.g., one channel for MUSE or split into two encoded signals for HDS-NA or NYIT. The encoded signal(s) are then modulated for subsequent transmission through the chosen medium -- broadcast, satellite, cable, fiber, etc. For the purposes of the present discussion, the "box" in the consumer's home does two things: first, it demodulates the transmitted signal; then, it decodes it.

Modulation/demodulation techniques are specific to each medium, and there may be more than one technique available for each medium. Hence, HDTV disputes about using the same format or compatible formats across media are referring to the encoding/decoding techniques.

Needless to say, media restricted to narrow bandwidth, e.g., U.S. broadcasting, won't be able to encode the 100 MHz studio production signals as effectively as media having larger bandwidth capacities, e.g., satellites or fiber. The narrower the bandwidth of the transmission medium, the more likely its encoding/decoding scheme will lose discernable aspects of the original studio signal; hence, the poorer the perceived quality of the final output on the consumer's display.

Issue: Should all of the various transimssion media encode/decode their signals in the same way, or should each medium be allowed to employ its own internally optimized coding formats?

Pro/Con: Common standards would tend to drag the quality of all media down to the level attainable by the medium with the smallest bandwidth, i.e., broadcasting. On the other hand, independent standards would permit each medium to achieve its own highest potential quality, but would require more components in the "box"; hence it would probably be more complex and more expensive.

2) Architecture

Even if all of the above questions [illegible] standards were miraculously settled overnight, processor/receiver designers would still have nightmares. Should the "box" be "open" or "closed" or something in-between? And at which level?

As noted earlier (Part A, paragraph 6), an open architecture might permit consumers themselves to add capabilities -- e.g., multiple broadcasting formats, multiple media -- via PC style add-in boards or Nintendo cartridges. Or the architecture might be open at the factory level, permitting consumers to specify the desired mix of features to be installed by the factory, like car options. By contrast, closed architectures might simply come with a pre-specified set of capabilities, like today's TV's and VCR's, consumers merely choosing amongst a range of competing models having different pre-specified features.

More openness might enable more consumers to get the exact mix of features they desired; but it might also lead to more expensive products, greater consumer confusion, and, perhaps worst of all, greater initial consumer resistance to HDTV. On the other hand, closed systems are also at risk because, in fact, the standards questions haven't been settled yet, and because the converging computer/communications/video technologies underlying HDTV are subject to unpredictable breakthroughs.

3) Strategic Impact

a) Believers, Critics, and Cynics

Issue: Will HDTV have substantial impact on the strategic infrastructure of the U.S.?

Pro: Yes. HDTV will be a substantial driver for electronic components, such as semiconductors, which, in turn, support the computer industry and other strategic segments of our economic infrastructure. In particular, most projections indicate that, eventually, HDTV will become a larger consumer of semiconductor products than the computer industry. Hence, if the U.S. does not own a substantial share of the HDTV market, it will eventually lose the semiconductor industry, the computer industry, and other linked strategic industrial sectors.

[E.g., the American Electronics Association

(AEA), Zenith, Prof. Schreiber (M.I.T.), the Congressional HDTV Caucus]

Con: No. As developed by its Japanese and European proponents, HDTV is a short-sighted analog technology which will soon be made obsolete by progress in digitally based computer workstations, fiber optic networks, and information processing software -- all three areas in which the U.S. maintains a commanding technical lead.

[E.g., George Gilder]

Con: No. HDTV is too little, too late. Even the most optimistic projections don't forecast its making substantial demand for semiconductors before the late 1990's. By that time, if present trends continue, the U.S. semiconductor industry will be extinct.

[E.g., "anonymous" Wall Street anaysts]

c) Foreign vs Domestic Technology

Issue: Should a foreign owned and/or controlled firm be permitted to participate in government sponsored R&D programs in HDTV, such as DARPA'S?

Pro: Yes, if the firm does most of its R&D in the U.S. and does most of its manufacturing here.

Applying these criteria to specific firms based on their track records to date in R&D and manufacturing, the answer is "maybe" for North American Philips (Netherlands), "maybe" for Thomson (French recent purchaser of RCA TV operations from GE), and "no" to all firms based in Japan. Indeed, application of these criteria might usefully exclude certain U.S. owned firms which have consistently located substantial portions of their manufacturing and R&D offshore.

Pro: Yes. U.S. firms are coming late in the HDTV game and must catch up our foreign competitors. Including foreign firms in joint ventures would enable the U.S. firms to learn from their foreign partners.

Pro: Yes. Department of Defense procurement regulations do not seem to permit exclusion of foreign firms, except in cases where national security considerations are involved.

Con: No, because of HDTV's projected strategic impact on the U.S. economy.

C. Who's Who -- A Partial Listing of Major Players in HDTV

1) U.S. Government Agencies

- Federal Communications Commission (FCC)
  Independent U.S. government agency established in 1934; responsible directly to Congress; regulates interstate and international communications by radio, television, wire, satellite, and cable; its five Commissioners are appointed by the President, confirmed by the Senate.

- National Telecommunications & Information Admin. (NTIA)
  Established in 1978 within the U.S. Dept. of Commerce, NTIA is the President's principal advisor on communications and information policy issues; NTIA also advises the Congress and Federal regulatory agencies, including the FCC; manages Federal Government's use of radio spectrum.

- Defense Advanced Research Projects Agency (DARPA)
  Established in 1958. DARPA is the central research and development organization for the Department of Defense (DoD) and has primary responsibilities to help maintain U.S. technological superiority over, and to prevent unforeseen technological advances by its potential adversaries.

- Department of State
  Leads U.S. delegations to international bodies dealing with telecommunications issues, e.g., CCIR.

- House Subcommittee on Telecommunications and Finance
  House component having direct jurisdiction over the FCC; Chairman Markey's hearings on HDTV have been a major force propelling HDTV onto the national agenda.

2) U.S. Private Sector Agencies

- American Electronics Association (AEA)
  Trade association mainly composed of U.S. owned electronics firms; sponsored well-publicized ATV task force report, "High Definition Television (HDTV): Economic Analysis of Impact" (1988), which helped put HDTV on the national agenda.

- Advanced Television Systems [illegible]e (ATSC)
  Founded by the IEEE, [illegible]ational Association of Broadcasters (NAB), the National Cable Televion Association (NCTA), and SMPTE; coordinates the development of national technical standards for advanced television systems; also makes recommendations for U.S. positions in CCIR.

- Advanced Television Testing Center (ATTC)
  Sponsored by U.S. broadcasters -- ABC, CBS, NBC, Public Broadcasting Service (PBS), the Association of Independent Television Stations (INTV), the Association of Maximum Service Telecasters (MST), and the National Association of Broadcasters (NAB) -- this center will begin testing alternative proposals for advanced television transmission standards in October, 1989; its findings will probably be given substantial credance by the FCC.

- Committee to Preserve American Color Television (COMPACT)
  Coalition mainly composed of labor unions in the U.S. color television industry; founded in 1976, it has been active in trade policy issues, successfully bringing antidumping procedures against manufacturers in Japan, Korea, and Taiwan.

- Electronic Industries Association (EIA)
  Largest electronic industry trade association; includes many foreign owned firms; sponsored report by R.R Nathan Associates forecasting HDTV impact.

- FCC Advisory Committee on Advanced Television Service
  Set up by the FCC to advise it on issues related to advanced television, including HDTV.

- Institute of Electrical and Electronics Engineers (IEEE)
  Largest and most comprehensive U.S. professional society covering all phases of electrical and electronics engineering.

- Society of Motion Picture and Recording Engineers (SMPTE)
  Preeminent professional society for movie and TV engineers; endorsed Japan's NHK production standard; a co-founder of ATSC.

3) Foreign agencies

- CCIR -- International Radio Consultative Committee, the part of the International Radio Telecommunication Union which sets voluntary radio/TV communication standards.

- EUREKA 95 -- European HDTV consortium founded in 1985; funded over $100 million in R&D; developing production and transmission standards incompatible with Japanese proposals.

- NHK -- (Nihon Hoso Kyokai) Japan's National Broadcasting Company, a well funded quasi-governmental agency responsible for national public television; sponsored over $500 million in HDTV research during past 15 years; developed NHK 1125/60 production standard and MUSE transmission standards.

4) Firms and laboratories

- C. F. Thomson -- French government owned consumer electronics firm; recently bought RCA and other consumer electronics operations from GE; holds approximately 26 percent of U.S. color TV market.

- David Sarnoff Research Center -- formerly part of GE/RCA, now part of SRI a U.S. contract research firm; however, it still has ties to Thomson; performs research in consumer electronics; staff = approx 450.

- North American Philips Corporation -- Consumer electronics firm based in U.S.; owned by Philips Industries; employs over 12,000 people; major R&D facility in Briarcliff Manor, N.Y.; developer of a proposed U.S. HDTV transmission standard; holds approximately 22 percent of U.S. color TV market.

- Philips Industries -- Dutch consumer electronics firm; parent of North American Philips; major participant in European Eureka 95 HDTV project.

- Zenith Electronics -- Only major U.S. owned firm left in television manufacturing; approximately 15 percent of U.S. color TV market.

- Major Japanese consumer electronics firms (Sony, Toshiba, Hitachi, and Matsushita) -- plan to market HDTV receivers and VCR's by 1991.

HDTV: The Technology *du Jour*

Proposals are flying around Washington to boost development of a high-definition TV capability in the United States. Can a depleted industry take on the Japanese?

TO HEAR SOME PEOPLE tell it, the industrial future of the United States will be determined by which manufacturers' names will be on the high-tech television sets that are expected to become a hot consumer item in the late 1990s. If none of them are American, the United States risks "missing out on the 21st century," says Representative Don Ritter (R–PA).

High-Definition Television, or HDTV, has consequently become what one observer describes as the "technology *du jour*" in Washington. Congressional hearings on the topic play to standing-room-only audiences. The Bush Administration is thinking of relaxing antitrust rules and giving tax breaks to U.S. companies developing HDTV. The American Electronics Association (AEA) last week called for $300 million in federal R&D funds to push the technology along, and it proposed the formation of a novel government-industry partnership, backed by $1 billion from Uncle Sam, to guide the development and production of HDTV systems. It is an astonishing leap to prominence for an issue that barely raised a flicker of public interest a year ago.

The outcome of all this political churning could have implications that extend well beyond television manufacturing, for what emerges in terms of federal support for HDTV may pave the way for broader changes to antitrust laws and provide a model for government funding for R&D in other critical areas such as machine tools and x-ray lithography. Indeed, this is one reason why HDTV is attracting so much attention. Says Brookings Institution economist Kenneth Flamm: "They see this as the shock troops landing on a beach that has to be invaded."

Why HDTV? The short answer is that billions of dollars and thousands of jobs may rest on whether or not U.S. companies can compete with Japanese and European manufacturers in producing HDTV equipment. A study done for the Commerce Department last year forecast that the U.S. market for HDTV receivers—which will have film-like picture quality, big screens, and the sound reproduction of compact disc players—will amount to $140 billion over the next 20 years. In November, the AEA upped the bidding: a $500-billion market could develop by 2010 for all HDTV-related equipment, including VCRs and video cameras, it predicted.

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"If the private sector doesn't want to pursue this without massive infusions from government, there is nothing we can do."

—Robert Mosbacher

But what's new? Similar dire predictions were made about U.S. failure to compete in the market for stereos and VCRs. But HDTV may be different because it will be on the technological cutting edge. HDTV receivers will be stuffed with more memory chips and microprocessors than today's personal computers. This means that, if the AEA's market projections are even remotely accurate, the manufacture of HDTV receivers could drive innovation in semiconductors, the effects of which would ripple through the electronics industry. And the advanced display technologies being developed for HDTV could have applications ranging from medical diagnostics to computer-aided design. "The issue is not a prettier picture in the living room. The issue is the industrial future of the United States," says David Staelin, an economist at Massachusetts Institute of Technology who recently completed a study of the U.S. consumer electronics industry as part of a huge MIT report on American competitiveness.

It will be an uphill fight to develop a domestic capability in HDTV though. Japanese and European companies have been working on HDTV systems for years, while U.S. efforts have been slow in getting off the ground. "The facts are very stark," says Solomon Buchsbaum, executive vice president of AT&T Bell Labs. "Right now, Japan and Europe are ahead of us in HDTV development."

Why? By now it is a familiar story: Both the Japanese and European efforts have benefited from substantial infusions of government funds, and they have involved cooperative ventures linking several electronics companies in the development of complete HDTV systems. Standardized formats, such as the number of lines per TV picture, were also established early on, to encourage cooperative development of studio production equipment, broadcasting systems, and receivers.

The core of Japan's HDTV effort is an R&D program begun in 1970 by the giant National Broadcasting Company (NHK). It is estimated to have been bankrolled by the federal government to the tune of $500 million. Private companies, including Sony, Toshiba, Hitachi, and Matsushita, joined the program in 1983 and, according to a Japanese government estimate, they have put about $400 million into the venture.

The Japanese decided early in their program that they would broadcast HDTV signals via satellite directly to individual antennas linked to each receiver (see box). Test broadcasts began earlier this year, and the plan is to begin marketing HDTV receivers and VCRs in 1991.

In response to the Japanese developments, the Europeans started a $200-million coordinated HDTV program in 1986. Called Eureka-95, it was the first substantial effort launched by the Eureka program, Europe's major multinational effort to pro-

relatively narrow signal that can be handled by the various broadcast media.

The fiercest constraints are in terrestrial, over-the-air broadcasting, in which TV channels are limited to 6 megahertz. The airwaves are already jammed, and a host of new users such as cellular telephones are clamoring for space on the spectrum. In most major cities, in fact, all the broadcasting slots are already allocated.

Last September, the Federal Communications Commission (FCC), which regulates terrestrial broadcasting in the United States, issued broad ground rules for HDTV: no additional bandwidth will be allocated, and the 160 million conventional TV sets currently in U.S. homes must not be rendered obsolete by a switch to HDTV. A single broadcasting standard will be chosen from contenders that meet those rules.

Some 20 groups have developed proposals, but there are generally acknowledged to be about half a dozen serious contenders. These are the groups that will be battling it out at the Alexandria test facility.

The proposals fall into two general categories: those that intend to broadcast HDTV signals that can be shown on conventional TV sets, and those that would simultaneously broadcast a conventional signal and an incompatible HDTV signal on different channels.

Among those in the first camp are Yves Faroudja, a French engineer and entrepreneur who runs his own research labs in Sunnyvale, California; North American Philips, a subsidiary of the Dutch electronics company, which has spent $15 million at its labs in Briarcliff, New York, developing an HDTV system for the United States; and the David Sarnoff Laboratory in Princeton, New Jersey, the old RCA lab that is now owned by SRI International and which, on this project, is working with the National Broadcasting Corporation and the French company Thomson.

Faroudja and Sarnoff are proposing an initial step in which additional information would be added to a conventional TV signal. Existing TV sets would not notice much difference, but new, "enhanced definition" receivers would display sharper images. In a second stage, Sarnoff has proposed transmitting an additional signal in one of the so-called taboo channels, the dead space between existing channels that is now left vacant to prevent interference. The second signal would be combined with the conventional signal in a high-definition receiver to produce very sharp images and digital sound. Philips is proposing to skip the first stage and go straight to a high-definition system, which, like the proposed Sarnoff system, would add a second signal in a taboo channel. Philips, in fact, already has such a system under test.

Among the groups advocating an alternative approach is Zenith, which has developed a system for transmitting an entire HDTV signal within a single taboo channel. Because today's receivers would not be able to tune into the HDTV signal, conventional signals and HDTV signals would have to be broadcast simultaneously while HDTV is phased in. Eventually, conventional broadcasting would cease and bandwidth could be freed up for competing users.

Japan's NHK is expected to plant a foot in both camps by offering two alternatives. One is expected to be compatible with existing receivers and another, like the Zenith signal, would require simulcasting.

The tests of the competing systems are expected to run through 1990, and the results will feed into the FCC's decision. The system eventually chosen will be the standard only for terrestrial broadcasting—it will not apply to cable TV or to direct satellite-to-home broadcasting, which are not regulated by the FCC.

Therein lies a possible nightmare for terrestrial broadcasters. Because cable transmission and satellite broadcasting are not so constrained in bandwidth or so vulnerable to interference, they may be better mediums than over-the-air broadcasting for transmitting HDTV signals—indeed, that is one reason why both Japan and Europe have chosen direct satellite broadcasting for their systems. An even better medium, eventually, would be high-speed fiber optic networks carrying HDTV signals in digital form. Thus, if the alternative media develop their own broadcast standards, they may be able to snag more viewers. However, a variety of broadcast standards would then emerge, and receivers would not be compatible with all the broadcasting mediums.

Schreiber of MIT has an answer to this problem: build supersmart receivers that can be programmed like personal computers to decode a range of incoming signals. "Open architecture" receivers of this type could also be upgraded by plugging in new cards. Schreiber's group has already tested prototypes of his smart receiver, but so far the broadcast industry has shown little enthusiasm. ■ C.N.

mote high-technology cooperation among European companies.

Like the Japanese, the Europeans are developing a system based on a set of agreed-upon European formats (different from NHK's) and have also chosen to broadcast HDTV directly from satellite to homes. Test transmissions are planned for 1990 and the system is scheduled to begin operation in Europe in 1995.

In contrast, U.S. efforts in HDTV are fragmented, as usual. They have not benefited from direct federal assistance, and there are as yet no agreed formats for the way HDTV programs will be produced and broadcast. As a result, different companies are taking very different—and generally incompatible—approaches.

Moreover, the technological and manufacturing base is severely limited because U.S. companies have steadily been dropping out of the consumer electronics business over the past few decades in the face of fierce competition from foreign (mostly Japanese) manufacturers. Zenith, in fact, is the only U.S.-owned company still making television sets, and there is not one U.S. company manufacturing VCRs.

Given this gloomy environment, it may seem like an impossible task to launch a viable U.S. HDTV effort. But those prodding the federal government to take some action emphasize the bright spots. For one: the Japanese and Europeans have tailored their systems around their own formats and designed them for direct satellite broadcasting; some of their technology may not be directly applicable if the United States opts for a different system. For another: the market for HDTV is expected to develop slowly because the early-model receivers will be expensive and massive. Perhaps the United States could build a better receiver.

Enter the Pentagon. Last fall, the Defense Advanced Research Projects Agency (DARPA) announced that it would launch a $30-million research and development program to develop high-resolution displays. This could be crucial for HDTV if it leads to low-cost flat panels or projection systems that would replace conventional cathode-ray tubes, which may be too bulky for big-screen HDTV receivers. Says James Carnes, vice president for consumer electronics at the David Sarnoff Research Center, which is developing an HDTV system: "HDTV will really take off when consumers can have bright, high-resolution displays that will fit through the door."

But more than a $30-million defense program may be needed. The AEA, the trade group that represents the interests of U.S. companies, is thinking big. Last week, it unveiled a proposal that calls for some hefty

federal outlays and a novel arrangement to guide government and private efforts.

For starters, the plan calls for DARPA's modest effort to be expanded to $100 million a year over 3 years. It would focus on key technologies, such as signals processing and the development of manufacturing systems, in addition to high-resolution displays.

Next, the plan calls for the creation of a board dominated by industry but with membership from government and academia, to coordinate and guide government and private HDTV efforts. The board's clout would come from $1-billion worth of low-cost federal loans and loan guarantees that it would use to back projects in individual firms or consortia.

As for the tricky issue of participation by U.S. subsidiaries of foreign-owned companies, the plan says they should be included if they perform most of the relevant R&D, design, and manufacturing in the United States and if they buy their semiconductors from U.S.-based firms. This could provide an entree for European companies, such as North American Philips, but would probably exclude many Japanese firms.

The plan also calls for a waiver of the antitrust laws to make such cooperation legal, and asks for tax breaks for some HDTV activities. And it suggests that the government should move as quickly as possible to adopt a format for broadcasting HDTV signals so that developments by individual companies can proceed in a common direction.

A novel aspect of the plan is that the proposed board, which would be known as the ATV Corporation, would hold title to technology underlying whatever broadcasting standards are eventually adopted in the United States. This would give it considerable authority to determine who could participate in the venture.

The Bush Administration may buy some elements of this plan. Commerce Secretary Robert Mosbacher, who testified before the Senate Commerce Committee last week shortly before the AEA unveiled its wish list, said that he personally favors relaxing antitrust restrictions and providing tax incentives to stimulate the industry. Mosbacher has promised to submit Administration proposals to Congress for HDTV by 1 July.

Mosbacher made it plain, however, that the Administration is unlikely to come through with a major cash outlay. "If the private sector doesn't want to pursue this without massive infusions from government, there is nothing we can do," he said. "I think they are hoping that Uncle Sugar will fund it and I don't think they should."

This drew a sharp response from committee chairman Ernest Hollings (D–SC), who noted that last year Congress established a variety of programs in the Commerce Department that would be the focus for supporting critical technologies such as HDTV, but the Administration has not funded any of them. Moreover, many key jobs in the department have still not been filled (*Science*, 14 April, p. 137). "I'm embarrassed for you," Hollings said, adding that he would work through the appropriations process to try to break some funds loose.

A half-dozen bills are in fact already in the congressional hopper to channel funds to HDTV, including a broad bill proposed by Representative Ritter that would provide $100 million a year in R&D funds and provide waivers from the antitrust laws for firms cooperating on HDTV.

Underlying the Administration's caution in getting involved in ventures like HDTV is a reluctance to establish industrial policy—in essence, to put the government in the position of picking potential commercial winners. The hesitation is understandable: many earlier attempts have been dismal failures. The Synthetic Fuels Corporation—a body similar in some respects to the proposed ATV Corporation—is a case in point.

But to some observers, such as National Academy of Engineering president Robert White, the debate over how to support HDTV points up once again the poor environment for fostering civilian technologies in the United States, and the lack of a mechanism in the federal government outside the Pentagon to fund industrial research. "We seem to careen from problem to problem. What we have is a much broader issue facing the economy, and we haven't puzzled that out yet," says White.

■ COLIN NORMAN

A Fast Track for High-Risk Science

When the National Science Foundation (NSF) asked its 1985 grant recipients how well they liked the agency's peer-review system, 38% said they were dissatisfied. A larger number—about two-thirds of the 9500 who responded—agreed with the statement that NSF is unlikely to fund high-risk, innovative research projects because its review process is too conservative. These results, cited in a report published last year, came as something of a shock, amounting to "a serious accusation, if true," says NSF director Erich Bloch. The agency last week came up with a response, revealed by Bloch at the monthly meeting of the National Science Board on 12 May.

Constance Holden

Erich Bloch

This fall NSF intends to launch an experiment of its own, a program of innovative grants that will bypass the peer-review system and make up to $50,000 available to principal investigators who can convince NSF program officers that their ideas deserve support. "We are now drawing up the rules and regulations," said Bloch, "and we're trying to keep them as unobtrusive as possible." The goal will be to attract new ideas and adventurous scientists, giving them the resources to explore topics that might not meet with approval in a more formal setting.

NSF already has had some experience with this approach in its engineering directorate. James McCullough, director of NSF's program evaluation staff and an advocate of the experiment, says it was first tried by Nam Suh, NSF's former engineering chief, who has since returned to the faculty of the Massachusetts Institute of Technology (MIT). "When Nam Suh came here from MIT he brought an agenda," McCullough says, "and I think this was high on his list." Under Suh, the engineering directorate in 1986 launched a pilot program called "Expedited Awards for Novel Research." As of February 1989, it had made 239 one-time awards of no more than $30,000 each.

Bloch empaneled a group to look into the results, chaired by John Kemper of the mechanical engineering department at the University of California at Davis. The Kemper committee gave a favorable report in March, adding several recommendations. It said NSF should not only continue, but expand the experiment to include every division in the foundation. It recommended that the ceiling be raised from $30,000 to $50,000; that no external review be required for proposals submitted; that an expenditure limit for this type of research be imposed amounting to 5% of each program's budget; and that the awards be made on a one-time basis, so that researchers will be able to renew grants only by submitting to formal peer review. All the recommendations were accepted.

NSF is working out the details of its new award system and McCullough expects the agency to get promotional literature out to universities this summer.

■ ELIOT MARSHALL

f: HDTV

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MAY 8 _ 1989
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****
* DIGITAL *
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INTEROFFICE MEMORANDUM

TO: Distribution

DATE: 03 MAY 89
FROM: Paul J. Curtin
DEPT: NEW COMPUTING STRUCTURES
EXT: 223-6596
LOCATION: MLO12B/U10
NET ADD: ASABET::

SUBJECT: BCG Presentation Notes

Attached is a copy of the presentation used for discussion by the Boston Consulting Group at a meeting in Maynard on April 19, 1989. They will be issuing a report to AEA soon and wanted feedback from Digital.

Attending the meeting were:

Paul Curtin	Bill McDonough
Rich Kalin	John J. Smith
Henry Crouse	Tom Gannon
Howard Fineman	Carlo Infante
Charles Fowler	Walt Dunham

After the meeting, Henry Crouse, myself and Todd Hixon (VP, BCG) had a conversation. BCG was interested in learning what kind or kinds of consortiums Digital would support in the HDTV area. He was informed:

- that Digital would not be interested in joining a entity whose purpose was to produce and sell consumer products (i.e., home tvs). Digital markets to a commercial/industrial customer.

- that Digital would seriously consider supporting an entity whose purpose was to design, develop and manufacture base technology products that are used by both workstation/computer systems and future HDTVs. These technologies include displays, semiconductors and communications technologies.

We will continue a dialogue with BCG.

Regards,

CREATION OF A U. S. BASED ADVANCED TELEVISION INDUSTRY

Discussion Notes

Prepared by

The Boston Consulting Group

Exchange Place
Boston, Ma 02109

April 17, 1989

These notes contain preliminary material used for purposes of discussion on April 17, 1989. They will be most meaningful to those who were part of the disucssion

OBJECTIVES

Create a competitive U. S. Advanced Television (ATV) industry

- U. S.-based industry has a large share of the U. S. market (>60%)
- Product performance, design, quality, and cost fully competitive
- Bulk of product value added U. S.-origin (including components)
- Technology content (design, semiconductors) primarily U. S.-origin

Create base technology and infrastructure that will benefit other key U. S. industries

• Technology	DSP design flat panel displays advanced high resolution CRTs
• System Infrastructure	electronic and electro-mechanical assembly rapid design material management
• Component Infrastructure	DSP and VRAM manufacturing advanced CRT manufacturing flat panel display manufacturing

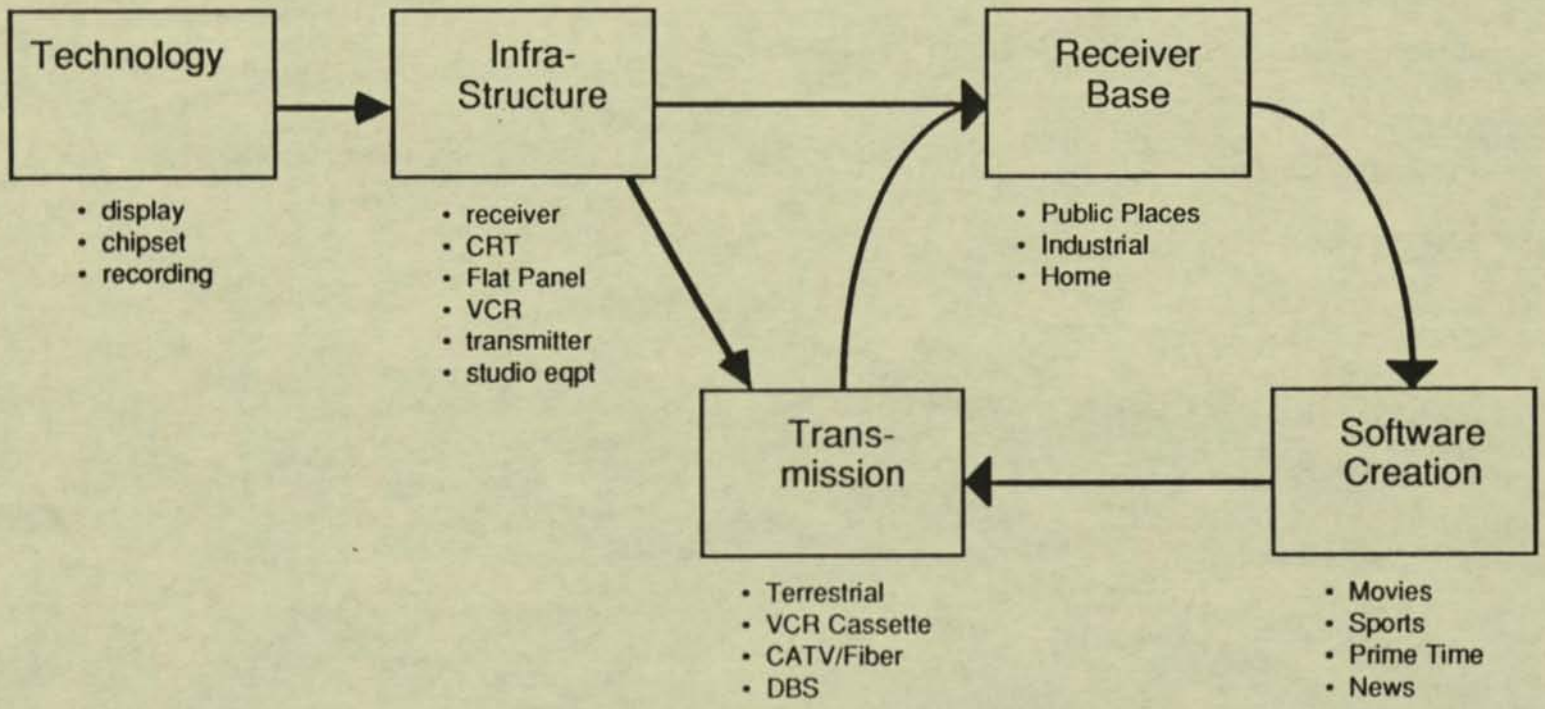
INDUSTRY/GOVERNMENT PARTNERSHIP PROCESS

1. Industry defines problem and proposes assistance that is needed
   - Market opportunity
   - Technology trends and opportunities
   - Competitive position of U. S. companies and infrastructure

2. Government puts in place programs and resources
   - Policy and legislative framework
   - Leadership structure
   - Incentives and economic assistance for participating companies

3. Individual companies make decisions to invest and participate
   - Individually
   - Through investment in a new company (RCA model)
   - Through joint ventures (e.g., ATT/Zenith venture)

U. S. ATV SYSTEM ELEMENTS



THE PROBLEM: OVERVIEW

The U. S. is dramatically behind Japan and Europe in quality of manufacturing infrastructure heeded to support an ATV business.

- Consumer electronics is a *manufacturing* business ⇒ plant level capabilities are necessary for success
- Manufacturing has been the "Achilles Heel" of U. S. consumer electronics

Some key technologies required for ATV are weak in the U. S.

- Hi-Res CRTs, flat panel displays, RAM process

Launching an ATV business is a "chicken-and-egg" problem

- Consumers want available software
- Broadcasters and producers want a receiver base
- Required investment is huge:
  - $20B - $40B for broadcasting equipment
  - $60B - $90B to put an ATV and an AVCR in 50% of U. S. homes

THE PROBLEM: KEY LINKAGES IN THE CHAIN

World class ATV industrial infrastructure for is needed for U. S. industry to dominate the U. S. ATV market ... and the market for related systems and components

- Investment in product or even process R&D does not offset this weakness

Pump priming mechanisms are needed to build the ATV receiver base

- Software availability is critical
- AVCRs and HD videotapes are probably the fastest, most economical way to build software availability and receiver demand — *tens of millions of dollars invested in software can sell billions of dollars worth of hardware*

Rapid development of ATV-related technologies is more likely to be the result than the cause of a robust ATV infrastructure and consumer market in the U. S.

- Technology for first generation ATV products will soon be in hand
- Achieving cost-effective volume production is the strategic challenge

MARKET DEVELOPMENT SCENARIO

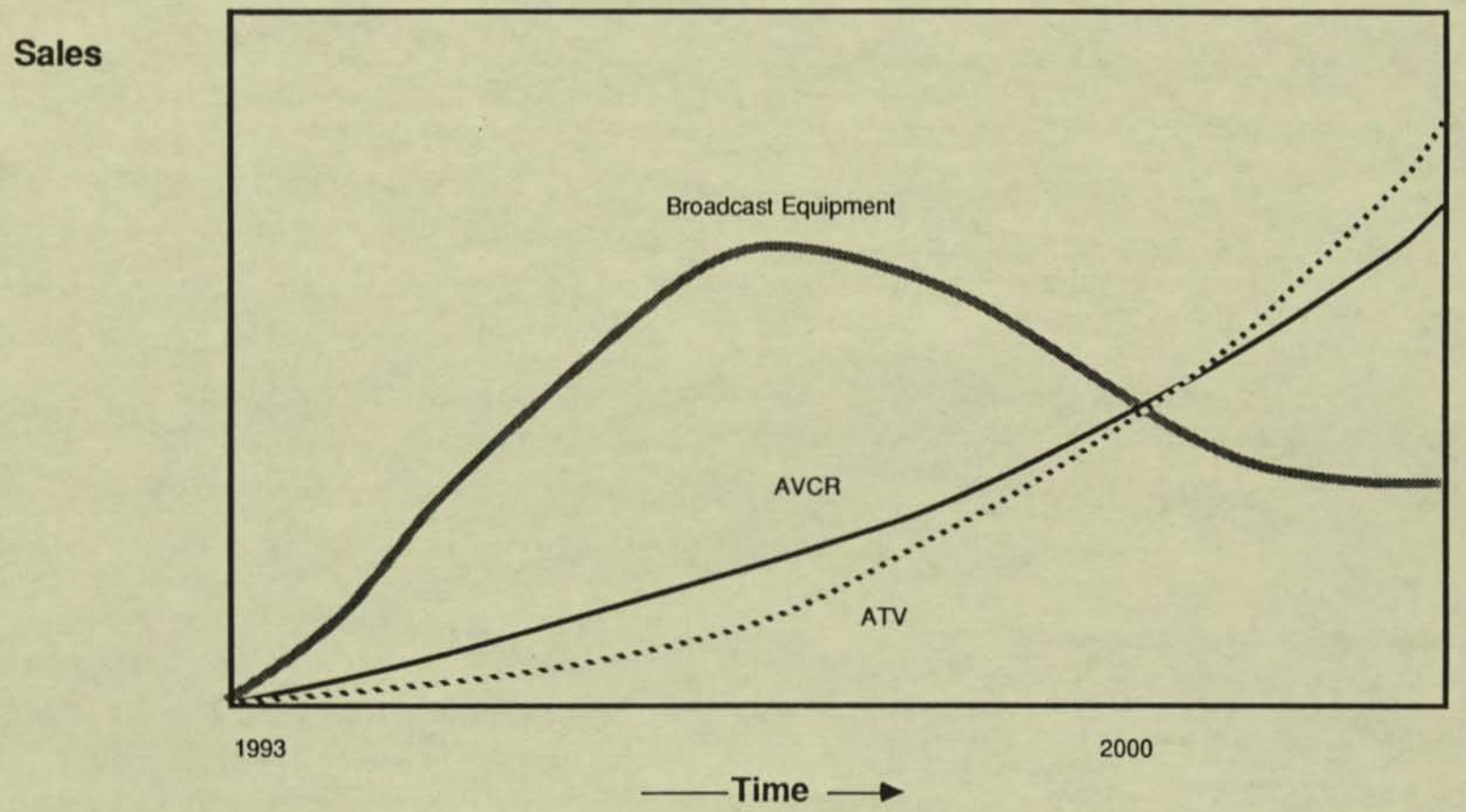
(Rough and Preliminary)

	Annual Market in mid-90s		Annual Market ~2000	
	Units	$million	Units	$millions
ATV	~200k	~$400	~1000k	~$1,500
AVCR	~300k	~$450	~1000k	~$1,000
Broadcast Equipment	Total market of $35 billion between 1993 and ~2005 Annual market peaking at about $5 billion			

Source: BCG rough estimates based on interviews and a range of industry statistical sources.

ATV MARKET DEVELOPMENT

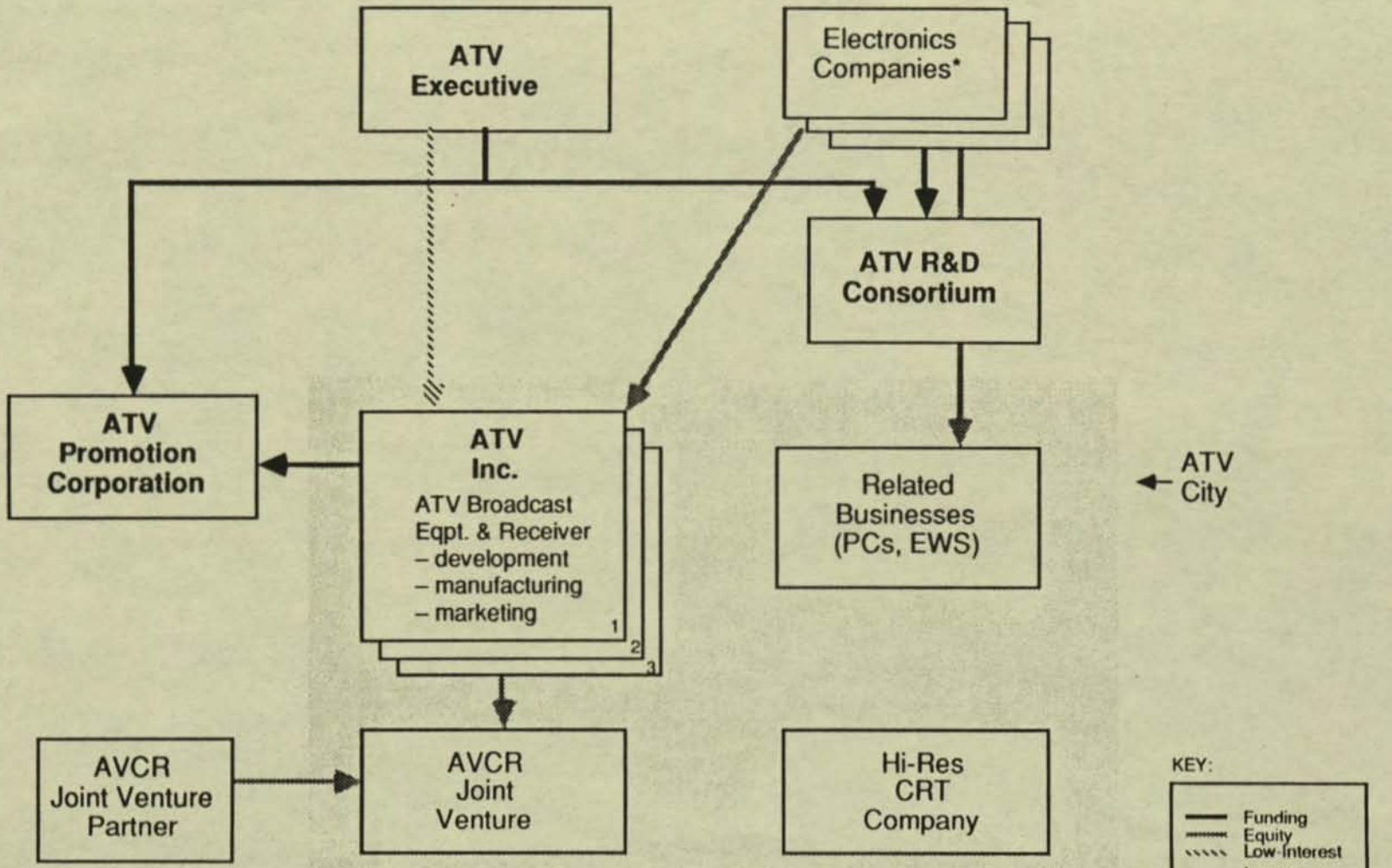
Schematic



OUTLINE OF BCG THINKING

Major New Steps	Desired Outcome	Reason
R&D Consortium	Consortium formed to develop key ATV Technologies	Improved technology needed for ATV and related industries
ATV City	Create world-class, co-located industrial infrastructure	Competitiveness with Japan Rapid product development
ATV Executive	Leads ATV industry development Administers government assistance	Leadership and monitoring essential
ATV Inc.	One or more new organizations formed to product ATV products in ATV city	Fresh start, clean infrastructure Entrepreneurial environment
Strategic Use of Standard	Negotiate and fund development of U. S. industry	Major untapped source of leverage
ATV Promotion Co.	Seeds market with hardware and software	Chicken-and-egg problem threatens slow start for hardware vendors

ATV INDUSTRY STRUCTURE



* Both U. S. and Non-U. S.-based

ATV CITY

Purpose

- Create first-class infrastructure for a competitive ATV industry
- Create technical and intellectual critical mass
- Create a fertile environment for suppliers and related businesses

Program

- Mandate co-location of key ATV industry functions and participants
- Offer economic incentives to investors ("ATV Incs.") ...
  - R&D grants, tax credits, etc.
  - low-interest "infrastructure" loans
  - favorable anti-trust review of joint ventures
- That meet specified criteria ...
  - develop and produce ATV broadcast equipment, ATV, AVCR
  - key activities located at ATV city (management, R&D, engineering, system manufacturing, materials management)
  - U. S. technical value added high (U. S. ownership not necessary)

Results Expected

- Economic incentives draw forth investors (individual companies, joint ventures, or a new consortium company)
- ATV city extremely competitive in cost, quality, and innovation
- Producers or related products and suppliers locate in and around ATV city $\Rightarrow$ self-reinforcing growth of infrastructure

WHY A SINGLE SITE FOR KEY ATV ACTIVITIES?

Assures creation of first class industrial infrastructure

- New, state-of-the-art facilities (not incremental upgrade of weak plants)
- Co-location of key activities ⇒ rapid and cost effective realization of new products
- Timely commercialization of emerging new technologies

A practical way to monitor U. S.-based content for companies participating in the program

- Activity must be visible at ATV city — both manufacturing and technical

Creates a self-reinforcing infrastructure-building process

- Suppliers move in to be close to customers
- Human infrastructure builds up ⇒ "silicon valley effect"
- Related industries locate in the same area (e.g., computer companies)
  - maximizes value of spin-offs to other industries (e.g., defense)

SCOPE OF ATV CITY

Products	Functions
Initially:	
• ATV Receiver	• System Assembly
• AVCR	• Circuit Board Manufacturing
• Broadcast Equipment	• R&D
	• Engineering
	• Marketing & product development
	• Sourcing & materials management
Longer term:	
• Hi-Res CRTs	
• Flat Panel Displays	
• PCs, Workstations, other computer products	

ATV INC.

ATV Inc.s are organizations formed to develop and manufacture ATV products at ATV City.

Several possible models:

1. Subsidiaries of established electronics companies

2. Joint ventures of 2 or 3 companies (e.g., ATT/Zenith)

3. A consortium company formed by multiple parents to develop ATV market and technology

   - To be successful, must quickly attain independence ...
   - And have sufficient committed capital to build plants and survive 5 - 7 years of operating losses

Foreign-owned company participation should be welcomed ... in the context of explicit U. S. content standards

- A JV with a foreign company is could contribute greatly to successful launch of an AVCR
  - *a comeback strategy for Sony in the VCR market?*

DISPLAY ACTIVITY AT ATV CITY

Best at first to focus on receivers, VCRs, and broadcast equipment

- System level of the business
- Similar technologies and manufacturing processes
- Traditional CRT is a relatively mature technology requiring distinct skills
- Several capable large CRT suppliers with U. S. plants

Likely that display activity will develop at ATV City over time

- New CRT plants located close to customers
- New technology CRTs and flat panels

R&D CONSORTIUM

Purpose

- Stimulate investment in key ATV technologies
- Target quantum-jump improvements that benefit U. S. industry
- Share cost among multiple, interested companies and government
- Pool talents and technologies of companies and universities

Program

- Consortium created (under 1984 R&D Consortia Act)
- Funding from participating companies, DARPA, NIST
- Priorities set by board of directors
- Mandatory technology cross-licensing to participants at modest cost
- Foreign company participation invited

Results Expected

- Focused effort of high quality resources in key areas
  - second generation flat panels, advanced CRT, DSP design and fabrication, etc.
- Development of strong base in technologies key to ATV and related products

ATV EXECUTIVE

Purpose

- Give leadership to development of U. S.-based ATV industry
- Administer programs and funding
- Coordinate efforts of involved government agencies
- Monitor progress and respond rapidly to problems

Program

- Leads/jawbones/builds consensus to create needed capabilities and infrastructure
- Builds support in software and broadcasting industries
- Buys transmission standard patents and licenses manufacturers
- Funds R&D consortium and ATV Promotion Corporation
- Administers infrastructure loans

Expected Results

- A coherent program
- Emerging problems rapidly recognized and resolved

STRATEGIC USE OF THE BROADCAST STANDARD

Purpose

- Establish a high-quality standard for ATV transmission
- Maximize opportunities for U. S.-based vendors
- Avoid standards proliferation
- Maximize rate of market penetration by ATV products

Program

- Standard approved by FCC in normal manner
- Key criteria (among others):
  - high-quality "true high definition" standard, with growth potential
  - compatible with multiple media: terrestrial, VCR, CATV, DBS, eventually optical fiber
- Early decision whether MUSE and MAC are serious candidates
- ATV Executive buys right to standard (sale a condition of approval)
  - licenses technology to manufacturers (U. S.- and foreign-based)
  - negotiates for reciprocal licensing of related technologies (e.g., key VCR technologies)
  - royalty rates tied to amount and quality of U. S. content in product

Expected Results

- U. S. has a unified, high-performance HD standard
- Standard used as leverage to promote growth of U. S. industry and technology

ATV PROMOTION CORPORATION

Purpose

- Stimulate development of market for ATV hardware, transmission services, and software
- Solve "chicken and egg" problem

Program

- Non-profit corporation
- Receives funding from participating companies and ATV Executive
- Disseminates information of ATV products and technologies
- Undertakes "pump-priming" programs
  - software production and distribution (esp. videocassettes)
  - broadcaster investment
  - commercial and industrial applications
- Operates a "market research consortium" for ATV producers

Expected Results

- Create broad awareness of potential benefits and business opportunities arising from ATV
- Create shared view of market opportunity among equipment producers, broadcasters, and software developers/distributors
- Seed the market at early stages by stimulating hardware demand and software availability

PUMP-PRIMING MECHANISMS

Videocassette Availability

VCRs and cassettes look to be the most cost-effective way to start the ATV market

- Value to buying an AVCR before an ATV — major quality gain on NTSC set playing pre-recorded HD software
- AVCRs will cost less than ATVs — extra cost is in chips, not the CRT
- Cost to create videocassette availability is tiny relative to re-equipping local broadcasters
  - 1-2 copies of top 200 tapes in 10,000 outlets costs about $150 million
  - incentives of $20 - $50 million could rapidly put software in place

Establishment of a U. S. VCR industry would be a major step forward

- New standard, controlled by the U. S., creates an opportunity

PUMP-PRIMING MECHANISMS

HDTV Broadcasting

Local broadcasting is essential for development of a large market

- Live sports is one of the most attractive products for the HD medium

Requires a huge investment by broadcasters

- Replacement of studio and transmission equipment ⟹ costs $20m - $40m per station
- Questionable prospect for incremental revenue

Need to offer both motivations and incentives

- Extended license period in return for ATV investment?
- Tax credits?
- Doctrine that investment in ATV capability is "in the public interest"?

PUMP-PRIMING MECHANISMS

Commercial and Industrial Market

In early years, commercial and industrial applications will be a vital part of the market, e.g.:

- Bars, restaurants, hotels
- Trade shows and expositions
- Government, training, and education

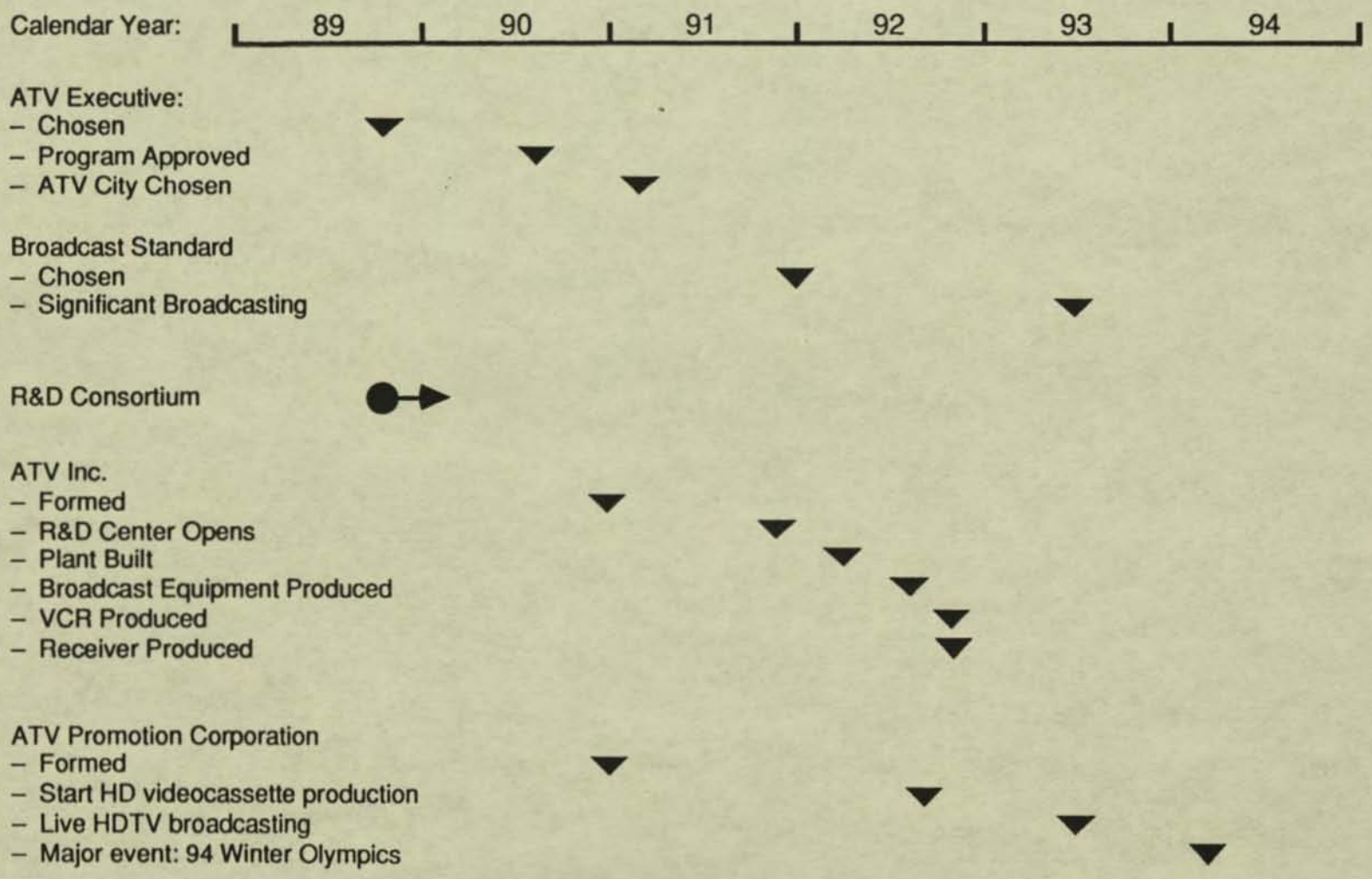
$\Rightarrow$ exposure which promotes consumer purchase

The Japanese manufacturers see these as the major opportunities in Japan in the 90s

ATV Promotion Co. and the ATV Executive can seed these markets via:

- Grants and consulting for experiment/showcase applications
- Providing equipment at economical lease rates
- Organizing significant government funded purchases at early stages of production

ATV DEVELOPMENT TIMELINE



A Friendly Family of Transmission Standards For All Media and All Frame Rates
With Some Comments on Production, Program-Exchange, and Display Standards

Executive Summary

This proposal is for a universal system of high-definition television *transmission* standards. The system is capable of accommodating all existing and a wide range of proposed formats. It allows each medium to configure its transmission format for optimum performance, considering the physical properties of the available channels. At the same time, it features exceptionally easy and inexpensive transcoding among widely varying transmission formats, requiring temporal interpolation only at the output of production systems and in receivers. It thus resolves the conflict between the need for exchange of programs among the various media and the desire of each medium not to be restricted in quality by the limitations of other media.

In the proposed transmission method, signals are divided into components, the data being grouped into 'packages' nominally 1/12 second long. Each component can therefore be thought of as a low-resolution, 12-fps progressively scanned picture. Components are combined to provide arbitrarily high spatial resolution as well as up to 60 progressively scanned (or even higher if desired) frames per second. The number and signal-to-noise ratio of the components varies from medium to medium; transcoding merely requires adding, deleting, and repacking components to achieve the highest quality given the physical characteristics of each medium. By a small variation of the duration of programs, "12" frames/sec becomes an integral submultiple of the frame rates of all TV and motion-picture systems used worldwide, thus simplifying the required temporal interpolation when converting to the display format.

The desirable characteristics of production, program-exchange, and display formats are discussed, and it is concluded that they should all be different. Thus, there are *four* different classes of formats that should be considered. The need for international uniformity of production and display formats is shown to be much less than for program-exchange and transmission formats. Current NTSC and PAL receivers must be served by today's signals. New receivers will have the capability of decoding a prescribed range of transmission formats, which, for a number of important reasons, will be decoupled from the display format.

Sections 1 and 2 are intended for all readers; the later sections are for TV specialists.

1. Background

Conventional TV systems use a simple raster scan and a video signal representing the point-by-point brightness of the input image, a scheme dating back at least to Bain's 1839 facsimile machine. (Similar — in some cases, actually more sophisticated — schemes were used even earlier to represent weaving patterns.) The key point is that, at the present time, camera, display, and video signal all use the same scanning standards in any one TV system, and that different standards are used in different countries. Still more standards are proposed for HDTV, and conversion from one to the other has become a serious problem involving both cost and quality, not to mention acrimonious debate. The preference for one standard or the other is neither entirely whimsical nor motivated solely by protectionist sentiments — there are real costs and potential quality problems associated with transcoding, particularly if it requires temporal interpolation.

Since 24-fps film plays such a central role in programming in all television systems, the friendliness of the TV system to film is very important. Systems that can make a one-to-one frame-to-frame conversion between film and television require less expensive equipment and get better motion rendition. This is the fortunate situation in the 50-Hz countries, which play film at 25 fps when used on TV. (Films made especially for TV are shot at 25 fps.) It is not surprising that Europe has resisted any 60-Hz production system, since that would entail giving up this important advantage without gaining any comparable benefit.

Motion rendition at 24 fps is not very good, but does not seem to be a source of dissatisfaction to today's viewers, even though they are exposed to much better motion rendition on video-originated subject matter. The 3-2 pulldown method gives even worse motion rendition than seen in the movie house. In principle, motion-compensated frame-rate conversion could give good motion when converting 24 fps to 60 fields/sec, but this has not yet been done commercially, and is likely to be more expensive than 3-2 pulldown.

The basic reason why transcoding is so difficult at present is because the video signals currently in use (and proposed for use in the NHK wideband system) are of the same directly displayable type as used by Bain so long ago. Transcoding such signals requires spatial and temporal interpolation, and the latter entails a tradeoff between smoothness of motion and sharpness of moving objects. While motion-compensated transcoding between PAL and NTSC has become technically quite successful, the transcoders are very expensive. Since they will never be made in very large quantities, they are unlikely ever to be cheap. This holds also for 1125/30/60[1] to PAL transcoding. On the other hand, cheap transcoders can readily be envisaged for receivers to be made in the millions.

From this argument, it is seen that easy transcoding is one of the most important characteristics of a transmission format, even within a single country. Although this paper is concerned primarily with transmission formats, careful consideration of such formats shows that their requirements are related to the particular uses to which they are applied. Clearly, other formats, such as those used for production, for international program exchange, and for display, are applied to quite different uses and therefore have quite different requirements. The

[1]In this paper, a/b/c designates a TV system with a lines/frame, b frames/sec and c fields/sec.

program-exchange format is the only one that needs international agreement.

2. The General Idea

We first distinguish between directly displayable (DD) and sequential-component (SC) formats. The DD format is what is used today, in which the scanning standard is suitable for directly driving a display. Normal camera output is in the DD form. At present, NTSC, PAL, and SECAM are the DD formats in use, and many other DD formats have been proposed for HDTV. An SC format is one in which the various components are transmitted in time sequence, and must at least have their sequence altered and their time bases adjusted for display. MUSE is in SC format and so are most MAC systems. Temporal interpolation is often required to go from SC to DD format. In the SC formats herein proposed for transmission for new TV systems, the signal comprises data *representing,* but not necessarily simply related to, the original optical image on the focal plane of the camera. Furthermore, this data is transmitted in units ("frames") nominally 1/12 second in duration, ranging from 4/50 to 5/59.94 seconds. The significance of the 1/12 sec period is that it corresponds to a whole number of fields in all the systems under consideration. This is one of the elements that facilitates transcoding, since it eliminates the need for temporal interpolation. Each SC format includes a digital component. A large range of SC formats is permissible, with the relevant parameters indicated by a header word in the digital data. For convenience, a small number of the most common formats may be indicated by a very short designation.

An example of an SC format useful in this method is that of the MIT CC system; another is the Zenith Spectrum-Compatible System. In both of these systems, the signal is divided into a number of spatiotemporal frequency components, and these components are transmitted sequentially. Digital data representing audio, the lowest-frequency component of the video, including all or part of chrominance, and some additional auxiliary information is also multiplexed. To display this data requires separating out the components, interpolating each to the display line and frame rate, and combining them to form a DD signal. A typical transmission format is shown in Fig. 1. In this scheme, two baseband signals of equal bandwidth are used, derived from adjacent scan lines to quadrature modulate a single carrier in the center of the channel.

In the different media, it may be desirable to repack the components to get the best quality taking account of special properties of the transmission channel. For example, in over-the-air transmission in today's taboo channels, Zenith has proposed sending the digital data during the vertical blanking intervals of neighboring NTSC stations. In cable applications, interference is not a problem, and higher CNR[2] may be counted on than in terrestrial transmission. Therefore, digital data can be transmitted continuously by the 'data-under' method,[3] which permits much more digital data to be transmitted and which makes 100% of the transmission time available for analog information. It is easy to see that transcoding between these two SC

[2]We distinguish here between the carrier-to-noise ratio (CNR) of a signal in a channel and the signal-to-noise ratio (SNR) of a video signal that is to be directly displayed.

[3]This method entails superimposing a reduced-amplitude analog signal on top of an unrelated multilevel (typically 2- or 4-level) digital signal.

formats requires only that the individual components be extracted and repacked. This requires multiplexing and perhaps time expansion or contraction, but not temporal interpolation. Of course, one signal may have more components and/or data and/or SNR than the other. In that case, some components must be dropped when transcoding from the higher- to the lower-capacity format, and some components may be absent when transcoding in the opposite direction. In both cases, the quality is limited by the information content of the poorer signal, but both signals are in precisely the correct format for further transmission.

It is seen from this example that the key to easy transcoding is that it is only *transmission* formats of the SC type that are involved, and not *display* formats. In transcoding, the signal is never put into DD form. Indeed, since the display format is independent of the transmission format, it is not necessary even to consider the display format during the transcoding process. Each 1/12 sec frame of information is rearranged into another 1/12 sec frame without any temporal interpolation. All that is needed is a frame store together with circuitry required to separate the components and to recombine them for retransmission.

The various components that comprise each 1/12-second data package can be thought of as independent still pictures. In transcoding, if the resolution of the components is changed, 2-dimensional interpolation must be performed. This may require reassembling the full image and again dividing it into components. Examples will be given of various schemes, some of which do, and some of which do not, require this operation.

3. Data-Packing Methods

In the SC format, various components are transmitted sequentially. In analog channels, such as terrestrial broadcasting, cable, satellite, and VCR's, most of these components are analog and some are digital. In digital fiber,[4] all components are digital. Unrelated digital and analog components can be combined for simultaneous transmission using the "data-under" method. Depending on the CNR and the required SNR for the analog signal, the digital data may be from one to four bits/sample. Two analog components can also be combined in similar fashion. One of the signals is coarsely quantized and the other reduced in amplitude so as to fit within one quantization step, and then added to the first signal. [1] This permits the CNR of the channel to be divided between two signals. When adaptively modulated, the highs components require only a very low CNR, so that it is quite practical to transmit two signals in a single channel at typical CNR's.

By these methods, the appropriate SNR can be achieved for each analog component while, at the same time, a substantial amount of digital information can also be transmitted. Of course, if desired, digital data can be transmitted only in one part of the frame, with the number of bits/sample chosen in view of the expected CNR. In the Zenith system, digital data is transmitted only during the vertical blanking interval of nearby NTSC stations so as to minimize interference. Where this kind of interference is not a a problem, digital data can be transmitted "under" all or most of the analog components.

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[4]It is also feasible to use analog transmission in fiber-optic cables.

In FM transmission, the appropriate SNR for each component can be achieved by using, in addition to the previous methods, appropriate time expansion/contraction. This operation changes the bandwidth, and hence the SNR, as a result of the relationship between modulation index and receiver SNR.

To maximize performance in imperfect analog channels, scrambling and/or adaptive modulation can be used on some or all of the analog components. [2] Adaptive modulation can be applied to any spatiotemporal component that is small in blank image areas. That involves multiplying the signal by a slowly-varying adaptation factor at the encoder and dividing it by the same factor at the receiver, thus reducing the effect of channel noise. Adaptation information is digitally transmitted. Scrambling involves transmitting the picture elements (pels) of each frame of a particular component in pseudorandom order. This results in dispersing the effect of most analog channel defects as random noise. When combined with adaptive modulation, the result is a ghost- and interference-free picture with vary large noise reduction in the blank areas where noise would otherwise be most visible. It is the use of these techniques that makes possible combining two components in one signal and still producing good pictures under typical channel conditions.

4. Some Examples Using Spatial Interpolation

In these examples, we shall allow spatial, but not temporal, interpolation during transcoding. This permits a wide choice of parameters for the components and makes it quite easy to devise systems optimized for various channel characteristics. However, it results in a more expensive implementation, since, in general, the entire luminance image must be synthesized into a single video signal and then redivided into components at each transcoding point. Although the process is straightforward, it loses the simple mapping between components and also may involve some quality loss in the filtering operations.

All the examples that follow are solely for the purposes of illustration. Other combinations of parameters are possible and may well be found superior with more experience in configuring the basic format for the different media, and as the properties of the media are better understood.

4.1 An Example of a Digital Transmission System

We first discuss a digital system since it is so easy to apportion channel capacity to each component. In Fig. 2, we have selected components to give a roughly diamond-shaped overall spatiotemporal frequency response, and we have assigned the SNR in inverse relationship to frequency. Thus the dc component has the highest SNR (59 dB, corresponding to 8 bits/sample) while the higher frequencies have the lowest SNR (23 dB, corresponding to 2 bits/sample.) We have taken two cases, 45 Mb/s and 90 Mb/s, in each case reserving 5 Mb/s for audio, adaptation data, and miscellaneous data. With equal horizontal and vertical resolution at an aspect ratio of 16:9, this gives 600x1064 and 872x1548 at 12 frames/sec for the two cases. Higher temporal resolution is provided at lower spatial frequencies, with chrominance rendered at 12 fps.

Note that this digital scheme is essentially uncoded. The high resolution achieved at moderate data rates is due entirely to using an efficient digital representation of the visual

information. Naturally, statistical coding can be applied to get even higher efficiency. There is some possibility that a very simple-minded nonstatistical DPCM system using only temporal prediction would give higher SNR, particularly in the higher spatial frequencies of the stationary image areas, but that is not the topic of this paper, which is concerned primarily with transcoding issues.

In a digital system, the order in which the various components are transmitted within each 1/12 second "frame" is not important, as long as it is known. In all likelihood, error correction would be used. Note that conversion from one video format to another is very easy as long as each component is identified and no temporal interpolation is required. It would be quite feasible to have a very-high-resolution program-exchange format that had more components, or higher resolution in individual components. Transcoding would still be simple as long as the 1/12 second duration for each package of data were preserved.

4.2 An Example of A Cable Transmission System

In cable systems, all signals are of the same amplitude, and therefore all channels can be used. Receivers do not have to discriminate against adjacent-channel signals much stronger than the desired signal. Furthermore, there is no fringe area; all subscribers are guaranteed a certain minimum CNR, which we take here to be 36 dB. There is no need to bunch the digital data into the NTSC vertical retrace interval. We therefore use the "data-under" method in which each analog highs component is added to a multilevel "digital" signal, the number of bits per sample, and thus the number of levels, being chosen in accord with the required SNR for the added highs component. The digital data represents RGB lows, audio, adaptation data, and miscellaneous data. The highs components are adaptively modulated and scrambled before being added to the digital data.

Note that this "cable" system is also suitable for over-the-air transmission in those applications where it is not necessary to minimize interference to nearby NTSC stations to the maximum possible degree. This would be the case in an ultimate high-efficiency system used by all broadcasters after the phase-out of NTSC. In broadcasting, the CNR would not be defined as precisely as in cable, and it may therefore be advisable to include a system at the receiver for discarding analog components when their SNR becomes too low.

In Fig. 3, we show the number of bits/sample used in the data-under channel for each component. Eleven components have 3 b/pel, six have 2 b/pel, and 3 have 1 b/pel, for a total of 20 highs components, giving 48 bits for each sample of a typical component. Since the 6-MHz channel is nominally equivalent to 12 Msamples/sec, each component is 50,000 pels, giving a resolution of 166x300. The maximum possible data rate of the data-under channel is 166x300x48x12 = 28.8 Mb/s, and the maximum data required for RGB lows is 166x300x3x8x12 = 14.4 Mb/s. Both of these figures are too high. As a practical matter, it would be easier to transmit at a lower digital rate, and to do some moderate nonstatistical coding on the RGB lows.

The system has a resolution of 664x1200 at 12 fps. Although their spatial resolutions are not exactly the same, it is readily seen that there is a one-to-one correspondence between components in the digital system and those in the hybrid cable system, so that transcoding remains quite simple.

For cable or over-the-air transmission, double-sideband quadrature modulation of a single carrier by two signals of equal bandwidth is the most efficient method of transmission, since the basebandwidth is then equal to the rf bandwidth. This is the arrangement used in Fig. 1. To minimize defects caused by carrier phase errors, the two signals should be derived from vertically adjacent image points, i.e., from adjacent scan lines. If scrambling is used, the line pairs should be identically scrambled. If transcoding involves vertical interpolation, each component should be reassembled from its two halves beforehand.

4.3 A Zenith-Type Over-the-Air Broadcasting System

At 36 dB CNR, the standard deviation of noise is 1/64 of the peak value. Theoretically, this is equivalent to 6 bits/sample, but 4 bits/sample is more practical. In a 6-MHz channel, this is, theoretically, equivalent to 12 Msamples/sec, for a peak data rate of 48 Mb/sec. If the digital data is confined to the vertical blanking interval, assumed to be 8% of the period, then the average rate is 3.84 Mb/sec. If we arbitrarily reduce this rate by half to account for even lower CNR and/or for somewhat less than 6 MHz effective bandwidth[5] then about 1.9 Mb/sec is available. Assigning .5 Mb/sec each to adaptation data and to audio seems reasonable, leaving .9 Mb/sec for digital lows. Almost any simple DPCM system would give adequate quality with 2 b/sample for each of two chrominance components and 3 b/sample for luminance, for a total of 7 bits/sample. At 12 fps, this gives a digital lows component 77 pels high and 138 pels wide. Using a more powerful coding method, such as vector coding, the resolution of the digital components could be improved.

We could utilize 92% of the transmission time for the analog components, for an equivalent average rate of 11 Msamples/sec. Using the same scheme as that of the cable system, there would be 23 components (three more are needed to get adequate resolution for the color lows) giving a resolution for each component 150 pels high by 266 pels wide, as shown in Fig. 4. The overall resolution at 12 fps is 600x1064.

Note that in this scheme, the SNR of all the analog components is the same, which is not efficient. Even with a CNR of 36 dB, the SNR of the highest-frequency components is excessive. It may be possible to transmit some additional digital data "under" these components, or even to put additional analog components "over" them to get even higher spatial resolution. All such arrangements could be accommodated with equal ease and with no change in the overall scheme. Of course, whatever packing method is used must be unambiguously indicated in a header.

For transmission in an NTSC environment, the digital data is transmitted in bursts of 1.33 msec every 1/59.94 seconds. To minimize interference with PAL transmissions, the digital data would be in bursts of 1.6 msec every 1/50 sec. In that case, the nominal 1/11.988 second interval becomes 1/12.5 seconds instead. For nonreal-time transcoding, the 4% difference can be accommodated by changing the program duration (e.g., by running a VTR faster or slower) as in done in Europe with movies. For real-time transcoding, temporal interpolation is required

[5]Where adaptive modulation and scrambling are used, the interference characteristics are very good. In that case, there is no need to have very sharp-cutting filters to define the channels, and some overlap can be used. It is quite likely, in that case, that signaling at the full 12 Msamples/sec with a channel spacing of 6 MHz will be shown to be quite practical.

as now used in PAL/NTSC conversion.

4.4 An FM Transmission System

Most TV programs, at some point, are transmitted in a satellite transponder channel using frequency modulation. In relay service, from point of origin to local television station or cable head end, large receiving antennas are used and the quality is very high. In DBS service, the emphasis is on small receiving antennas. Because of the rather sharp FM threshold, however, the CNR at the FM demodulator must be high enough to guarantee good-quality reception, with very little impulse noise.

FM has a "triangular" noise spectrum, so that the noise rises with frequency. This is quite desirable for the luminance signal, but undesirable for the color components if impressed on a subcarrier as in NTSC. In any event, since it is a one-dimensional signal that is modulated, the desirable frequency distribution of noise holds only in the horizontal direction. In the vertical direction, the noise is uniform. Subband coding can therefore be used with FM in order to achieve an overall noise distribution that is best from the perceptual viewpoint.

If a signal is divided into n subbands to be transmitted sequentially, then if each is time-compressed by the same factor n, all have the same SNR. By apportioning the relative time compression appropriately among the components, their relative SNR can be adjusted. Using a resolution of 150x266, each component has 40,000 pels, for an average transmission rate of 40,000x12 = 480,000 pels/sec. We elect to use the 45 components shown in Fig. 5. Note that 6 are devoted to data (audio, adaptation data, and dc component) and that we have, in this case, extended the chrominance temporal bandwidth to 24 fps. We assume a CNR of 15 dB and an rf bandwidth of 27 MHz. To achieve a difference of about 6 dB in SNR in adjacent components, we use time-compression factors as shown. The modulation index was computed using Carlson's rule and the SNR shown is therefore extremely conservative. Experience shows that much higher deviation can be used for the higher-frequency components and that we can expect an additional improvement in SNR in the blank areas of up to 24 dB by the use of an adaptive modulation index.[6]

It is believed that performance with these values will be excellent, although a simulation must be performed to be sure. With adaptive modulation, actual performance depends on image statistics. If the SNR is found to be too low, then the resolution or the number of components must be reduced; if higher than needed, which is likely in this case, then resolution or number of components can be increased.

Although not described here in detail, a format for magnetic tape recording would be similar to that for FM transmission by satellite. In both cases, the inherent CNR is low, the channel bandwidth available is fairly high, and the signal level is subject to substantial variation.

5. Some Examples Requiring Neither Spatial Nor Temporal Interpolation

If the components in all the various transmission formats have the same spatial resolution, no interpolation of any kind is required in transcoding. The formats would differ as to which

[6]These calculations were performed by Julien Piot.

components are digital and which are analog, and as to the number of components and their SNR. Synchronization methods might differ as well as the techniques used to avoid mutual interference with other transmissions. For the sake of this discussion, we shall assume that the resolution of all components is 150x266. Thus the 45-Mb/sec digital system, the Zenith-type system, and the FM system as described above are already of the right form.

5.1 A 90-Mb/sec Digital System

In Section 4.1, an increase in capacity from 45 to 90 Mb/sec was utilized by increasing the spatial resolution of each component but keeping the number of components the same. A simpler method of transcoding is possible by keeping the resolution of each component the same and increasing the number and SNR of the components. While this method is harder to think about, it is easier to implement in hardware since each component can be transcoded separately just by repacking. The components do not have to be recombined and reseparated with the synthesis and analysis filter banks that are required when the resolutions are different.

At a resolution of 150x266, there are 40,000 samples in each component. We previously reserved 5 Mb/s for audio and data, leaving 40 Mb/s for analog components. In 1/12 sec, this gives 84 components times bits/sample, for the distribution shown in Fig. 2, where there are 23 components ranging from 2 to 8 bits/sample. If, for a 90 Mb/sec rate, we reserve 10 Mb/s for audio and data, we have 168 components times bits/sample. Using the distribution of channel capacity shown in Fig. 6, we have raised the spatial resolution in the stationary areas to 750x1330 and have raised the spatial resolution at the higher temporal frequencies correspondingly. We have also raised the SNR of many of the components. It is safe to say that the picture quality of this configuration will be very high indeed.

5.2 A Cable System

For cable or for over-the-air use in an all-HDTV environment, where there is no need to take special precautions to avoid interference with nearby NTSC stations, the system shown in Fig. 7 can be used. In this case, we use the 150x266 component resolution, while the system of Section 4.2 and Fig. 3 uses the 166x300 resolution. At a data rate of 12 Ms/sec and with 40,000 samples per component every 1/12 sec, 25 analog components are permitted. In Fig. 7, we have 41 components, of which 6 are digital, leaving 35. Of these, 10 are doubled up, leaving 25. Digital data is transmitted 'under' all the components that are not doubled up, for a rate of 18.24 Mb/sec, which is on the optimistic side. Using DPCM for the digital components with the number of bits/sample as indicated in Fig. 7, we require 9.12 Mb/sec plus audio and data.

The net result of all this is that the resolution and SNR are about the same as the arrangement of Fig. 3. Experience may dictate some change in the total number of components in the interest of a more or less conservative design. As in the other examples, the numbers are for illustrative purposes only.

6. Production and Program-exchange Standards

From the previous discussion, we can see that it is possible to design very effective transmission systems once the requirements are clearly stated. In this case, the main requirements are bandwidth efficiency and easy, defect-free transcoding. These requirements can be

met by the use of subband coding and adaptive modulation, together with appropriate choice of the resolution of the components. For good interference protection and encryption, we can add scrambling.[7]

By applying similar principles to production and international program-exchange standards, we quickly come to views that challenge the conventional wisdom. For example, we are now seeing a determined effort to get the 1125/30/60 system adopted as an international standard for these purposes. A little examination will show that the two applications — production and exchange — have quite different requirements and therefore the two kinds of formats should probably be different. A production system should readily be produced by a camera with appropriate performance, including spatial and temporal frequency response and sensitivity. The production signal should be suitable for post-production, including all kinds of special effects. It is quite clear[8] that interlace is a highly undesirable property of a production signal. In view of the fact that *all* HDTV transmission systems currently proposed discard diagonal resolution in three-dimensional frequency space, there is no need to include it in the production signal. This greatly eases camera design, in that the bandwidth can be reduced and the sensitivity thereby increased, by eliminating these components at the source. This can be done by offset (quincunx) sampling or by using separate camera tubes for the low-spatial, high-temporal components and the high-spatial, low-temporal components. The elimination of interlace in tube-type cameras will also raise the vertical resolution substantially, because of the equilibrium-discharge phenomenon coupled with the Gaussian beam shape. This is important, since no current interlaced TV camera has vertical resolution nearly good enough for 1000-line images.

While a simple video signal, much like that required to drive a display, is most appropriate for post-production, we have a totally different situation with respect to international exchange of programs. Whereas the product of the post-production process must be converted to the exchange format once only, the latter must be converted to the transmission format used in each medium repeatedly, at each point where the program is to be used. Hence transcodability is the most important characteristic of the exchange standard, just as it is for the transmission formats that we have discussed above. Furthermore, the exchange standard should as easily be converted to a transmission standard in the 50-Hz countries as in the 60-Hz countries.

Although bandwidth efficiency and interference performance are much less important for exchange standards than for transmission formats, a version of the SC format proposed here appears to be highly suitable. The spatial and temporal resolution and the SNR can be as high as desired by adding more components and/or by raising their SNR. This can be done as readily for digital, baseband analog, or FM versions of the format. By a small adjustment in time duration, 24, 50, 59.94, and 60 Hz systems can all be accommodated. It goes without saying that transcoding from this 'exchange' standard (which is actually a super-transmission format) into any of the likely transmission formats is very easy, entailing no temporal

[7]Note that scrambling can be used in any of the transmission formats. In transcoding, the scrambling can be kept, changed, or eliminated, as desired.

[8]At least to me. Everyone does not agree about this.

interpolation, and even no spatial interpolation if desired.

With this choice of exchange standard, the only places in the entire TV chain where temporal interpolation is required, from studio to the home, is after post-production and in the receiver. The cost of the former is implicit in all existing proposals to separate studio from transmission standards, and can readily be absorbed as part of the cost of production. Note that this has to be done once only. The cost of interpolation in the receiver can be low because receivers will be made in very large quantities and the necessary special chips will become practical and economical.

If a scheme like this were adopted, it is clear that international agreement would be required only for the exchange format. If desired, that could be in the form of rather flexible specification of components and packing methods, allowing for a range of quality levels with very little extra trouble. It is also clear that, except for the convenience of manufacturers, no international agreement at all is required for production standards.

7. Transcoding Between the Transmission Format and Camera or Display Formats

For displayable camera formats at 59.94 fps (nominally 60 fps) or at 50 Hz, the transmission components at 12 fps are first found by prefiltering and subsampling. For reconversion to the displayable format, the 12-fps components are temporally up-converted by integral factors of 5 or 4, as appropriate. Quadrature-mirror filter banks are the best implementation of the two operations at present, although there is some possibility that superior transient response can be obtained with other filters at the cost of some reduction in resolution. The particular filters used range from simple decimation and replication at one extreme to ideal low-pass filters on the other. To some extent, the filters implement a tradeoff between motion smoothness and the sharpness of moving objects.

When the input signal is from 24-fps film, there is no point using transmission components higher than 24 fps. In that case, a different selection of components is made, facilitated here because of the nominal 1/12 second 'frame' period. Higher spatial resolution is attained. Motion-compensated interpolation will eventually permit excellent motion rendition from film.

When transcoding to and from interlaced display formats, it is probably easier to interpolate in two steps, dealing with interlace/progressive conversion in one step and with the 12/60 or 12.5/50 fps conversion in a second step. It should be noted that a receiver-compatible EDTV signal such as ACTV-1 can be generated from one of the HDTV or EDTV transmission formats rather easily. Sufficient transmission components are used to achieve at least the desired EDTV receiver performance, and these are interpolated to 60 fps, progressively scanned. This signal is divided into the NTSC resolution image and the enhancement information. Vertical-temporal filters followed by vertical-temporal subsampling to get the interlaced format follows, and then the enhancement information is hidden within the NTSC signal or prepared for transmission in an augmentation channel as required by the particular system.

Conclusion

We have presented a scheme for configuring a range of transmission formats that feature very easy, defect-free transcoding between formats optimized for use in the various media. The considerations used in the analysis are applied to production and international-exchange formats, and it is concluded that the latter two have entirely different requirements. A production format should be progressively scanned and should discard diagonal components at the source. An exchange format can be a version of the transmission format described in this paper.

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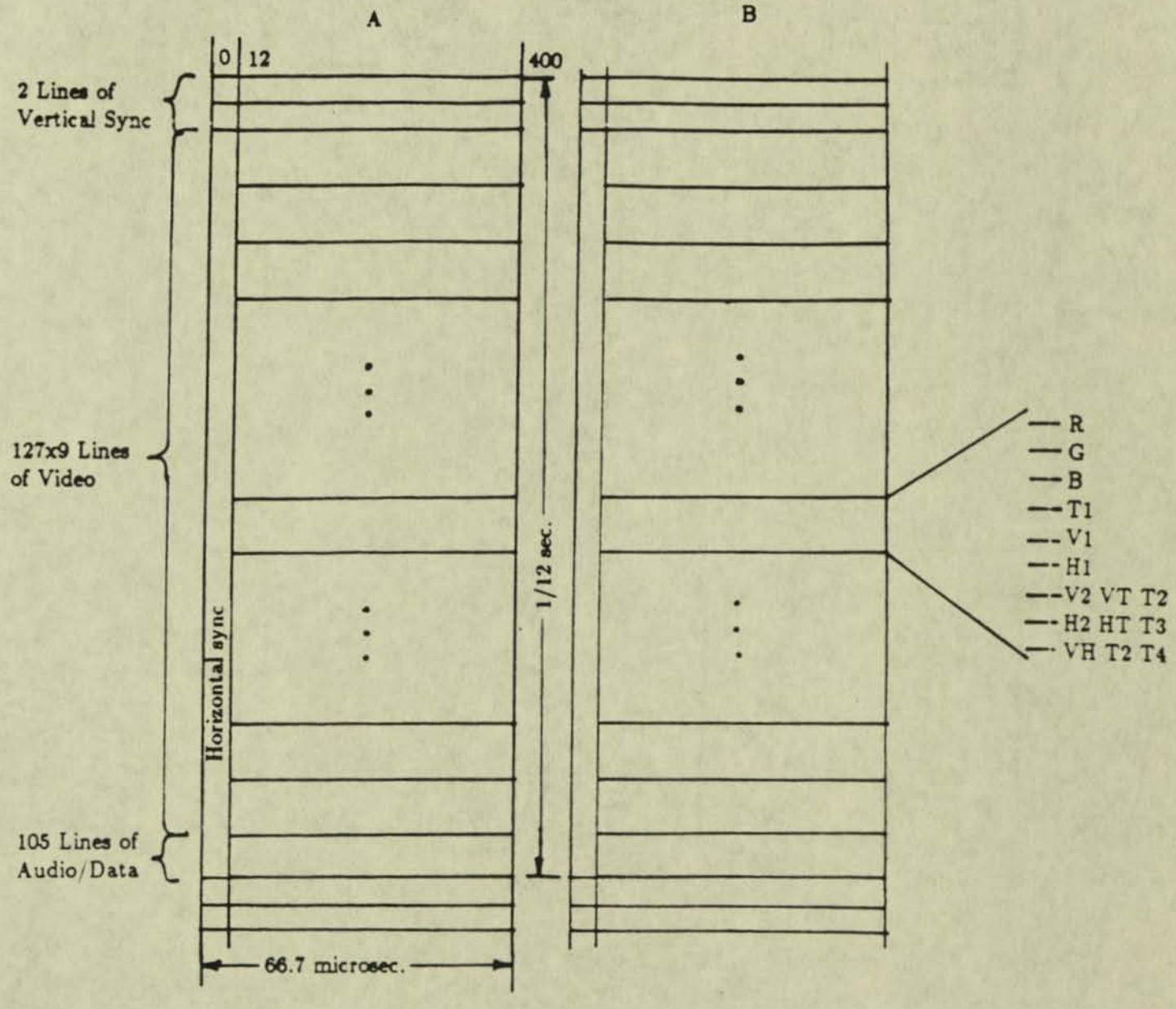
617-253-2579

Figure 1. *Typical Transmission Format.* This shows how the data is packed for transmission in the MIT-CC system. Two 3-MHz analog signals are quadrature modulated onto a single carrier. Each signal comprises intervals 1/12 sec. in length, consisting of spatiotemporal components interleaved with sync and data.



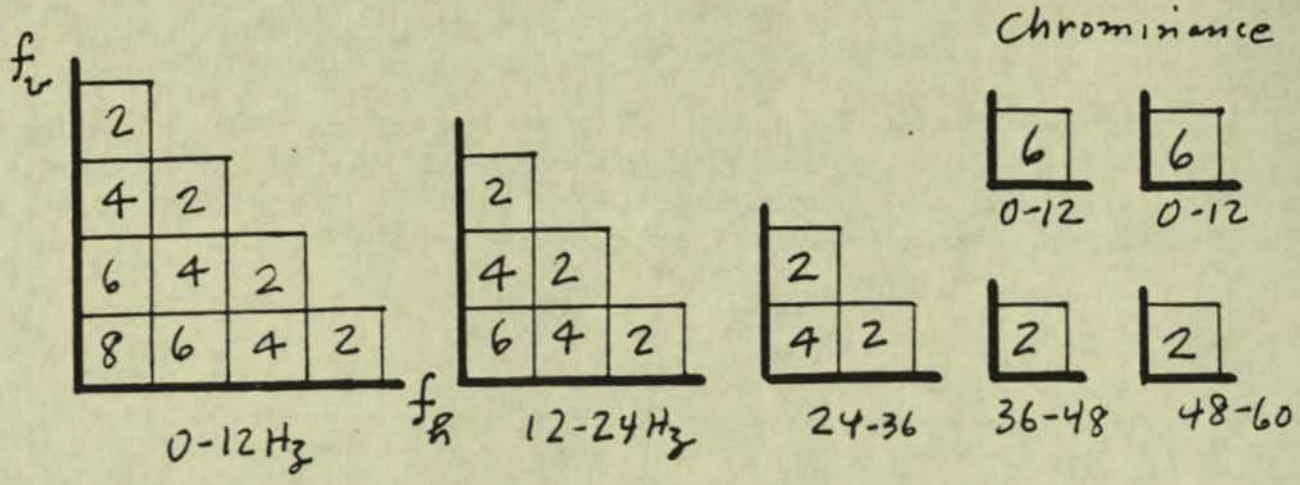


Figure 2. *Components in a Digital System.* At 45 Mb/s, each component is 150x266 pels; at 90 Mb/s, each is 218x387. The number in each component indicates the number of bits/pel assigned. See also Fig. 6.

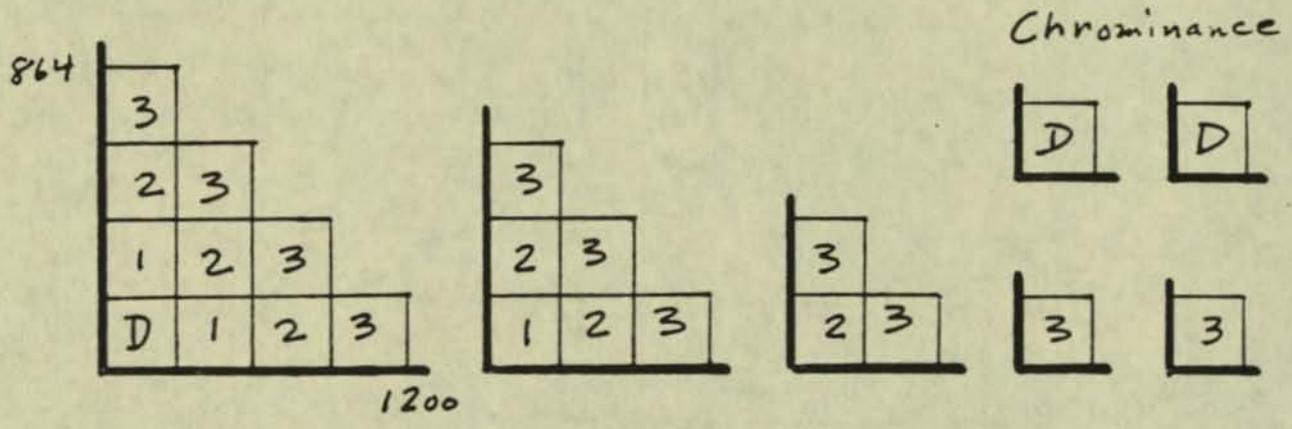


Figure 3. *Components in a Cable System.* This system uses "digital under" in which every component except RGB lows is transmitted in analog form with a digital signal underneath. The number in each component indicates the number of bits/pel in the "under" signal. D indicates that the component is transmitted digitally. In this version, the resolution of each component is 166x300. See also Fig. 7.

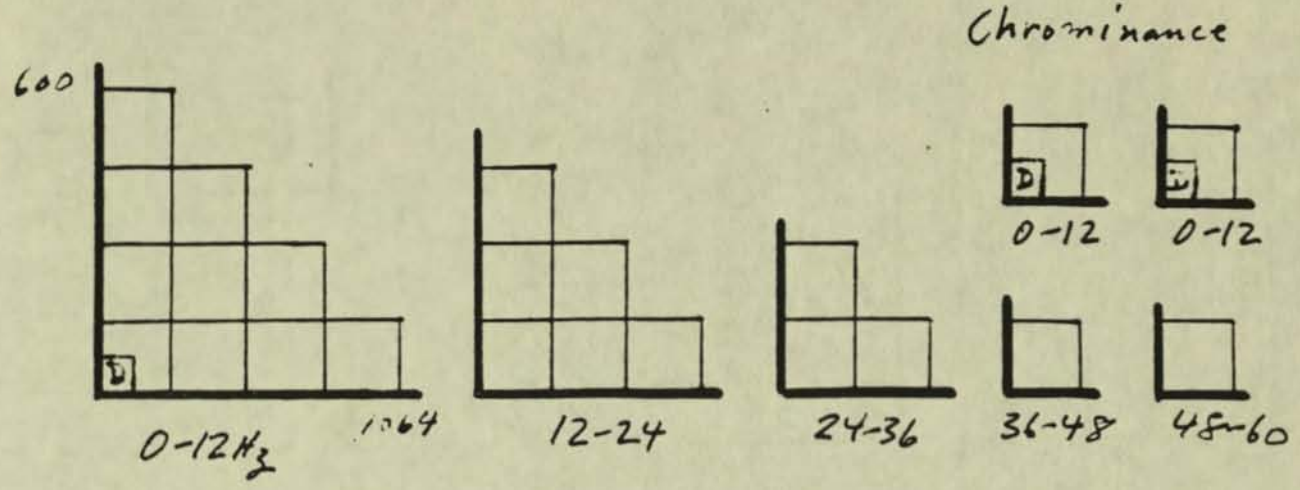


Figure 4. *A Zenith-Type Over-the-Air System.* In this system, all analog components are 150x266. In addition, there is a digital RGB signal 77x138. Digital data is transmitted in bursts synchronous with the vertical retrace interval of interfering conventional signals, either NTSC or PAL. See text at Section 4.3.

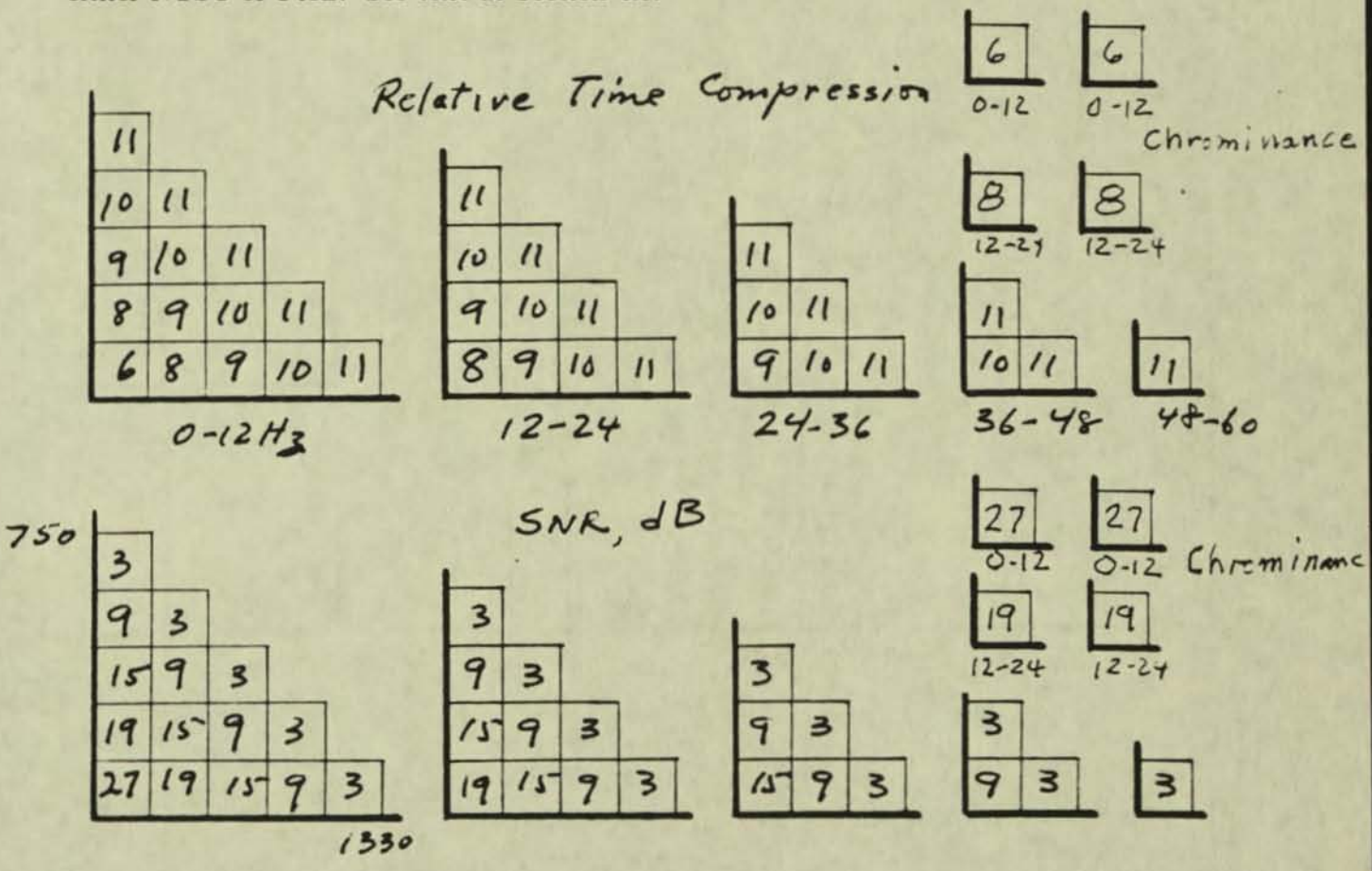


Figure 5. *An FM System.* There are 45 components, of which 6 are devoted to lows, audio, and data. The highs components are 150x266. The numbers in the boxes represent the relative time compression factors and the SNR for the respective components. The higher-frequency components are compressed more and therefore have a lower SNR. This permits a lower compression and higher SNR for the lower-frequency components. See text at Section 4.4.

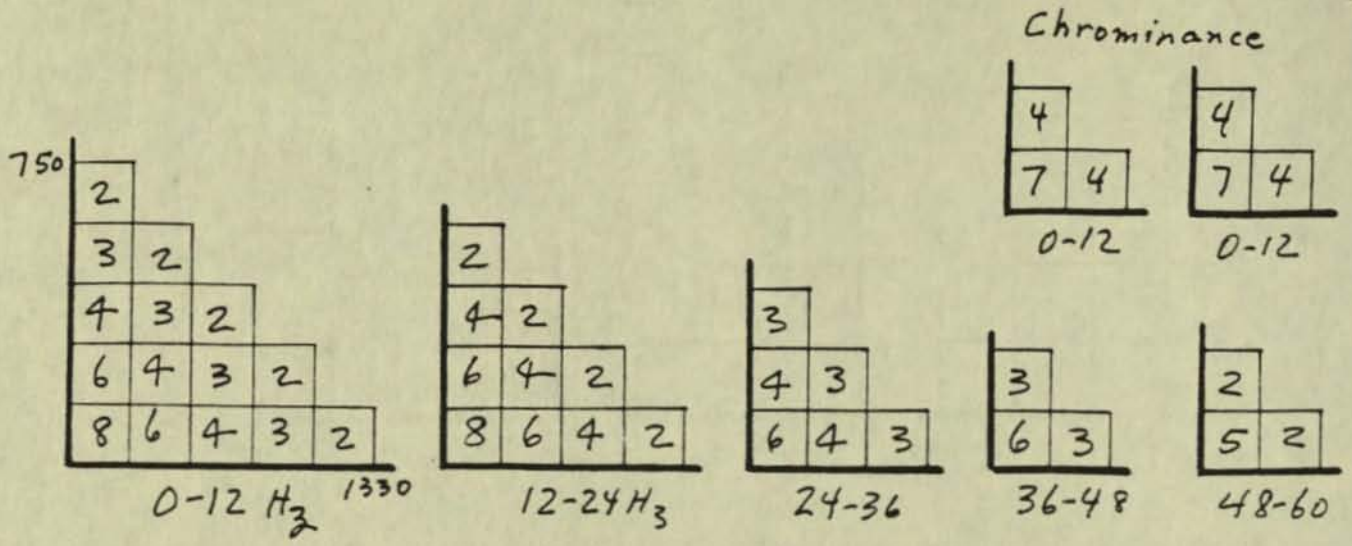


Figure 6. *A 90-Mb/sec Digital System.* This very high-quality system is configured to use the same 150x266 resolution as most of the others, for the sake of the easiest possible transcoding. Numbers show the bits/pel assigned. See also Fig. 2.

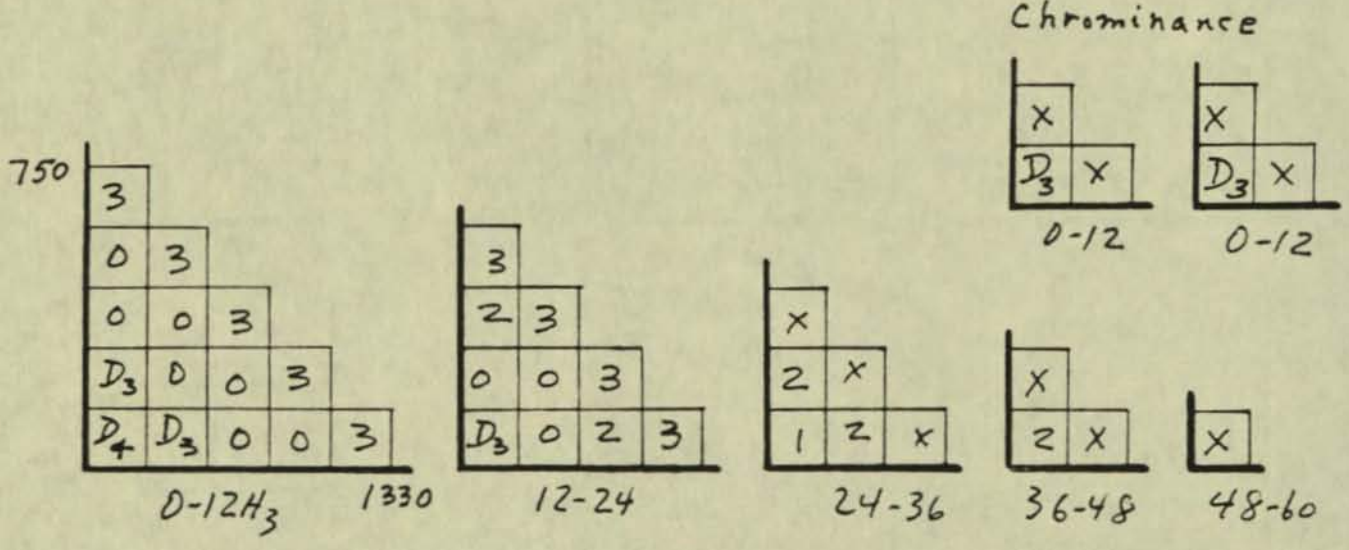


Figure 7. *A Cable System with 150x266 Components.* Like the system of Fig. 6, this one is also configured for maximum ease of transcoding. A number in a box indicates the number of bits/pel 'under' the analog signal. The character "x" means a component is hidden in a lower-frequency component marked "o." D_n means digital transmission (DPCM) at n bits/sample.

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Withdrawal of United States Support for the NHK HDTV System as an International Standard

Comments of

William F. Schreiber
Director, Advanced Television Research Program

The Media Laboratory
Massachusetts Institute of Technology
E15-387 MIT Cambridge Mass 02139

submitted to the
National Telecommunications and Information Administration
Department of Commerce

March 1, 1989

These comments are those of the author and do not represent the official positions of his research sponsors or of MIT.

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"I am convinced that the principal motive behind pushing the NHK system is, and the main effect of adopting it would be, to advance Japanese economic interests to the detriment of our own. There is no reason whatsoever for the US to be a party to inflicting this damage on itself." (see below)

1. Executive Summary

These comments begin with a short history of the development of the NHK HDTV system and the manner in which the so-called industry consensus was given to the State Department. The bulk of the report presents reasons why the United States should cease supporting that system as an international standard for production and program interchange. The fundamental grounds are that it is neither a production nor a program-interchange system at all, that its performance in those applications would be poor, and that its adoption, for many reasons, in not in the national interest.

- **Production systems and transmission systems are tightly linked.** It is simply not true that any production system can be used with any transmission system. The cost of transcoding depends on the relationship of the two sets of system parameters. Easy transcoding is a prime requirement of both production and interchange systems. The NHK system would give a great advantage to compatible transmission systems, such as the MUSE family, just because they have an easy relationship with the "studio" system. If it did not make any difference which standard was adopted, we would not see this one pushed on us so hard.

- **The Japanese systems were developed for and are intended for DBS service and therefore would not work well in the terrestrial channels that will be used in the US.** Picture quality in the home is limited primarily by transmission impairments. These systems are more vulnerable to these impairments than NTSC.

- **The use of interlace reduces quality and complicates transcoding.** A production standard should use progressive scan. That would simplify transcoding into NTSC, which will be required for years to come. A system for making movies should be 24 frames/second progressively scanned, and not 30 fps interlaced.

- **New TV sytems should be introduced with full consideration of the present state of the TV broadcasting industry.** The use of MUSE-like systems by the alternative media is perceived as a threat by the broadcasters who now provide free and universal service, which is greatly prized by the American public. The Japanese proposals completely disregard the effect on the broadcasting industry, and are likely to damage it severely.

- **If a Japanese standard is adopted, the possibility of participation by American-owned companies in what is expected to be a very large market will be foreclosed.** Standards have historically been used to control markets. Both the patent situation and the head start of Japanese-owned companies down the learning curve would prevent US companies from catching up.

- **An international production standard is certainly not required to maintain American supremacy in software production.** The medium of production has *no effect at all* on the salability of US-made TV programs. It certainly would not help sales to Europe, which will never use the Japanese system.

2. Introduction

There is a move in the CCIR to adopt the NHK wideband high-definition television (HDTV) system as an international standard for production and international program exchange. This is supported by Japan, the United States, and a few small countries. Within the United States, it has been adopted by the Advanced Television Systems Committee (ATSC), and accepted as a standard by the Society of Motion Picture and Television Engineers (SMPTE)[1] and the American National Standards Institute (ANSI). ATSC adoption amounts to a recommendation for exclusive use, but SMPTE and ANSI adoptions definitely do not imply any such recommendation. They simply codify systems that are proposed by others.

Support for the NHK system within the US was never unanimous. As the industry has become more aware of the implications of use of the system for production, more opposition has developed. In this paper, the technological and policy background is discussed and an argument is made that if support for this system was ever in the national interest, it no longer is, and that such support should therefore be withdrawn promptly.

2.1 History of the Japanese developments

HDTV development, orchestrated by the Japan Broadcasting Company (NHK) began in Japan in 1970, and widespread demonstrations were made in 1981. Picture quality is roughly equivalent to 35-mm movies. This required substantial improvements in cameras, displays, recorders, and film scanners, work that was carried out primarily by private Japanese companies. The system tying all of the new products together, however, was entirely conventional. The NHK system was conceived as a new service, to be delivered by direct broadcasting from satellites to home receivers (DBS), with today's NTSC system remaining in place for terrestrial broadcasting.[2]

The original wideband system, now often referred to as the "studio system," requires 4 to 5 normal channels (up to 30 MHz) at baseband, but was nevertheless transmitted in 1978 using experimental satellite transponder channels of somewhat more that 100 MHz bandwidth. This was evidently deemed uneconomical, so that development of a compressed version was begun around 1981. In 1984, a reduced-bandwidth version called MUSE was announced, requiring only one-fourth the channel capacity. This was achieved by reducing the diagonal resolution by half and by reducing the transmission rate of detail information to 15 frames per second (fps.) This produces some loss of sharpness of moving objects, but a clever interpolation method results in surprisingly little loss of resolution. However, the sophisticated signal

---

[1]The SMPTE standard is designated 240M. In this paper, I shall use "NHK" to ensure that the reader understands that this is the Japanese system. SMPTE 240M does flesh out the NHK standard with much more explicit parameterization. The only changes from the original Japanese proposal are in aspect ratio (16:9 rather than 5:3) and in frame rate (60 Hz rather than 59.94) and these were made before SMPTE began its formal consideration.

[2]This is also the mode planned in Europe. In both regions, the number of channels now available to viewers is many fewer than in the US. It is expected that the public will be motivated to buy satellite receivers at least as much for extra channels as for HDTV. In a particularly infelicitous choice of language, Dr. Yuko Nakamura, Director-General of Engineering at NHK, once compared HDTV and NTSC to FM and AM.

SEMICONDUCTOR TRADE ISSUES FOR 1989

1989 ACTION PLAN:

Access to Japan's electronic/semiconductor markets is of critical importance to the United States. A greater focusing of attention on Japan, not less, is required to open these markets. A high level of U.S. Government interest appears to be the only successful approach. It is important that the Administration:

- Include Japan, and in particular, semiconductors on the Super 301 list.
- Maintain sanctions until Japan honors its commitments.
- Initiate an interagency review of the sanctions to determine the actual impact and consider alternatives to increase their effectiveness.
- Maintain a strong and effective antidumping monitoring system, especially since demand for semiconductors is predicted to soften in 1989.
- Encourage industry efforts to improve research and production, and revitalize downstream markets.

U.S. Semiconductor Industry -- SEMICONDUCTOR LEVERAGE -- FIGURE 1

- The U.S. Semiconductor Industry is the nerve center of the U.S. electronics industry. Its research and technology set the foundation for tomorrow's new technology developments.

- Preserving this industry is critical to the technological competitiveness and national security of the United States.

- This chart, **SEMICONDUCTOR LEVERAGE**, depicts the place of semiconductors in the food chain. The dependencies run in both directions, to upstream as well as downstream industries.

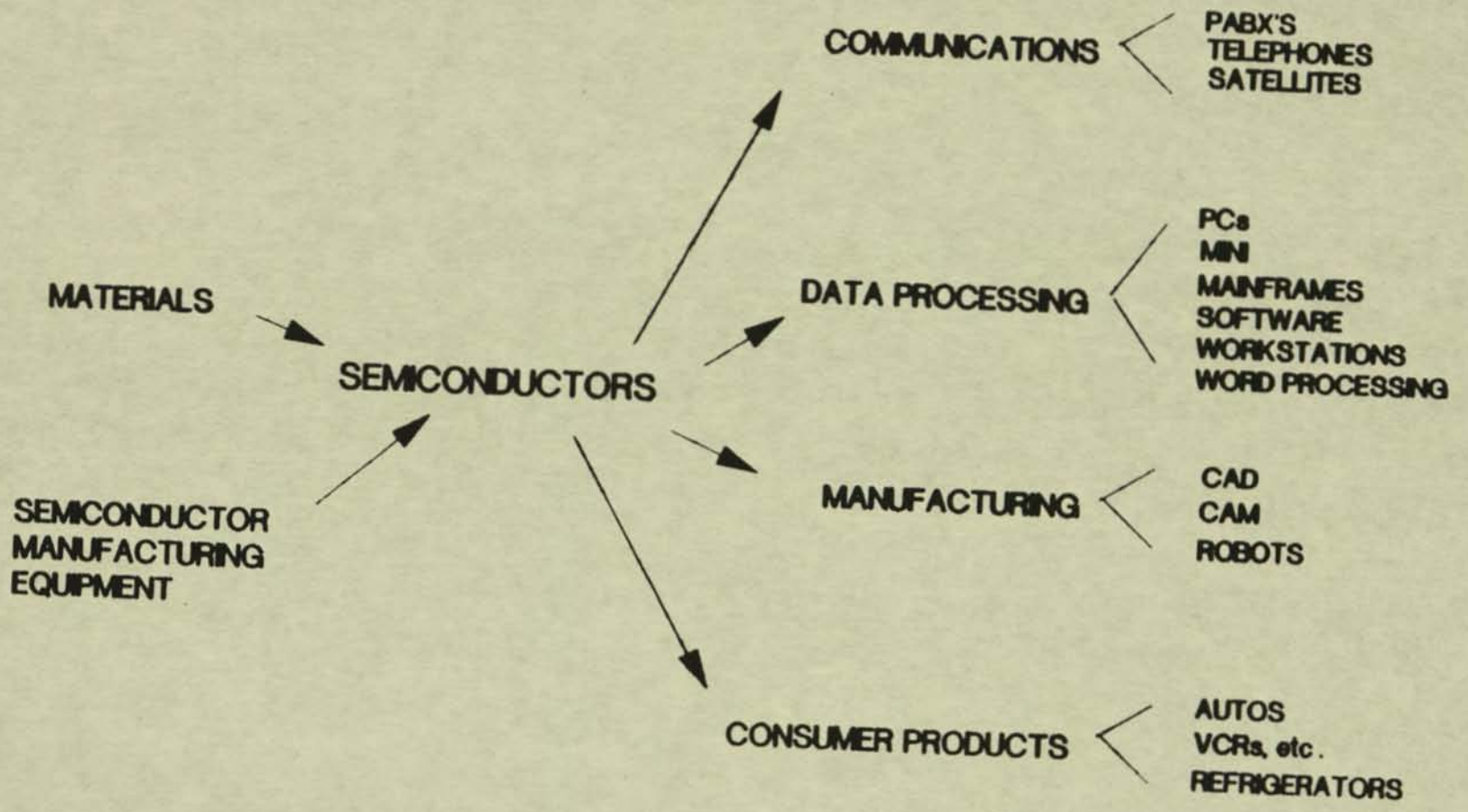
- Semiconductor producers are interdependent with both equipment and materials suppliers, as well as with users.

- SIA has, for several years, realized that the industry is dependent upon the health of the user community. Only recently, the user community has also recognized that it is dependent on the merchant semiconductor industry.

- The need to maintain an infrastructure in the United States of semiconductor materials and equipment makers has given rise to SEMATECH, as well as closer relations among the members of the food chain. (Japan systematically uses vertical integration, keiretsu, and industry-wide collaborative efforts to exploit and protect these linkages.)

- The U.S. semiconductor industry wants access to foreign markets, specifically the world's largest semiconductor market, Japan, not protection.

SEMICONDUCTOR LEVERAGE



U.S.-Japan 1986 Semiconductor Trade Agreement

- **HISTORY BEHIND AGREEMENT:** SIA undertook two efforts to counter MITI targeting: working to halt dumping; and working to increase access to the Japanese market.

- In 1985, prices seemed to have abandoned the learning curve and were just headed down.

- **HITACHI DIRECTION -- FIGURE 2:** Hitachi's direction to its salesmen was to quote 10% below U.S. competitors, while it assured a 25% distributor profit margin.

- **SEVERITY OF DUMPING -- FIGURE 3:** Major (7) Japanese Producers found to price EPROMs from 18% to 65% below cost.

- Bringing dumping under control involved a major effort by the U.S. Industry and the U.S. Government extending over four years.

- After issuing a warning, the United States and Japan negotiated general commitments through the <u>High Tech Working Group</u>. While ineffective, this served as a necessary step to convince the U.S. Government and Industry that more effective actions were required.

- Petitions to the U.S. Government led to antidumping and Section 301 investigations. The 256K DRAM case was self-initiated by the U.S. Government, an unprecedented step.

- The U.S. Government concluded that Japanese producers were dumping chips into U.S. and Third Country Markets.

MEMO TO HITACHI DISTRIBUTORS (FORMERLY, MEI)

UNBEATABLE

PRICE LEADERSHIP

WE'RE NUMBER 1

- 10% BELOW INTEL AND AMD
- 15% - 20% BELOW OTHER JAPANESE SUPPLIERS

PRICE CROSSOVER

12K - 1.6 x THE 64K
256K - 2 x THE 128K

COST/BIT ATTRITION

CMOS PREMIUM SLASHED

27C64 - 25% OVER NMOS

AND HEADING FOR PARITY

WIN WITH THE 10% RULE

HN4827128, HN27256

FIND AMD AND INTEL SOCKETS....
QUOTE 10% BELOW THEIR PRICE...
IF THEY REQUOTE,
DO 10% AGAIN....
DON'T QUIT TILL YOU WIN!

HN27C64

WIN FUJITSU BUSINESS,
USE THE 10% RULE

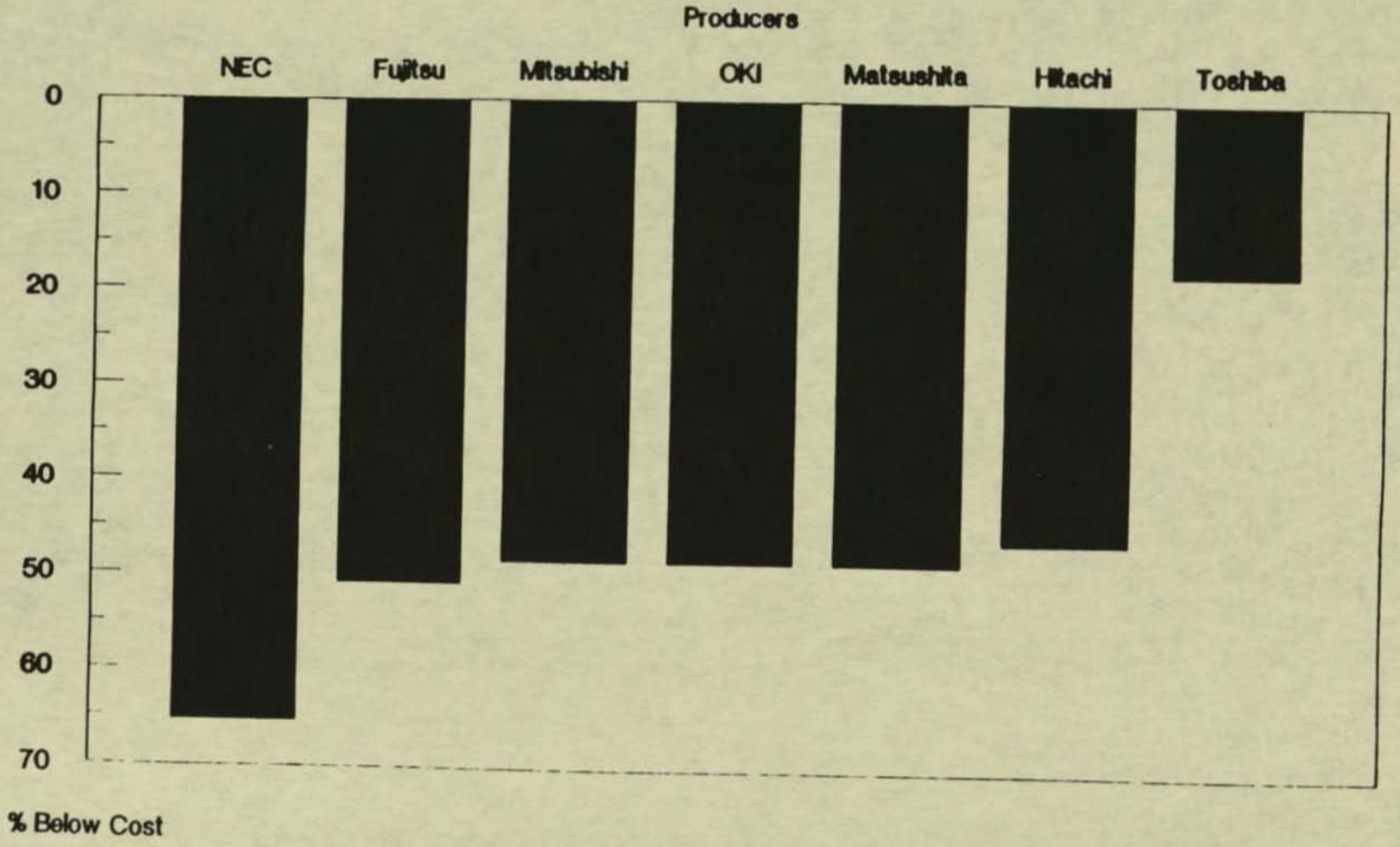
25% DISTI PROFIT MARGIN

GUARANTEED

HN4827128, HN27256, HN27C64

HITACHI EPROMS

SEVERITY OF DUMPING -- EPROM PRICES
PERCENT BELOW COST



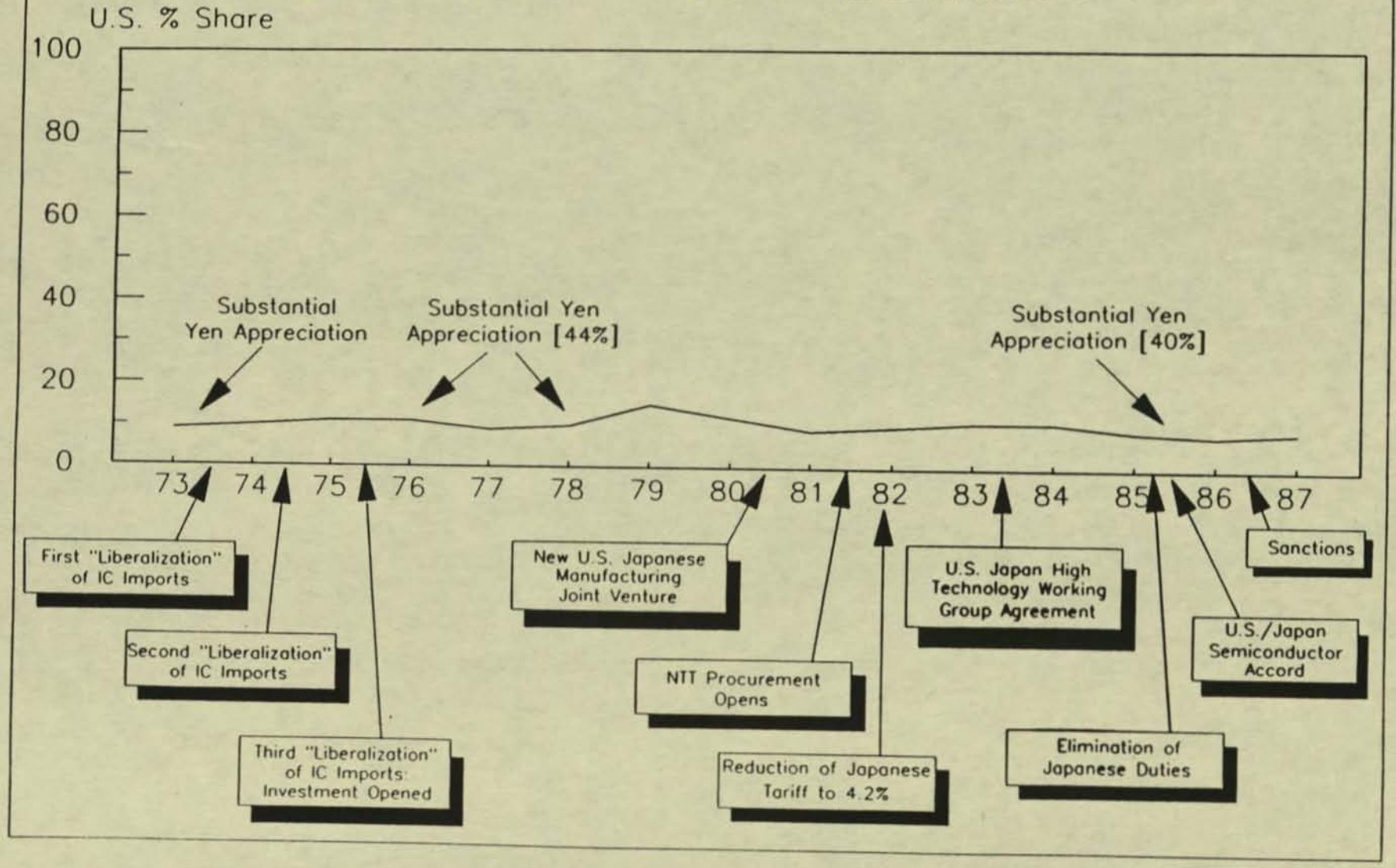
- **TRADE LIBERALIZATION WORM CHART -- FIGURE 4:** Lack of Access to the Japanese market had been a chronic problem.

- After 14 years of negotiations (1973-1986), U.S. access to the Japanese market remained flat at about 10 percent despite Japanese "liberalization" measures, U.S. investment attempts, and yen appreciation.

- Since the Japanese market has structural barriers to foreign suppliers, increasing market access can only succeed if Japanese firms themselves decide to increase their purchases from foreign suppliers.

- In fact, U.S. Market Share in Japan had dropped to 8.5% in 1986; down from the historic level of about 10%.

"LIBERALIZATION" MEASURES, U.S. INVESTMENT ATTEMPTS, AND YEN APPRECIATION HAVE HAD LITTLE EFFECT ON U.S. MERCHANT FIRMS' PENETRATION OF THE JAPANESE MARKET



- **SEMICONDUCTOR AGREEMENT -- FIGURE 5:** Negotiated by Clayton Yeutter and signed on September 2, 1986, the Agreement is almost at the half-way mark. The five year agreement is due to expire in 1991.

- In exchange for U.S. Government suspension of Section 301 and semiconductor antidumping trade cases, the Japanese Government committed to halt dumping in the U.S. and Third Countries and accepted as reasonable the U.S. expectation that foreign access would increase gradually and steadily to a 20% share of the Japanese market.

- The Japanese Government committed to impress upon Japanese producers and users the need to achieve that 20% level by 1991. U.S. chips are the primary foreign source of supply.

THE SEMICONDUCTOR AGREEMENT

Content

- U.S. Suspends Trade Cases
  - Section 301
  - 256K+ DRAMs
  - EPROMs
- Japan Commits:
  - To Halt U.S. And 3rd Market Dumping
    - * 256K+ DRAMs
    - * EPROMs
    - * Monitored Products
  - To Provide Market Access
  - Not To Undercut Agreement In Japan
- Fast Track Antidumping Action

Status of Commitments in the Agreement

- **WORM CHART -- FIGURE 6:** The agreement was not honored by Japan and resulted in the imposition of sanctions -- an U.S. Government action unprecedented in modern times.

- The U.S. market share was 8.5% when the Agreement was signed and only rose to the present level when $165 million worth of sanctions (100% tariffs) were threatened and then imposed on Japanese products in April 1987.

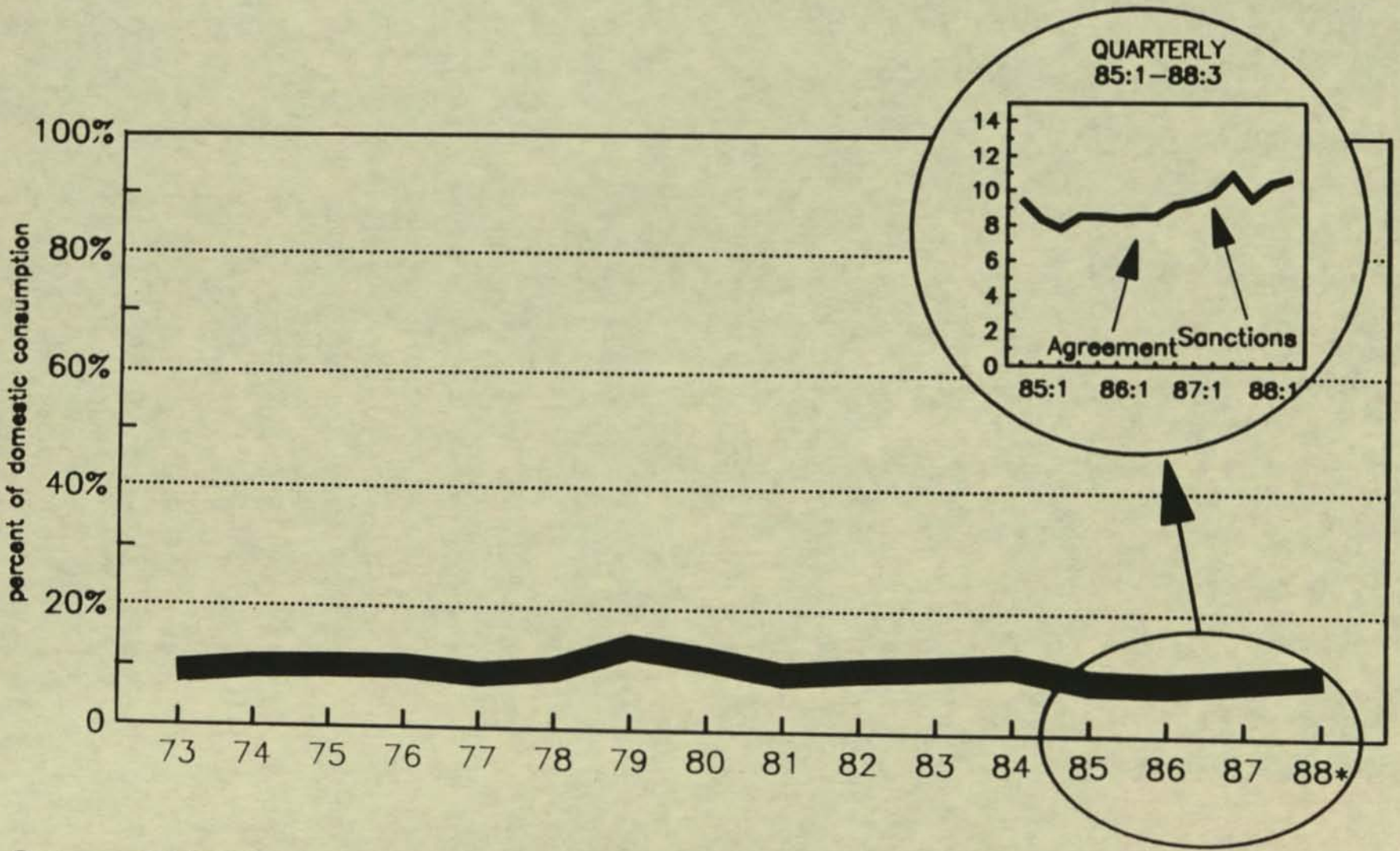
- U.S. semiconductor market share in Japan at the end of 1988 is estimated to be at 11.1% -- up from the 1984 level but about the same level it has been for the last 15 years. Under the Agreement, the U.S. market share should be 14.1% at this point.

- Semiconductor dumping did not cease until $135 million worth of sanctions were imposed on Japanese goods. Since the dumping ended, these sanctions were removed at U.S. industry's request.

- However, there is a potential risk of renewed Japanese dumping in 1989. Since the U.S. producer is the residual supplier, there is a loss of share if the market softens. Current indications are that the markets could be softening -- billings are at 11.1% and bookings are at 10.2%.

- The Agreement has real value, since U.S. participation in the Japanese market has increased from 8.5% in 1986 to 11.1% today. Without the Agreement, there will be no chance of return in DRAMs. It is imperative that the Agreement be enforced.

U.S. PENETRATION OF THE JAPANESE SEMICONDUCTOR MARKET



Source: SIA/WSTS.
*Based on first three quarters of 1988.

Effects of Lack of Market Access on the U.S. Industry and Economy

- **MARKET ACCESS:** The U.S. Semiconductor Industry seeks access to open markets, not protection.

- Japanese noncompliance with the market access provisions of the Agreement has serious implications in terms of lost sales and fewer U.S. jobs.

- A projection of the current U.S. market share in Japan through 1991 translates into a loss of about $4 billion in sales and about 12,500 fewer U.S. jobs compared with what would otherwise exist if the Japanese lived up to their commitment.

- Increasing market access is essential to the survival of the U.S. semiconductor industry.

- The implications for the U.S. industry of prices being driven to very low levels for extended periods simply the rapid erosion of the industry, and ultimately its extinction.

- When U.S. companies were driven out of production of DRAMs, the U.S. industry lost a crucial technology driver.

- Injury to the U.S. semiconductor industry has a direct adverse impact on the U.S. computer, television, video and all consumer electronics producers as well as many defense components.

- Japan has committed to improve foreign market access in Japan, the world's largest semiconductor market, to 20% by 1991.

- A high level commitment of U.S. Government interest in access to the Japanese market has been and will continue to be essential to opening that market; other strategies have been unsuccessful.

- U.S. products are competitive worldwide:

  --Excellent Quality;
  --Product Portfolio is geared to today's and future markets;
  --Sales Efforts in Japan continue to increase markedly;
  --There is Abundant Capacity; and
  --The only measure of success is to increase foreign participation in the Japanese markets as measured by share.

- SIA and AEA continue to work jointly on gaining increased access to the Japanese market.

- **U.S. INDUSTRY EFFORTS IN JAPAN -- FIGURE 7** -- U.S. investments in Japan have increased by 68% for facilities from 1984 - 1987.

U.S. Efforts in Japan

- Increasing Investments in Japan (1984-1987)
  - Total employment +27%
  - Technical support personnel +20%
  - Facilities for manufacturing, design, quality and test +68%
- U.S. Quality Awards from Japanese Customers
  - 16 (1986-87)
  - Customer Examples:
    NEC, Matsushita, Mitsubishi, Ricoh

Source: 1988 SIA Study

Conclusions - Actions Needed

- **CONCLUSIONS - ACTIONS NEEDED -- FIGURE 8:** The United States should stand firm in its resolve to achieve access to the Japanese semiconductor market and continue to maintain the sanctions until Japan honors its commitment.

- U.S. Trade Representative Hills indicated in her confirmation hearings that USTR's "strategic goal is to open markets." She acknowledged to Senator Bentsen that the U.S. Government is "very disappointed with how the Japanese have carried out their agreement" to increase market access under the Agreement, and that it would be difficult for them to "get to the 20 percent level by 1990 at their current rate."

- In his confirmation hearing, Commerce Secretary Mosbacher stated: "...the foreign market share of the Japanese semiconductor market is still no better than the historical level...because of this situation I support the continuation of sanctions."

- Given the high priority for the United States of its trade relationship with Japan, it is important that the Bush Administration include Japan, and in particular, semiconductors on the Super 301 list.

- On the issue of Japan and the Super 301 provisions, Hills stated in response to Senator Danforth, "We will aggressively implement Super 301 and 301...in our strategic goal to open markets, and to have those markets be open with the discipline of equitable rules."

- The Administration should initiate an interagency review of the sanctions to determine the actual impact and consider alternatives to increase their effectiveness. These alternatives should include: change the product mix; impose tariffs on selected auto and consumer sector products; and impose tariffs on future products, i.e., HDTV.

- The U.S. Government needs to maintain a strong antidumping monitoring system. If there is a downturn in the market, renewed dumping by Japanese producers is a very real possibility. Work on strengthening antidumping laws should be started now.

- Industry consortia efforts to improve research and production, such as SEMATECH, as well as efforts to revitalize downstream industry, such as consumer electronics (HDTV) and computers, should be encouraged by the U.S. Government.

- SIA and its member firms will continue to devote substantial efforts to selling in the Japanese market and improving the cooperation of the Electronics Industry Association of Japan and its member firms in realizing the market access goals of the Agreement.

CONCLUSION - ACTIONS NEEDED

- Include Japan, and Specifically Semiconductors, on Super-301 List
- Initiate Administration Interagency Review of Sanctions
  - Determine Actual Impact
  - Consider Alternatives to Increase Effectiveness
    * Change Product Mix
    * Impose Tariffs on Selected Auto and Consumer Sector Products
    * Impose Tariffs on Future Products, i.e., HDTV
- Maintain Strong Antidumping Monitoring
  - Strengthen Antidumping Laws
- Encourage Industry Efforts to Revitalize Downstream Industry
  - Consumer Electronics (HDTV)
  - Computers

f: HDTV

Opening Remarks — Pat Hubbard, VP AEA

She introduced the speakers, talked about AEA's role and differentiated AEA from IEEE's position. IEEE sees HDTV as a "TV only" business. AEA sees HDTV as an electronics and computer business issue.

Boston Consulting Group — Todd Hixon, VP

(they have 6-8 people working on the project). Their goals are:

1. Create a vision and framework for a successful ATV business by defining
   a. role of industry
   b. role of government

The final product will be a business plan. Todd's definition of "high definition" was a display with more than 1 million pixels. Their preliminary estimates of the cost of a 35 inch HDTV were:

	1992 *Cost*	*Percent*	1997 *Cost*	*Percent*
Semiconductors	$330	8%	$55	2%
Display	$962	24%	$760	29%

I left out all other costs. The system has some processing power because of an assumption of terrestrial transmission which requires compression. The cost of the display dominates. BCG then estimated costs of various displays:

	1993 *	*1997* *
CRT 20	$ 93 (6%)	$ 72 (12%)
CRT 26	$188 (10%)	$145 (17%)
CRT 35	$962 (24%)	$770 (29%)
LVP > 40(light valve projection)	$250 (14%)	$ 85
AMLCD (active material LCD)	N/A	$730 (29%)

* estimated % of cost. CRTs are standard NTS tubes.

BCG will visit Japan next week and talk to all display manufacturers. It is their opinion that beyond 1997 AMLCD will be less expensive. That projection may be useful early on. They noted that both Matsushita and Mitsubishi are planning to triple the production of 35" tubes in the U.S.

HDTV Business

Volumes will be slow to build

	Price *Mid 1990s*	Price *Late 1990s*
26″	$1500.00	$ 650.00
35″	$3000.00	$2500.00
Volume	100K-200K/yr.	1000K-1500K/yr.

The market will be dominated by whoever controls the display and to a lesser extent chips. It is a vertically integrated business that includes workstations and PCs.

U.S. Technology (BCG opinion) vs. Japan

CRT	weak -> parity
Projection	weak
Flat Panel	very weak
Future FP	good ideas, small investment
DSP	strong design; process is one generation behind Japan
Memory	strong design, process is one generation behind Japan

Japan is 10 years ahead on HDTV production. Europe is 8 years ahead on HDTV production.

U.S. vs Japan Model for Development (TV)

	Basic R & D	Production Design	Tube Mfg.	Circuit Mfg.	Assembly	Production Variance Time	New Technology Time
U.S. based Co.	Chicago	Urban area	Midwest	Mexico	Mexico low/Midwest	1 year	3 - 6 years
Matsushita	------>	Osaka	---------->			4 - 6 mos.	12 months
Mitsubishi	------>	Nagaokakyo	---------->			4 - 6 mos.	12 months

NOTE: U.S. companies pursue cheap labor. Japanese companies co-locate all activities. Invest more capital to make up for high wages (Japan is a high wage country). Japanese only move very successful products to either low wage areas or high consumption areas.

Japan co-locates for speed. Japan only moves large successes to low wage countries. U.S. wastes time in hand-offs.

Comments:

Large businesses will exist in the base technologies, especially displays.

Fiber loop is only conjecture. Cannot count on it in any realistic business plan. The country will not be wired this century. Depending on type of fiber used, it may reduce the number of available channels.

Possible U.S. Initiative

1. Create a world class U.S. high resolution display capability.
   - multiple technologies (CRT— >FP)
   - multiple markets (work st/pc, ATVs)
2. Create an ATV venture based on a fully integrated "ATV City".
   - all major functional elements & component suppliers co-located.
   - first rate infrastructure

Ways U.S. Government could help

- leadership & monitoring of progress & problems
- legal assistance with pooling of resources
- up front investments
- detect & neutralize *(promptly)* systematic undermining of U.S. ATV industry.
- create incentives for U.S. producers with emphasis on technology and skill intensive value added.

NOTE: it is a 10-year investment

This is a manufacturing business *not* a design business.

The U.S. Government needs to assist & help create a first class manufacturing climate.

(comment from audience)

Japan has invested $1 Trillion in this area over 20 years creating an infrastructure to support ATV and they will threaten our computer market.

BCG Plans

BCG has made a great deal of progress in four weeks. They plan to have a draft by May 1 and hope to have the final report by May 15.

Craig Fields, Deputy Director for Research (he spoke, no slides, random comments)

- DARPA has seen innovative display technologies in the U.S. which could be best in the world.
- DARPA needs to insure a domestic supply of semiconductors.
- They received 82 proposals, 5 white papers.
- Best ideas are better than Japanese (some working in labs).
- Government agreement on roles
  - President wants Mossbacker (Commerce) to lead
  - DARPA has a technology role
- Multi agency review process for proposals (49 people)
- Have narrowed the number of proposals from 82 to 49 involving 106 firms (several of each kind ($300M+)
- DARPA will link up companies to complete programs
- They are looking for funding from other agencies. They will decide within a month or two

(Lots of discussion, technology great, but what is being done about cost of capital, lost of agreement re: problem, no real solutions. . .)

Foreign Participation

AEA asked for an open discussion of members on the subject of foreign participation (really Thompson and/or Phillips). No one ever raises a remote possibility of Japan being involved.

Comments ranged from "no way", "keep them out", etc. to "Let's work together".

Some people talked about reciprocal issues and setting strict pro U.S. terms for participation. Merrifield cautioned that we not panic and we are living in a global economy. No resolution was sought (IBM wants door left open for Europeans).

FCC Standards - Dick Wiley, Chairman of the FCC advisory committee on HDTV. He is also a former chairman of the FCC.

- He is recommending the committee be extended for 2 years.
- They are reaching the testing stage.
- They will design independent tests & test real hardware (no simulations)
- Hope to complete testing in CY1991
- Possible selection "around CY1992"

Phillips & Thompson They were allowed to present - their handouts are attached

Phillips

Is a large U.S. company with 52,000 employees. Wants to participate, will agree to all kinds of terms. They expect it will be 5 years before HDTV comes on the scene. Pushed very hard for their proposed standard (see slides)

Thompson

Spoke of long U.S. history (RCA, GE). Problems with TV business. It is a low profit global business. U.S. has suffered because of:

1. dumping
2. cost of capital
3. lack of government assistance

They are investing in huge tube facility in U.S.

See the biggest technologies threats from

light valve	>	not enough R & D $ available for
flat panels, etc.	>	it to happen in the U.S.

Both Thompson & Phillips spoke indirectly of the threats from Japan and both had open arms for any and all kinds of partnerships. I felt they were looking to partner to be more American and to reduce their capital costs.

COMMENT: The biggest concern in the room was capital formation, technology in the U.S. was not a large issue.

Bruce Merrifield - Asst. Sec. Commerce

NOTE: (he is leaving Govt.) Bruce was very outspoken. Some highlights:

- The artificial 4-year boom/bust cycle caused by election is bad.
- Expansions die when the Fed murders them.
- Laws to allow collaborative manufacturing possible this year (using both safe harbor & rule of reason).
- Now possible for federally funded R & D to be owned by those who do it (a new law)
- New technologies beyond the capacity of any one company, U.S. must either opt out of these or allow collaboration.
- Global village - cloned factories in consumption areas controlled by satellites theway of the future.
- Recommends "Use limited R & D partnership rules to get around anti-trust limited partners own but do not manage (may be on board)
- Stunning announcements in Room Temperature Superconductivity coming.
- "Deficit is a myth" We don't have a trade deficit - capital flow counts - in time with satellite programmed flexible production lines doing the work, no real tradewill exist.

Legislative Initiatives - James Turner

He spoke of committees and bills pushed the importance of this committee. Some comments:

- Section 5131 of the last trade bill gives Commerce authority to participate in ventures (needs funding).
- Congressman Brown has introduced a bill to fund $100M to 5131 (Federal matching $)
- Congressman Campbell et al - have introduced a bill to modify anti-trust laws. It allows collaboration among competitors if they could merge.
- Congressman Edwards has a less ambitious change to anti-trust laws

NOTE: Michael Alsenberg has a great deal of background on all of these.

COMMENTS:

We must continue to reinforce the position that in the long run it is the base technologies that matter. If out of this activity we can gain support for competitive volume, U.S. based display and/or semiconductor industries, Digital wins.

We are taking a position that consumption comes in the workstation area long before the consumer area.

Any government investments should serve the U.S. workstation/PC manufacturers.

We are also suggesting we keep the door open for Europeans.

AMERICAN ELECTRONICS ASSOCIATION
HDTV BUSINESS PLAN GROUP MEETING
March 28, 1989
Sheraton-Carlton Hotel, Washington, D.C.

ATTENDEES LIST

ROBERT REGAN
ASSOCIATE DIRECTOR
AT&T

RHONDA CRANE
PUBLIC AFFAIRS MANAGER
AT&T

RONALD ROSENZWEIG
PRESIDENT & CEO
ANADIGICS

DOUG GRANT
MARKETING MANAGER
ANALOG DEVICES SEMICONDUCTOR

WILLIAM POULOS
MANAGER GOVERNMENT AFFAIRS
APPLE COMPUTER

JAMES BROWN
PRESIDENT & GENERAL MANAGER
COHU, INC.

JOHN O'SHEA
CHIEF FINANCIAL OFFICER
COMPRESSION LABS, INC.

KEN KENITZER
EXECUTIVE V.P. ENG./OPR.
COMPRESSION LABS, INC.

DAN WALD
EXECUTIVE DIR. ENGR.
COMPRESSION LABS, INC.

ED BURKE
DIRECTOR PERIPHERAL PRODUCTS DIV.
DATA GENERAL CORP.

PAUL CURTIN
BUSINESS DEVELOPMENT MGR.
DIGITAL EQUIPMENT CORP.

JOHN WENTWORTH
PROFESSIONAL ENGINEER
DOTRONIX, INC.

ATTENDEE LIST
PAGE TWO

JAMES GIBBY
CHIEF FINANCIAL OFFICER
FIRST PACIFIC NETWORKS

JIM ASHER
V.P. EXTERNAL AFFAIRS
HARRIS SEMICONDUCTOR

RON YOUNG
SENIOR SCIENTIST
HARRIS SEMICONDUCTOR

BARRY BRONSON
MANAGER TECHNOLOGY COMMUNICATIONS
HEWLETT-PACKARD

DAN SCHOTT
ASSOCIATE DIRECTOR
HONEYWELL

LEN GOLDING
VICE PRESIDENT
HUGHES NETWORK SYSTEMS

JAMES INGRAM
DIRECTOR GOVERNMENT RELATIONS
IBM

DAVE De VOE
TECHNICAL SUPPORT MANAGER
I.T.T.

TOM DeBERARDINE
SALES MANAGER
LYTEL, INC.

PALLE SMIDT
V.P. MARKETING
MCC

BARRY WHALEN
V.P. PKG./INT.
MCC

DON WALKER
MANAGER LEGISLATIVE PROGRAMS
MOTOROLA, INC.

ATTENDEE LIST
PAGE THREE

LARRY PUHL
MANAGER OF RESEARCH
MOTOROLA

LIONEL ROBBINS
V.P. SLAES & MARKETING
OVONIC IMAGING SYSTEMS, INC.

JAMES GOELL
V.P. SALES, MARKETING & APPLICATIONS ENGINEERING
PCO, INC.

RICHARD ELKUS
CHAIRMAN
PROMETRIX CORPORATION

BRIAN MACKNICK
DIRECTOR TECHNOLOGY DEVELOPMENT
RAYCHEM CORPORATION

DENIS BIEBER
PARTNER & CEO
REBO HIGH DEFINITION STUDIO

AMAURY PIEDRA
CEO
SEATTLE SILICON CORP.

ALOIS STRNAD
V.P. MIS
TANDEM COMPUTERS, INC.

TOM LONG
V.P. & GENERAL MANAGER TECHNOLOGY GROUP
TEKTRONIX, INC.

WENDELL HARRISON
MANAGER BUSINESS DEVELOPMENT
TEXAS INSTRUMENTS

JEAN JACQUES GRIMAUD
PRESIDENT
VPL RESEARCH

GUESTS

THE BOSTON CONSULTING GROUP:
RON BRUMBACK, MANAGER
ROGER BOWLBY, CONSULTANT
TODD HIXON, VICE PRESIDENT
RANCH KIMBALL, CONSULTANT
KENNETH KEVERIAN, CONSULTANT
SUSAN KURYS, ASSOCIATE
GREGORY PHIPPS, CONSULTANT
LEWIS PINAULT, CONSULTANT
ROBERT SCHWARTZ, CONSULTANT
ROBERT ZIDER, DIRECTOR

CRAIG FIELDS
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THOMSON CONSUMER ELECTRONICS

D. BRUCE MERRIFIELD
ASSISTANT SECRETARY FOR TECHNOLOGY POLICY
DEPARTMENT OF COMMERCE

AEA STAFF

PAT HUBBARD
JOHN HATCH
DENISE MICHEL
CECILE COLEMAN
PRESTON SCOTT, COUNSEL, FENWICK, DAVIS AND WEST

PHILIPS

American Electronics Association
March 28, 1989

PHILIPS HDS-NA
HIGH DEFINITION SYSTEM FOR NORTH AMERICA

Philips Laboratories
North American Philips Corporation
Briarcliff Manor, New York, USA

Philips has proposed HDS-NA (High Definition System for North America) as an HDTV standard suitable for the United States. The HDS-NA system consists of a satellite feeder signal and a terrestrial distribution signal. The satellite feeder signal is needed for conveying HDTV information from studio distribution sites to local broadcast stations and CATV head-ends, and could be used for delivering HDTV information directly to consumer homes via Direct Broadcast Satellite (DBS). The terrestrial distribution signal is used for local broadcast and for CATV. The satellite and terrestrial signals are a matched pair designed such that conversion from satellite signal to terrestrial signal can be accomplished without complexity, without degradation of signal quality, and at low cost. Conventional NTSC television signals are, by design, easily derived from the satellite signal and the terrestrial signal is directly compatible with today's television system. Viewers of conventional television would continue to see NTSC pictures without degradation.

The Philips system is different from other systems in that it introduces no motion artifacts in the HDTV picture. Objects in motion move in a smooth pattern and remain in full focus. HDS-NA pictures are wide screen (16:9 aspect ratio), they are accompanied by up to 4 channels CD comparable digital sound, and they result from the delivery of 1050 lines of television information per frame time. HDS-NA ensures that the NTSC viewer will continue to see a selected portion of the wide screen by including a pan-and-scan feature (for use at the studio).

The satellite feeder signal can be accommodated on conventional FSS (Fixed Satellite Service) and DBS transponders. The design allows for future improvements by extending

naturally to higher bandwidths. Because of the nature of the satellite signal, an allocation of greater bandwidth will never obsolete in-place satellite television receivers. New receivers will be capable of displaying improved pictures while old receivers will continue to display quality to which the viewer has become accustomed.

The terrestrial distribution signal is a half-channel augmentation design. It requires 3 MHz of additional spectrum (not necessarily contiguous with the standard channel used) to convey information which must be added to NTSC to create the HDTV viewing experience. Further improved HDTV is possible through use of yet additional bandwidth should it become available. This applies both to broadcast and cable delivery.

Today's demonstration features hardware designed to create and decode the satellite signal.

In October 1988, Hughes Communications Inc., a subsidiary of Hughes Aircraft Company, and Philips announced agreement to test Philips HDS-NA system for satellite delivery. The agreement, representing a joint investment of $2.5 million, will be conducted on a cooperative basis by scientists and engineers of both companies and will result in satellite over-the-air tests in 1989. North American Philips is the first American-based television receiver manufacturer to announce a program for testing an HDTV system for the United States. As tested by the two companies, satellite delivery of HDTV to the United States could be implemented in the early 1990s.

In addition to the work on the HDS-NA satellite feeder signal, Philips is building a second generation HDS-NA terrestrial distribution signal for use in broadcast and CATV. This system will be an advanced version of the "half-channel" (4.2 MHz) augmentation system which Philips first showed publicly in May 1988. The new half channel augmentation system consists of the standard (6 MHz) NTSC signal augmented by the additional information required to generate HDTV carried in a separate half-channel (3 MHz). Our studies indicate that the signal energy of the augmentation channel can be well below that of the main NTSC signal, permitting the use of normally restricted guard-bands and taboo regions in the spectrum allocated to television. Philips plans to demonstrate and field test this second generation hardware in 1989.

Philips is fully prepared to join with others to further develop and refine an optimal system for American HDTV and will not use its intellectual property rights to inhibit full participation by other American-based manufacturers.

North American Philips is a major participant in the electronics industry in the United States. It is a major manufacturer of consumer television products. With 57,000 U.S .employees and sales in excess of $5 billion, it ranks among the largest 100 industrial companies in the

United States. The largest Philips business in the USA is the Philips Consumer Electronics Company which has world-wide responsibility within Philips for the design, development, and marketing of NTSC television and which will manufacture this year more than two million large screen color television receivers in Tennessee for sale in the U.S. and for export to the Far East. In Ohio, the Philips Display Components Company will manufacture, during 1989, more than three million color picture tubes for use by Philips and for sale to others in the USA television market. In all, Philips has over 12,000 employees in its television related businesses in this country, and its PHILIPS, MAGNAVOX, SYLVANIA Audio-Video and PHILCO TV brands are among the most popular in the country.

Philips conducts research and development at Philips Laboratories in Briarcliff Manor, New York. The Laboratories employs 350 scientists and staff, and for more than four years has been working on the design and development of an HDTV system for the United States. HDS-NA (High Definition System for North America) is an American product. It was conceived, designed, developed, and built at Philips Laboratories in Briarcliff Manor, New York and represents an investment to date of $15 million. With growing resources, Philips is committed to lead and to join with others in the HDTV market to bring an American-based HDTV viewing experience to the North American public.

Letter to the Editor
New York Times

March 22, 1989

Some Cheers for the Home Team

The article by David Sanger published in your March 21 edition discusses the Japanese "lead" in TV of the future and assigns proper credit to the Japanese for their foresight and their commitment to long term investment.

Companies in America have not exhibited such foresight nor have they invested with such consistency. A reader of your article could conclude that we have, in fact, done nothing in America. I write to point out that this is not the case and to encourage you and others to write further on the subject in a way which engenders some well deserved national pride. We appear to have adopted an inclination for self-flagellation. This is non-constructive and masks important facts.

At our laboratories in Briarcliff Manor, New York, we have worked for four years and have invested to date $15 million on the design of an HDTV system suitable for the United States. The system which we call High Definition System for North America (HDS-NA) was conceived, designed, developed, and built at our laboratories in Briarcliff and qualifies proudly as an "American product" and an "American system." The hardware we have built produces consumer-level HDTV pictures as good as any demonstrated in this country. Different from other systems, ours is NTSC-compatible and usable on an even-handed basis by satellite, cable, broadcast, and VCR modes of television delivery. We have demonstrated our results in several public forums. Only Philips (made in America) and NHK (made in Japan) have shown hardware which delivers HDTV for the American scene.

Philips is a multinational with a substantial presence in the United States. We conduct research in America, we develop products in America, we manufacture products in America, and we export products manufactured in America to the Far East. Philips has 52,000 employees in the United States, 12,000 involved in television related businesses. In Tennessee, Philips manufactures more than 10,000 large screen television sets each working day and in Ohio, Philips manufactures 3,000,000 television picture tubes annually. In its American presence, Philips (North American Philips Corporation) is a "domestic" company.

America has native television activities to be proud of. It seems counter-productive to imply otherwise. Perhaps it's time to do a bit of cheer leading for the home team.

Mark Rochkind
President
Philips Laboratories
North American Philips Corporation

HIGH DEFINITION SYSTEM
FOR NORTH AMERICA

AN AMERICAN PRODUCT

PHILIPS

PHILIPS NTSC TELEVISION

RESEARCH SUPPORT

Philips Laboratories
Briarcliff Manor, New York

PRODUCT DEVELOPMENT AND MANUFACTURING

Philips Consumer Electronics Company
Knoxville and Greeneville, Tennessee

PICTURE TUBES

Philips Display Components Company
Ottawa, Ohio

INTEGRATED CIRCUITS

Signetics Company
Sunnyvale, California

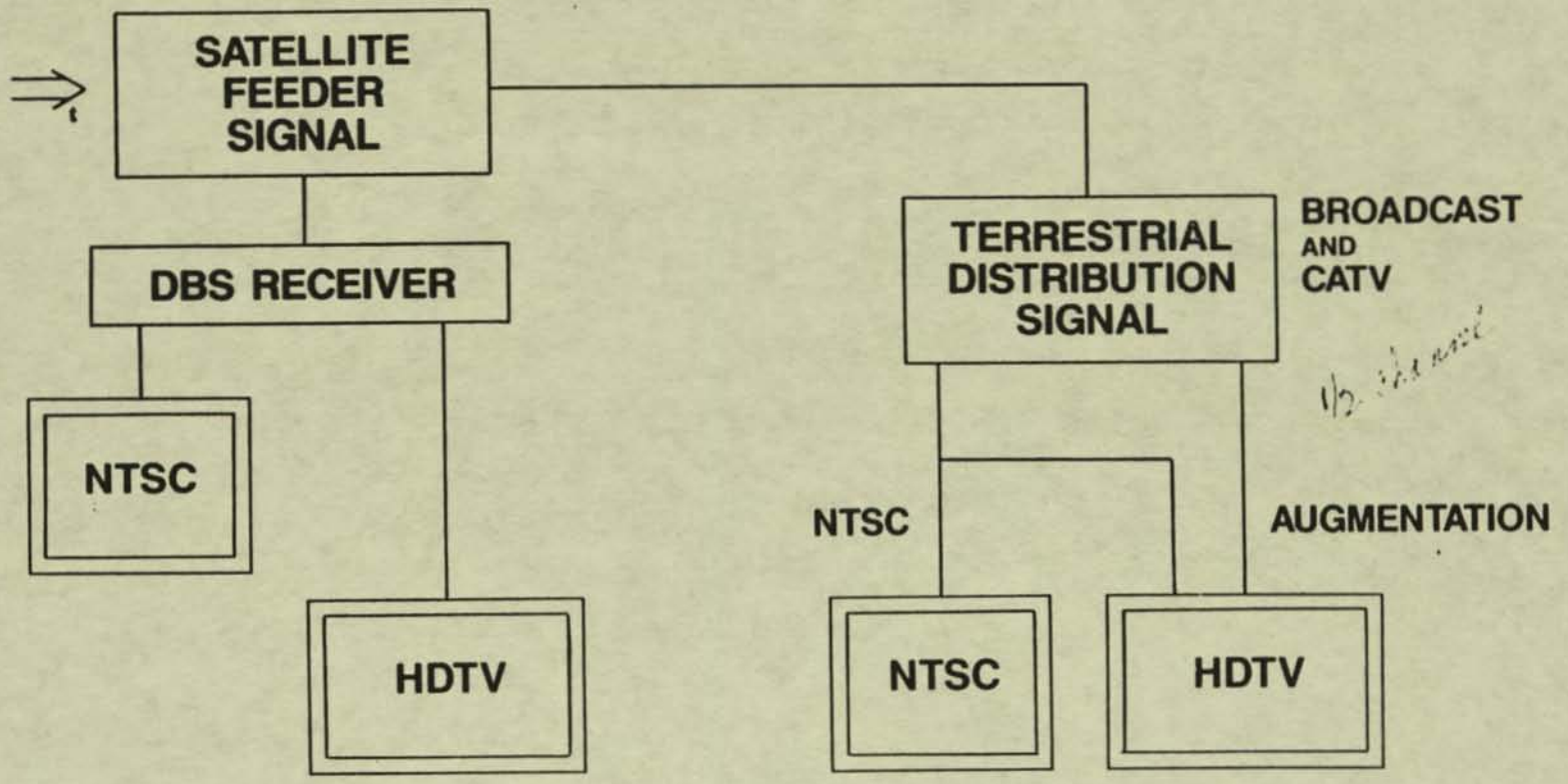
PHILIPS 

HDS-NA

HIGH DEFINITION SYSTEM FOR NORTH AMERICA

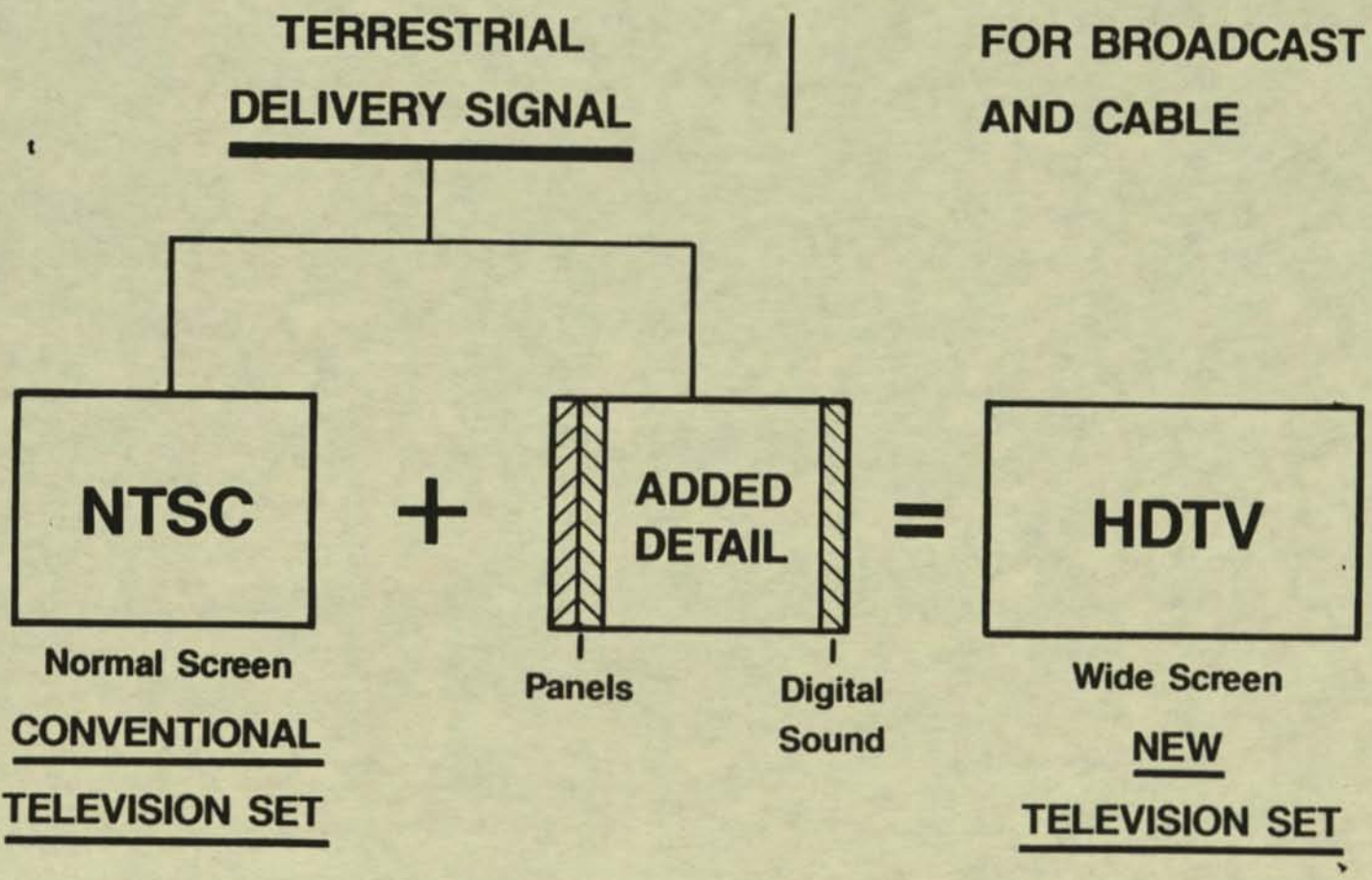
PHILIPS

SYSTEM CONCEPT / HDS-NA



PHILIPS

NTSC COMPATIBILITY / HDS-NA



HDS-NA

SYSTEM DESIGN OBJECTIVES

- NTSC Compatible (without degradation)
- Comparable in Quality to What Will Be Available Elsewhere
- Usable on Even-Handed Basis by All Modalities of Delivery

PHILIPS

HDS-NA ATTRIBUTES

(1) Wide Screen / 16:9 Aspect Ratio

(2) CD Quality Digital Sound / Four Channels

(3) No Motion Artifacts

(4) HDTV Resolution (1050 Lines per Frame Time)

(5) NTSC Compatibility Without Degradation

(6) Pan-and-Scan Capability (16:9) → (4:3)

PHILIPS

HDTV DEVELOPMENT CHAIN

CONCEPT

SIMULATION

HARDWARE IMPLEMENTATIONS

TRANSMISSION TESTS

SYSTEM REFINEMENT

SILICON DESIGN

STANDARDS

PRODUCTS

PHILIPS

FCC TENTATIVE DECISIONS

(1) NTSC Compatibility

(2) Preserve Spectrum

(3) Maintain Broadcast as Competitive Service

(4) Do Not Retard Other Modes of Delivery

PHILIPS

EMERGING CHOICES

(1) SINGLE CHANNEL (6 MHz)
NTSC Compatible - EDTV

(2) HALF CHANNEL AUGMENTATION (6 + 3 MHz)
NTSC Compatible - HDTV

(3) FULL CHANNEL AUGMENTATION (6 + 6 MHz)
NTSC Compatible - HDTV

(4) SIMULCAST WITH NTSC (6 + 6 MHz)
Non-Compatible - HDTV

PHILIPS

COMPATIBLE EVOLUTION TO HDTV

CONVENTIONAL TELEVISION (4:3)

NTSC → IDTV → IDTV+

WIDE SCREEN TELEVISION (16:9)

HDTV

PHILIPS

UNIFIED STANDARD

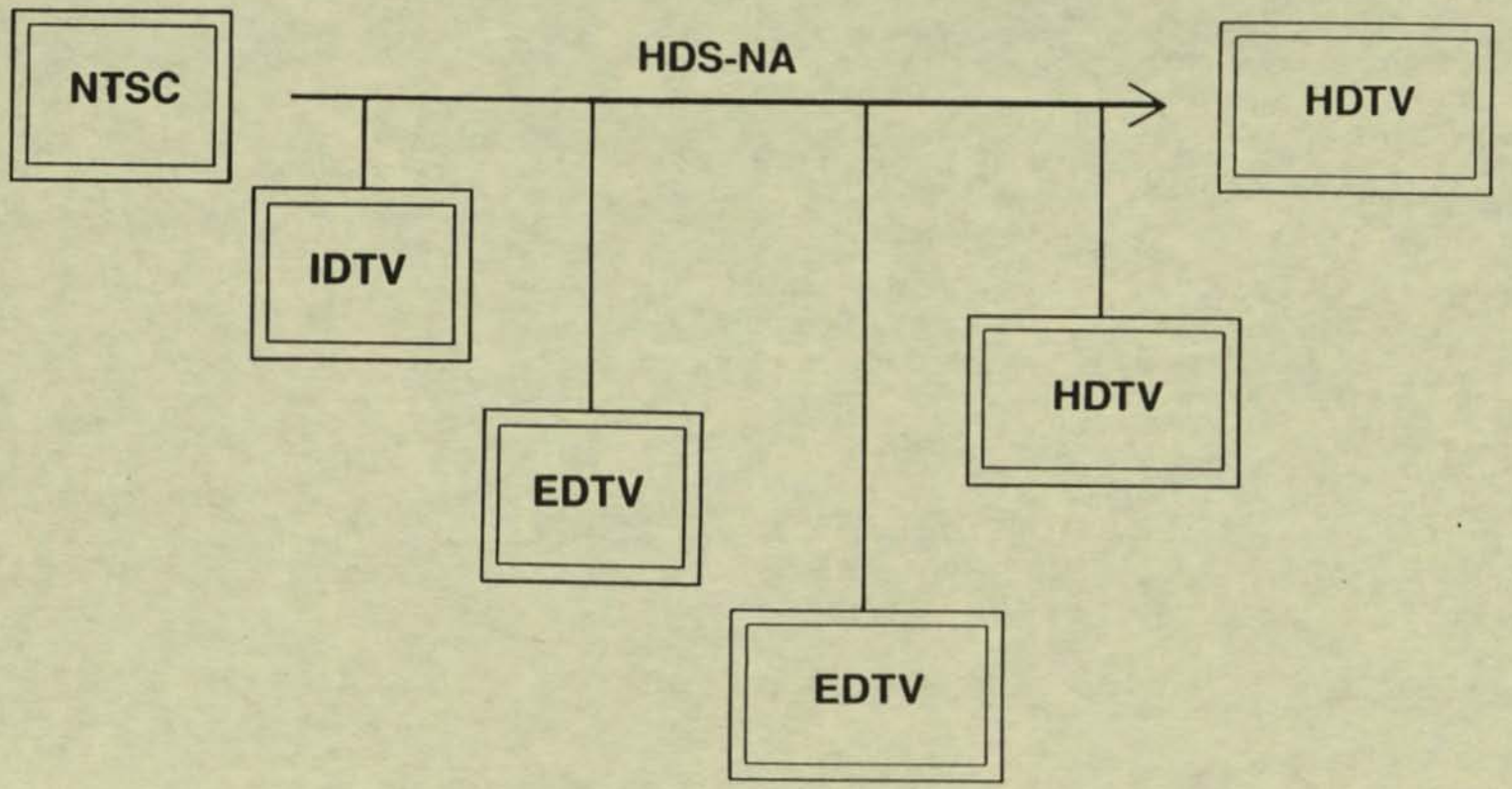
- **Matched Satellite and Terrestrial Signals**
- **Quality Parity Across Media**
- **Headroom for Future Improvements**

BENEFITS

MINIMIZE DEVELOPMENT
MINIMIZE COST TO CONSUMER
MINIMIZE CONSUMER CONFUSION AND ANXIETY
MAXIMIZE RATE OF MARKET PENETRATION
ADVANTAGE FOR RESURGENCE OF INDUSTRY

PHILIPS

SINGLE STEP TRANSITION



PHILIPS

AEA HDTV BUSINESS PLAN GROUP

March 28, 1988
9 a.m. - 3 p.m.
SHERATON-CARLTON HOTEL
923 16th Street, N.W., WASHINGTON, D.C.
Mount Vernon Room, Lower Lobby

AGENDA

Goal: To understand approach and preliminary findings of Boston Consulting Group and provide input to help them achieve viable industry strategy by May 15.

Boston Consulting Group Presentation	9:00 - 11:00 a.m.
Defense Advanced Research Projects Agency ○ Craig Fields Deputy Director for Research DARPA	11:00 - 11:30 a.m.
Foreign Participation ○ Open Discussion	11:30 - 12:00 noon
Lunch served in the Potomac Room	12:00 - 12:30 p.m.
Federal Communications Commission/Standards ○ Richard E. Wiley Senior Partner Wiley, Rein & Fielding	12:30 - 1:00 p.m.
North American Philips ○ Mark Rochkind President, Philips Laboratories North American Philips	1:00 - 1:20 p.m.
Thomson Consumer Electronics ○ Joseph Donahue Vice President, Senior Scientist Thomson Consumer Electronics	1:20 - 1:40 p.m.
Department of Commerce/National Institute Standards and Technology ○ D. Bruce Merrifield Assistant Secretary for Technology Policy Department of Commerce	1:40 - 2:00 p.m.
Congress/Legislative Initiatives ○ James Turner Counsel House Subcommittee on Science, Research and Technology	2:00 - 2:40 p.m.
Summary Discussion	2:40 - 3:00 p.m.

From: RDVAX::FULLER "SAM FULLER, ML12-2" 19-APR-1989 11:58
To: DELUCA
Subj: print and file in HDTV

From: TRIPPR::KURZONT "Forever Young 14-Apr-1989 1443" 14-APR-1989 14:44
To: @DISLIS1.DIS,KURZONT
Subj: News in a Nutshell, issue 112

For Internal Use Only

*** NEWS IN A NUTSHELL ***

Mary Kulas
New Computing Structures
MRO2-3/T99
Trippr::Kulas

Issue 112
April 14, 1989
5 pages

****
Please send additions/deletions/changes to distribution list to Lee Kurzontkowski at TRIPPR::KURZONT. Thanks.

Comments and suggestions welcome. Send to Trippr::Kulas.
****

Since HDTV will be a regular column in the newsletter from now on, I thought an overview of what has happened to date might be beneficial. Therefore, this week's issue is devoted exclusively to HDTV. It includes the following sections:

I. DEFINITION OF HDTV

Narrow definition - a new high-performance consumer television

Broader definition -
"ATV [Advanced Television] is a fundamental new imaging technology with enormous capability to affect not only most electronics industry segments, but the balance in the end user markets between cable, broadcasters, etc."

"HDTV represents the merging of the television and the computer industry."

The AEA and IEEE both believe that HDTV and associated technologies represent the last chance for the U.S. to have a presence in the consumer electronics markets and prevent loss of market in such non-consumer fields as computers.

At the heart of the problem is the U.S. loss of significant electronic based technologies. A common food chain exists in the electronics industry (defense, commercial and consumer). The U.S. has not lost the ability to innovate in this area, but has fallen behind in its capability to "engineer for manufacturing," develop process equipment and manufacture in volume. The U.S. is far behind Japan in many areas such as displays, DRAMS, Digital GaAs,

packaging, test equipment, optics, and photonics. One must consider these and other technologies as components of an electronic food chain which feeds all levels and segments of the industry.

II. PLAYERS

U.S. Government - DARPA, Commerce Dept., FCC, Congress

Associations - American Electronics Association (AEA), IEEE

Industry - Computer, semiconductor, television, cable
Broadcast, Display, RBOCs

Japan - Hitachi, Sony, Matsushita, NEC, etc.

Europe - Philips, Thomson

III. STATUS OF HDTV

Japan has spent about $700m over the past two decades and will begin direct-broadcast satellite HDTV transmission to their home market next year.

Europe has been spending about $200m-$250m per year on HDTV in the pan-European Eureka project. Satellite broadcasts of a wide-screen 625-line version of the Multiplex Analog Component format are expected to begin in 1992, with full-service European high-definition MAC broadcasts following in 1997.

Boston Consulting Group estimates Japan is 10 years ahead of U.S. efforts; Europe eight years.

The U.S. has not yet selected a transmission status. The FCC hopes to choose a U.S. standard within 2-3 years.

Market projections:

AEA believes $20b-$40b by 2010 for HDTV receivers.

Initial prices for receivers will be $2,500 to $4,000 at retail.

IV. CURRENT ACTIONS

o Hearings before Congress are currently underway. Section VII, PROPOSED LEGISLATION, contains a summary of Representative Mel Levine's proposal. Rep. Levine has taken a leading role in support of HDTV efforts.

o AEA has organized a large group of companies to devise a business plan for entering the market and it includes all enabling technologies. Preliminary plan may suggest a display consortium. Boston Consulting Group has been hired to put together the plan. Final version may be ready by May 15. Digital is a participant in the AEA effort. Section VI, MEETINGS, contains notes from the most recent AEA business plan meeting.

o DARPA accepted proposals until Feb. 27 to award $30m to display and enabling electronics work. DARPA received 82 proposals, 5 white papers. Narrowed down to 49 involving 106 firms. AT&T and Zenith are jointly asking for $13m to develop some advanced TV parts.

o The National Association of Manufacturers recently held a trade

forum to discuss how the U.S. government and U.S. industry should respond and have already responded to the HDTV challenge and the likely impact on U.S. trade policy. Industry representatives also shared their perspective on the HDTV issue. Digital was one of the panelists.

V. ISSUES/PROBLEMS

- Many versions of how HDTV should be developed and deployed. For example, MIT wants an open architecture; Electronic Industries Assocation does not.

- U.S. risks becoming a second-rate technology player if U.S. cedes HDTV-receiver production to Japan and others.

- Some believe that as sophisticated HDTV products gain more and more processing power, they will begin to compete with PCs and workstations. If the Japanese have a dominant HDTV position, they will leverage the volume to take PC market share from the U.S.

- HDTV may drive technology in advanced semiconductors, high-resolution displays and other technologies because HDTV receivers and video-cassette recorders will use vast amounts of digital memory and logic circuitry.

- High resolution flat panel and CRT display technology developed for HDTV will find applications in defense, medical imaging, and computers, among other segments.

- "There's almost an HDTV hysteria today." "It's becoming a symbol of what's wrong with the U.S. and [with] U.S. competitiveness." Larry French, Corporate VP at North American Philips Corp.

- Electronic Industries Association believes the focus should be not on who owns HDTV manufacturing, but rather on assuring the maximum number of U.S. jobs in HDTV production and R&D.

- All U.S. companies acting on their own, except IBM, lack the capital to build competitive plants.

- HDTVs will first cost $2,500 to $4,000 at retail. There is a risk that U.S. consumers will not accept the technology thus creating a mass market to drive volume pricing.

- Some form of government participation will be essential for success. Any one or combination of the following have been suggested:

  - Consortium (industry, government/industry)
  - Federal loan guarantees
  - Tax breaks
  - Relaxation of antitrust laws
  - New trade regulations
  - Stricter enforcement of current anti-dumping laws

VI. MEETINGS

Notes from the AEA HDTV Business Plan Group meeting held 3/28/89.

- Pat Hubbard, VP of AEA
  Says the IEEE view of HDTV is "TV only" business.
  AEA's view is that it is an electronics and computer business issue.

o Boston Consulting Group, as mentioned earlier, is preparing the business plan for the AEA. Final version may be ready May 15. Some preliminary notes from that plan:

Definition of "high-definition" - display with more than one million pixels.

Volumes will be slow to start.

Market will be dominated by whoever controls the display and to a lesser extent, chips. It is a vertically-integrated business that includes workstations and PCs.

US. Technology (BCG opinion) vs. Japan

CRT	weak -> parity
Projection	weak
Flat Panel	very weak
Future FP	good ideas, small investment
DSP	strong design; process is one generation behind Japan
Memory	strong design; process is one generation behind Japan

o Craig Fields, Deputy Director of Research, DARPA

Innovative display technologies exist in the U.S. which could be the best in the world.

DARPA needs to ensure a domestic supply of semiconductors.

Government agreement on roles:
President wants Mosbacker (Secretary of Dept. of Commerce) to lead.
DARPA has a technology role.

DARPA will link up companies to complete program.

Looking for additional funding from other government agencies.

o Discussion of foreign participation in the work group

Opinions range from "no way" to "let's work together." Really speaking of Thomson and/or Philips. Japan is not mentioned.

o FCC Standards, Dick Wiley, Chairman of the FCC advisory committee on HDTV and former FCC chairman

Asking for two-year extension of committee

Reaching testing stage

Design independent tests and test real hardware (no simulations)

Possible selection around CY1992

o Philips (invited to present)

Wants to participate.
Expects it will be five years before HDTV comes on the scene.

o Thomson (invited to present)

Investing in a huge tube facility in the U.S.
Sees biggest technologies threats from light valve, flat panels, etc.; not enough R&D money available for it to happen in the U.S.

Thomson and Philips are both open to any and all kinds of partnerships.

VII. CURRENT LEGISLATION

The following summarizes Representative Mel Levine's position on HDTV. His District office is in Los Angeles, CA. He has taken a lead role support of HDTV efforts.

"U.S. is poised on the threshold of a revolution in electronics. What was too costly or impractical in the past will soon become inexpensive and feasible. In combination with a variety of technical breakthroughs, new technologies will be available which may radically alter industries dependent of or related to these developments. In other words, the very infrastructure of our economy and defense may be affected."

The U.S. must be in the forefront of this revolution or we could become dependent on others for its sources of technology.

ATV is the focal point for this new generation of electronics. Development will have repercussions on any industry utilizing electronics or involved with televisions, plus many more.

Legislation proposed would:

- Establish an industry consortium known as TV TECH.
- Structure TV TECH like the successful HDTV European consortium, EUREKA '95.
- Encourage pilot projects and state incentives to attract the development of advanced television industries.
- Limit participation to U.S.-owned firms; allow flexibility to arrange for technology transfer from non U.S.-owned firms.
- Provide protection for patents, royalty rights and license fees.

f: HDTV

American Electronics Association

AEA

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February 3, 1988
To: HDTV BUSINESS PLAN GROUP
From: Pat Hubbard
Re: General Update

Markey Report: "Deep-six" the pages I FAXED you last week on the proposed summary ACTION PLAN for Markey. We rewrote--and rewrote--and rewrote--and rewrote and...finally submitted the attached. Writing footprints are primarily from AT&T Bob Regan, IBM Jim Ingram, and me. Many thanks for many of you for input.

Because time did not permit any one AEA group--yourselves, the old ATV Task Force, the ESP Steering Committee, etc. to review the whole document, we sent it in as representing "a compilation of views from a variety of AEA sources, including AEA staff and selected key companies which have been actively involved in this issue since June 1988." A list of your companies was attached to the document as members of the HDTV Business Plan Group.

Markey--February 23 Hearings: See attached showing Markey's intention to hold hearings on February 23. We will offer to testify. Do any of you volunteer????

Business Plan Consultant: Word is "out" and I have received 6 or so unsolicited proposals from groups/individuals to conduct the business plan. I am currently following a hot lead that may "possibly" result in an extensive and costly--but mostly pro-bono effort. If it comes through, will let you know.

Additional Business Plan Companies: You can see from the attached list that some 5 additional companies have joined in funding. Another three or four are currently considering it. North American Philips and Northern Telecom have offered their input on an informal basis as well.

Meeting: None is scheduled nor anticipated. The work at hand now is to get a consultant on board who get input from each of you. ---A most serious and continuingly difficult question asked of AEA by DARPA, Government agencies, Congress et al and I ask each of you to consider it thoughtfully is: "Do we anticipate partnerships or participation with foreign owned U.S. based companies which do significant R&D in the United States? I will be in Wasington Feb. 6-10: intend to go to Dept. of Justice to try to clarify the anti-trust issue and will let you know outcome. I am briefing a small group of Senate and House S&T staff next week, meeting with staff to R. Porter, Bush's Economic Policy Advisory, etc. Welcome your input any time.

Apologize for any difficulty in reaching me. Phone and mail activity is extremely high.

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HDTV BUSINESS PLAN COMPANIES

AT&T

AVX CORPORATION

ANADIGICS

ANALOG DEVICES SEMICONDUCTOR

APPLE COMPUTER

COHU

DIGITAL EQUIPMENT CORPORATION

DOTRONIX, INC.

FIRST PACIFIC NETWORKS

HARRIS CORPORATION

HEWLETT-PACKARD

IBM

I.T.T.

MICRO ELECTRONICS COMPUTER TECHNOLOGY

MOTOROLA

OVONIC IMAGING SYSTEMS, INC.

PCO, INCORPORATED

PROMETRIX

RAYCHEM CORPORATION

TEKTRONIX, INC.

TEXAS INSTRUMENTS

THE GRASS VALLEY GROUP (TEKTRONIX)

VARIAN ASSOCIATES

VPL RESEARCH

EDWARD J. MARKEY
CHAIRMAN

U.S. House of Representatives
Subcommittee on Telecommunications and Finance
of the
Committee on Energy and Commerce
Washington, DC 20515

Room H2-316
House Office Building Annex No. 2

LAWRENCE R. SIDMAN
CHIEF COUNSEL/STAFF DIRECTOR

NEWS RELEASE

FOR IMMEDIATE RELEASE
February 1, 1989

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MARKEY ANNOUNCES SERIES OF HDTV HEARINGS

Congressman Edward J. Markey (D-Massachusetts), Chairman of the House Subcommittee on Telecommunications and Finance, today announced that the Subcommittee will hold a series of hearings to consider reports concerning the policy implications of advanced television technologies, including high definition television (HDTV). The first hearing will be held on February 23, 1989. Witnesses at the hearings will include heads of government agencies with relevant jurisdiction, executives representing telecommunications, electronics, computer and semiconductor companies, economists and academicians and other interested parties.

Congressman Markey noted that as of February 1, the Subcommittee had received more than two dozen reports in response to his request last September for "action memos" outlining strategies for developing advanced television technologies. "In light of the tremendous number of responses and the increasing concern about this important issue among industry leaders and government officials alike, I believe it essential that the Subcommittee hold hearings to review the strategies outlined in the action memos as expeditiously as possible", Markey stated.

In announcing the hearings, Markey noted that "many of the reports submitted today contained divergent viewpoints as to how best to optimize American involvement in the HDTV revolution. I want to help drive American industries to a consensus viewpoint on this technology. Working as a team, government and industry can fashion a coherent national strategy on HDTV, a strategy that reflects the economic, trade, technological and, potentially, national security implications of advanced television technologies.

"While a few American companies are involved in the development of HDTV, we as a nation are late getting into this ballgame. I want to ensure that at the final gun American industry, American workers, and, most importantly, American consumers are winners", Markey stated.

Markey concluded by noting that the hearings announced today will buttress the extensive record on advanced television technologies developed by the Subcommittee during the 100th Congress. The Subcommittee held hearings concerning HDTV on October 8, 1987, June 23, 1988 and September 7, 1988.

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American Electronics Association AEA

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February 1, 1989

The Honorable Edward J. Markey
2133 Rayburn House Office Building
Washington, DC 20515

Dear Congressman Markey:

The American Electronics Association (AEA) is pleased to respond to your request for a report on American participation in advanced television technologies. We appreciate the opportunity to contribute to the Subcommittee's consideration of this vital issue. We especially commend your personal leadership.

The document represents a compilation of views from a variety of AEA sources, including AEA staff and selected key companies which have been actively involved in this issue since June, 1988. In addition to responses to specific questions you have raised, included is a summary and two attachments: (a) list of AEA ATV Task Force companies and (b) "HDTV--An Historical Perspective," Richard Elkus, Chairman, Prometrix, Inc.

Major macroeconomic policies are a prerequisite to the competitiveness of the U. S. economy. Macropolicies alone, however, are insufficient. The lack of an adequately broad level of participation by the U. S. economy in consumer electronics, including ATV, is not just a symptom of the absence or failure of certain micropolicies. Rather, it is a consequence of the failure of the American political system to acknowledge and respond to a fundamental change in the world's economy.

Fortunately, the U. S. possesses significant competitive strengths in ATV on which a strategy of revival can be built. Among these are: a large homogeneous market; software to deliver the U. S. stock of movies, music, and other materials; a large and healthy computer and telecommunications industry; a healthier but still vulnerable semiconductor industry; existing ATV technologies or skills to develop them; and future digital technology.

Unfortunately, the U. S. lacks a viable, broad based consumer electronics industry and an adequate level of R&D, engineering, and manufacturing skills in consumer electronics to protect the U. S. economy against end use market domination by others. Among options presented herein, therefore, are the need for incentives to promote the investment of domestic capital and technology in the broad consumer electronics market and for increased access by the domestic semiconductor industry to the worldwide consumer electronics market end use producers. AEA will continue to examine the role of the U. S. Government and the foreign owned R&D and manufacturing resources available in the U. S.

AEA is fully committed to help organize and support formation of an industry-wide ATV strategy to build upon U. S. strengths. Nineteen AEA companies have now pledged to underwrite the development of a business plan as the next crucial step to revive a strategic U. S. based industry (list attached). We urge you and your Subcommittee's continued leadership in speeding the consensus making process essential to a coherent ATV public policy.

Sincerely,

J R Iverson

J. Richard Iverson
President and CEO

JRI:efs

Enclosures

RESPONSE OF THE AMERICAN ELECTRONICS ASSOCIATION TO THE REQUESTS OF THE SUBCOMMITTEE ON TELECOMMUNICATIONS AND FINANCE OF THE COMMITTEE ON ENERGY AND COMMERCE OF THE UNITED STATES HOUSE OF REPRESENTATIVES

February 1, 1989

SUMMARY OF THE AEA RESPONSE ON ATV TO THE REQUESTS OF THE SUBCOMMITTEE ON TELECOMMUNICATIONS AND FINANCE OF THE COMMITTEE ON ENERGY AND COMMERCE OF THE U.S. HOUSE OF REPRESENTATIVES.

February 1, 1989

The American Electronics Association (AEA) believes that the United States economy faces an unprecedented challenge. Future improvements in our standard of living and maintenance of the balance between the leading economies of the world are threatened by continued diminishment of U.S. competitiveness in strategic industries such as ATV.

The potential market for ATV technologies is enormous, with current estimates ranging from $40 billion to $150 billion. If the United States is to compete successfully in the ATV marketplace, American business needs a national strategy around which it can rally. While preserving the benefits of our free enterprise system, we need to rebuild our companies' and country's technological leadership and competitiveness through improved cooperation of industry, government and academia.

Substantial participation by the U.S. economy in ATV is vital to American competitiveness across the board. Participation by the U.S. economy principally as assembler, distributor and consumer of ATV products is not sufficient.

Failure of U.S. industry to perform research and development, design, engineering and manufacture of ATV products and services will seriously inhibit its ability to participate successfully in related markets such as semiconductors, telecommunications and computers. Failure to participate in ATV will make U.S. national security dependent upon the availability of technological capability controlled by other nations.

The United States must develop an environment which supports, encourages and enhances U.S. industry's competitiveness in response to the global marketplace of today. U.S. policies and strategies must recognize that competitiveness occurs not only between individual companies, but between countries and economies as well. Ultimately, the competitiveness of our economy is more than just the sum of the competitiveness of individual domestic and foreign firms operating in the U.S. macroeconomic policy environment. Competitiveness must include consideration of the effects of investments in education, the infrastructure, basic research, and the policy environment that promotes or discourages collaboration among individual firms, universities and government.

Special measures will be required to improve U.S. competitiveness and ATV participation and several options Congress should consider are l sted below:

1. Revising antitrust laws and providing specific exemptions for new high-tech ventures like ATV.

2. Special tax treatment, including reduced cost of capital, to nurture the new venture until it is viable.

3. Encouraging State incentives to promote high technology ATV development.

4. Expanding Government's export market role to improve market access for U.S. manufactured products and services and generally working to create a level playing field. Access by the domestic semi-conductor industry to the world-wide consumer electronics market end-use producers is a specific area for improvement.

5. Increasing Government's ancillary roles in providing credit options for countries buying American-made products or services; in establishing U.S. training and technical services for less advanced countries as incentives to adopt the U.S. developments, and the like.

6. Working with academia and industry to better understand and provide the scientific/technological educational skills necessary to maintain highly advanced industries.

7. Establishing special funding to generate the necessary investment in research and development, leading to meaningful participation in the total ATV market process.

8. Examining patent policies and licensing rights to support American ventures.

Although the United States seriously lags in ATV technological capability, the U.S. also possesses many competitive advantages, including a huge homogeneous market. We need to take full account of our relative advantages and disadvantages in developing a best-interest strategy aimed at moving us toward our desired destination. Discussion of the ideas outlined above will help formulate a cohesive national strategy.

AEA has been actively involved in exploring ATV policy options for several months. Assistant Secretary of Commerce Al Sikes brought the issue of ATV to the attention of the AEA in the Spring of 1988. In May, AEA's newly established Board-level Science and Technology Committee appointed an ad hoc ATV Task Force to study the competitive aspects of ATV. In June, AEA held an ATV information meeting attended by some fifty government and industry executives. From this meeting, an AEA ATV Task Force was established.

In the last six months, significant progress has been made within the AEA:

- The committee-level ATV Task Force was elevated to AEA Board-level, reflecting the Board's view of ATV potential impact on the larger membership.

- Twenty-eight companies eventually comprised the ATV Task Force (See Attachment A); they met four times -- June, August, September and November.

In September, AEA's Board requested that two third-party government studies be undertaken and authorized exploration with government agencies regarding a possible joint industry-government ATV R&D consortia.

As an outgrowth of the Task Force, some twenty AEA member companies recently joined together to fund the development of a business plan. The purpose of this group is to define a structure and an investment strategy for U.S. participation in ATV and related markets.

AEA strongly supports the initiative and efforts of the sub-committee and Chairman Markey and is hopeful that the results of this inquiry will pave the way for improved U.S. competitiveness and a new economic viability. Such initiative can speed the consensus-making process essential to a coherent ATV public policy.

If we are to compete successfully in ATV, the traditional relationship between government and industry must adjust to reflect today's global competitive realities. We need to create an environment which restores U.S. leadership in technology and industrial competitiveness. American business does not seek more government intrusion, but it does need a national strategy and direction around which it can rally and compete.(1) We need to decide our destination, relative to:

- A stronger technology base
- Improved market share
- Increased number of quality jobs
- Reduced trade deficit, etc.

We then should do what it takes to achieve these common goals.

"Finally, what remains is to ensure that the United States becomes a dynamic player in the world technological arena. To ensure that patent and royalty rights benefit the economy of this nation. To ensure that the "cutting edge" in technological leadership for computers and sophisticated electronics is not jeopardized. To ensure that scientific and technological jobs are retained, not just assembly-lines. To ensure the Government provides policy direction and strategies for success, not additional forms of intrusion. To ensure that this issue does not get diluted by competing political interests--that it remain the national interest."(2)

Background

French Government SECAM Promotion--One Example of Government "Enabling". If we assume a nation no longer measures its strength in military or economic terms alone, but also on its underlying technological capability, a review of the French Government's leadership and involvement in promoting the French SECAM/color television system in the 1960s is relevant. It shows how a government was able to create and promote an industry in the private sector through the use of standards and political marketing strategies.(3)

The belief in the existence of a technological gap led the French Government to a policy of creating and developing a strong "indigenous capability" in certain highly advanced technologies that spearhead related industries. The decision of the French Government to promote the SECAM color television system as a "national champion" stemmed from the fact that SECAM was a French-owned technology.

French Patents: Key to Indigenous Industry

SECAM had been based to a large extent on American-owned patents for the NTSC American color television system standard. From efforts to develop a computer industry in France, the French had learned that the development of an industry depended upon owning patents, having the industrial capability to manufacture the products, and having the ability to protect them by maintaining control over political, economic and technical forces in the external environment.

SECAM signified the potential for the economic independence of France in the realm of this technology. With their own color television system, the French would not run the risk of being dependent upon anyone else for its technology. Adopting the existing U.S. color television standard would have meant having to pay royalty fees, at a percentage determined by the Americans, for the license to manufacture NTSC receivers and equipment.

Instead, an anticipated economic return of billions of dollars from worldwide sales of the license rights of SECAM, and its professional and consumer electronics, as well as the possible sales of French color television programs, made the system a potentially lucrative venture. There was potential for revenue from royalties, sales of studio, broadcast and transmission equipment, television receiving sets, technical "know-how", movies and entertainment services. The potential market for SECAM in the early 1960s was national and international, including almost every country where the U.S. NTSC standard had not been established.

Using SECAM to Promote Relationships with Other Countries

The French also had the opportunity to use the SECAM system to promote scientific as well as cultural exchange with other countries. Through the sale of technological expertise, and television programs, the French had new opportunities to expand their sphere of influence in other directions. SECAM represented a means of closer communication and cooperation between France and countries adopting the French technology.

SECAM as the National Champion for Independence from U.S. NTSC

President de Gaulle was convinced by the arguments and economic data from his advisors that in the SECAM color television system lay the possibility of a "national champion" which would succeed because SECAM contained the ingredients that previous national champions had lacked to make France independent of U.S. technology.

Combined with the expected lucrative financial return, these factors prompted President de Gaulle to direct national resources to promote the SECAM system at home and abroad.

West Germans Develop PAL, a Third System

The French did succeed in developing a color TV industry. Eventually the West Germans developed a third system, PAL, incompatible with NTSC and SECAM, but heavily based on SECAM patents. The world was divided by three different color television systems which closely paralleled political and cultural alignments.

U.S. Government Lack of Help and Impediments Loses NTSC Sale

One of the key reasons the United States lost the sale of the NTSC system was due to poor political coordination and impediments the U.S. Government put on its industry. U.S. Government assistance was minimal and lack of coordination actually hindered the sale.(4)

Deja Vu With ATV

Today as discussions again revolve around the future of television, the same issues are being rehashed. It is a case of deja vu, except that this time the world players are much more sophisticated, the stakes are many times higher, and the technologies involved are much more complex.(5) Because of the inter-relationship of electronic industry segments, non-participation by the U.S. electronics industry in the emerging ATV market could deprive the U.S. not only of a vast new market opportunity, but the resources necessary to sustain today's leading edge technology: semiconductor manufacturing first, then others such as test equipment, software, manufacturing equipment in general, and ultimately, telecommunications and computers. The consequences of such a loss would cost the U.S. electronics industry its ability to compete effectively in the global marketplace. The potential of ATV offers us a window of opportunity back into consumer electronics.(6)

Foreign Trading Partners are Positioned for 21st Century

Reports accumulate on the United States falling behind Japan and Europe in research of technologies essential to industrial and economic success in the 21st century. The Japanese Government's role in directing and coordinating industrial research is well known. Japan's commercial successes in consumer electronics have won that country economic rewards which have been reinvested in more research, giving it a lead in product development that is the envy of the world. The European community is also providing cooperative research programs and promoting trans-national industrial combinations for projects too big or too expensive for individual countries or companies. ATV is one example of Europe-wide cooperation, the purpose of which is to position Europe to meet 21st century industrial competition. ATV has been targeted by Japan as its next major consumer electronics push.

Members of AEA's ATV task force understand the magnitude of the challenge and that a new level of industry and government cooperation and coordination will be required to "enable" meaningful U.S. participation in the ATV market.

Question 2: **Should the federal government adopt or attempt to adopt an HDTV standard for all media industries, including broadcast, cable, DBS and VCR or only terrestrial broadcast? Or should the marketplace decide? Provide criteria and timetable where appropriate.**

Basically, Government should not dictate ATV standards beyond what is necessary to protect existing investment in NTSC receivers and terrestrial broadcast. Government should let the marketplace decide, while helping guide, coordinate and arbitrate industry diversity as necessary.

ATV Standards Issues Abound with Complexity

Most people are confused over standards issues. One reason is that multiple standards are in question, e.g. production, transmission and receiver, and that when referring to a particular ATV system several standards are combined together.

Technicians who understand the standards tend to debate the merits of the various combinations ad infinitum. When the debate over color television systems occurred, the key question was in the modulation of the color signal: the U.S. had NTSC, the French SECAM and the Germans PAL.

ATV systems are much more complex because there are many more methods of transmission, each with different standards. The key consideration, however, should be compatibility as the many standards proposals are developed and evaluated.

In considering a U.S. standard, though technical issues are extremely important, policy should drive the decision because the standards selected will affect how well the United States can compete. The consideration should include:

1. Compatibility with existing over-the-air standards to protect the consumers needs and embedded costs.

2. Accounting for the capital outlay already in studio production and broadcast to minimize expense to the broadcast industry.

3. Maximizing opportunity for future growth, enhancement and availability of consumer products and services.

4. Efficient utilization of bandwidth.

5. Capacity for technological quality and longevity.

6. Advantages to U.S. consumers, manufacturers, and broadcasters.

FCC Call for NTSC Compatibility Helpful

The FCC's decision calling for a system compatible with existing sets and terrestrial broadcasts was widely applauded as protecting existing economic investments while allowing for the development of a quality American ATV system.

The Europeans

The Europeans are currently investing over $200 million per year on advanced television related research. They do not view HDTV as just another important market segment, but as the strategic industry of the future because of all the interrelationships to other segments. Having achieved unanimity and effective organization through EUREKA 95, a consortia of 17 European countries formed in 1985, Europeans feel that:

1. They have an integrated market and thus internal opportunities for sales.

2. Without any of its own domestic manufacturers, the United States must choose a standard and, because Japan poses a serious trade threat to the U.S. as well as to Europe, it is likely that U.S. ties may lead to adoption of the European standard.

In Europe, manufacturers were able to develop their HDTV system in about two years. But unlike companies in the U.S., European companies have remained strong in consumer electronics.

The Japanese

The Japanese have also spent hundreds of millions of dollars on advanced television research and will undoubtedly have the first commercial system available, probably in the early 1990's.

U.S. Should Resist Adoption of Foreign Standards

Without a thriving indigenous television industry, the temptation is to adopt another nation's standard.(reference 5) But this time the stakes may be too high and before the U.S. Government adopts any other country's standard, as was seen in the January 1988 controversial decision by the Advanced Television Systems Committee to choose the system developed by Japan's NHK, it is important to understand the following:

1. Telecommunications, computers and defense are inextricably linked and we can't afford to become dependent on another nation's standard or source of supply.

2. The United States has its own huge domestic market, and thus has guaranteed sales for the TV industry alone. Because of the high initial price of the ATV receiver, the probable lack of a broadcast standard and the newness of the service, sales will be relatively slow to start. It will take years to saturate our market. This lag offers a unique opportunity to rebuild virtually a dead domestic industry.

Despite the pronouncement of some that it is already "too late", there is time for the U.S. electronics industry, with the encouragement and leadership of government, to mount a winning effort. The first standard into production is not necessarily the successful entry, e.g., the case of Betamax versus VHS.

3. There are enormous internal benefits to be reaped in the interrelated industries. It is not only a chance to rebuild an industry, but create new ones on the technological "cutting edge." Hundreds of thousands of new jobs may potentially be created by successful U.S. re-entry.

4. The Europeans and Japanese intend to adopt their own standards, so there will not be a single worldwide standard. The damage to a "single world standard" is done, regardless of U.S. strategy. The large U.S. market will encourage others to adapt equipment to U.S. standards.

5. There is room for a multiple set of compatible standards designed to provide the consumer a choice across a full spectrum of services from the most basic model television to a feature-rich, fully integrated home entertainment and management information system.

6. There is a matter of loss of international prestige: becoming a second-rate nation by adopting any other nation's standard and further erosion of the trade balance. With another nation's standard, one adopts its patent and licensing rights, and potentially builds foreign industry at U.S. expense. The United States does not need a repeat of the Dynamic Random-Access Memory (DRAM) disaster.

7. Losing the high-technology jobs involved with R&D will ripple through the education system and result in further diminishment of U.S. technological competitiveness.

Government Standards Setting - Appropriate for Broadcast Only

Although a national ATV transmission standard may be needed for broadcast to protect the embedded cost, this should not preclude other standards for other transmission media. Rather, it should be left to the manufacturers and distributors to satisfy consumer needs and desires. Compatability is important, but in no event should Government unnecessarily extend government restrictions into other modes of distribution such as DBS, cable and fiber.

Need for Coalitions to Promote Common Public Good

The current U.S. position is divided with several special panels and interests probing the subject of a domestic U.S. standard. The list includes, but is not limited to:

- The FCC seeking comments on various allocation schemes to provide American homes with the necessary 6 to 18 MHz needed for an HDTV signal.

- The FCC's Advisory Committee on Advanced TV comprised of some 25 industry participants with a stake in ATV.

- The Advanced Television Systems Committee, a voluntary group designed to replicate the NTSC, that developed the current TV transmission standard during the 1950s.

- The Advanced Television Test Center (ATTC), which involves seven organizations that have pledged $3.5 million and service support to conduct over-the-air propagation tests of proposed ATV systems.

- The Cable Television Laboratories, the cable TV industry equivalent to ATTC.

- The National Association of Broadcasters (NAB).

- The Electronic Industries Association (EIA).

- The National Cable Television Association (NCTA).

- The Institute of Electrical and Electronics Engineers (IEEE).

Government Needs to Assign Standards Accountability

It is difficult to find the solution to the dilemma without Congress determining what entity has the accountability for standards.

While preserving the benefits of the free enterprise system, in order to compete successfully in today's global marketplace we need to rebuild our companies and country's technological leadership through greater cooperation and collaboration of industry and government.

Government initiative and leadership should be exercised to unite and coalesce diverse interests into a strategy which places U.S. public interest first.

AEA ATV Task Force Recommendation

In its September 9, 1988 report to the AEA Board of Directors, the AEA ATV Task Force stated the following:(reference 6)

"The ATV issue is being studied by several diverse groups. There is a need to convene and coalesce the various interests into a United States position. This is a complex subject, the issues must be clearly framed, a consensus built and a plan developed that serves the national interest.

Because of the ubiquitous nature of the issue, the diversity of interests, and the virtual absence of a U.S. controlled ATV infrastructure, government involvement is necessary to move the issue forward."

Question 3: **Assess the potential market for advanced television technologies along with economic assumptions and any supportive data or empirical evidence. Also provide a breakdown of the potential market for manufacturing consumer electronics and related computer componentry, including semiconductor technology.**

DOC Projects Sizeable ATV Sales & Jobs

The Department of Commerce estimates that early in the next century, the world market for ATVs will be some $40 billion, with half of that in the United States. Other projections are considerably higher. The ATV market will generate at least 700,000 jobs according to Larry Darby's 1988 study for the Department of Commerce.(7)

Value Needs to be Placed on Technological Knowledge

Furthermore, the lost dollar volume is only the tip of the iceberg.(8)

It is impossible to give value to the loss of technological knowledge and capabilities: research and development, manufacturing technology and the marketing and distribution infrastructure.

Shortcomings to Market Assessment by Product Lines

Although an assessment of the potential market by specific product lines will supply some "hard data" to analyze and discuss, it is important to recognize the shortcomings of this approach: (reference 2)

- Many other product lines may be more heavily impacted in the future and may not be identified in a product-line approach.
- Processes and services which are likely to be affected are ignored, as well as the billions of dollars involved.
- Future applications and spin-off industries from a "driver or spearhead technology" like ATV are not built into the equation.

Thus, a product-oriented approach leaves many windows of opportunity untouched, although it does provide at least a minimal testament to the importance of what is happening and serves as a basis for further study and dialogue.

Europeans Think "Big" Relative to HDTV

In September 1988, the International Institute of Communications sponsored a meeting in Washington, D.C., at the National Association of Broadcasters on ATV issues.

The European representative valued the global HDTV market at five trillion dollars -- the combined gross national products of the European consortium working together on HDTV. This may be an overstatement but what it does is clearly indicate that the competition is thinking BIG, not just looking at a few consumer product-lines.

HDTV will not just replace one TV with another. It is a fundamental technology that will have an impact on key electronics industries and companies. This "impact" is what makes it difficult to assign a hard data value to soft data still in embryonic form.

Nonetheless, assumptions on price and market penetration can be made and projections developed to serve as a guide to the future marketplace. Such projections have been done by AEA, EIA and others, using information from recognized research firms and associations. The studies are available for review.

However, technological situations change. New discoveries are made. And finally, the breadth and depth of the repercussions of this new technology are likely to have even greater impacts, as we come to understand its potential. These reports can, however, serve as resources for a continuing national dialog.

Consensus that Market is Huge

ATV is more than just television receivers, studio equipment, program, and program development. This fact needs to be emphasized and made abundantly clear. In his report to the NTIA, "Economic Potential of Advanced Television Products," Larry Darby suggests that markets have different growth rates.

Projecting various scenarios over a 12-year period for just two product lines, TV receivers and VCRs, he estimates gross sales of between $70 and $150 billion. In actual fact, because of the interrelationship of ATV development to numerous other markets, the value may more closely approximate hundreds to thousands of billions of dollars. By almost any yardstick or measure, and under any set of assumptions, this market is huge and the U.S. portion of the total market is substantial.

ATV - A Technological Revolution -- Provides Spin-off Markets

Technological revolutions like ATV provide tremendous market opportunities. Initial products usually tend to expand on existing markets and then grow at a very rapid rate as new markets are created. In time, products from these new technologies become interrelated and interdependent. New markets are created that are often totally unforeseen. It becomes difficult to determine in advance how far interrelationships between newly created products and markets will extend and what the ultimate impact will be.(9)

There is, however, no way the U.S. can afford to be absent from the ATV competition.

Question 4: What is the potential impact of advanced television technologies on the American electronics industries, including the consumer electronic and related industries, and our Nation's balance of trade and our overall economy?

High Stakes Should the U.S. Not Participate in ATV

Twenty years ago, the United States failed to establish its color television system, NTSC, as the world standard. This contributed to the demise of this domestic industry.(reference 5) There are few or no indigenous American-owned companies represented in the consumer entertainment market.

Today we are faced with a similar challenge of considering a standard for ATV, but the industry leaders to date are Japan and Europe.

Domination of End-Use Markets

Because ATV requires sophisticated semiconductors, and vast numbers of them, U.S. semiconductor companies are concerned that foreign domination of ATV directly threatens them. The "food chain" concept emphasizes concerns with the dependency of a final end-use market on an individual component or technology. In turn, domination of an end-use market like ATV can provide the economic means to dominate semiconductor research and development, and subsequent control of electronics products in general. (reference 9)

The stakes are too high -- economically, job-impact, national security, defense, and technological leadership -- for us not to proactively seek an American best interest solution. ATV represents the opportunity, the point of entry, probably the "last chance", for the United States electronics industry to be a significant player in consumer electronics once again.

Industry Inter-relatedness Compounds Loss of Non-Participation

As stated previously, because of the inter-relatedness of electronic industry segments, non-participation by the United States electronics industry in the ATV market could deprive the United States not only of a lost new market opportunity but the resources necessary to sustain today's leading edge technology -- semiconductor manufacturing first, then others such as test equipment, software, manufacturing equipment and, ultimately, computers and telecommunications.

The consequences of such a loss could cost the industry its ability to compete in the global marketplace. It is for this reason that individual corporate members of the United States electronics industry share a common interest in the development of an environment leading to significant U.S. technological and manufacturing participation in ATV.

Electronics Products are Economic Engine-Drivers

Electronic products in one form or another are fundamental to almost every other product and market. Consumer electronics is the engine that pulls the economic train. It is in the advancements in technology and applications of those technological advancements that make ATV a critically important area of impact to the United States.

ATV Will Drive Almost All Products and Services

ATV will touch virtually every aspect of the electronics industry as we know it today and will affect markets far afield from those directly related to electronic products. As a result of the domination of these inter-related markets by foreign competition, few manufacturers of end-use products in the United States could produce without dependence on foreign sourced materials, components or ancillary products.(reference 9) ATV is much more than a "pretty picture" and the related markets include, but are not limited to:(reference 6)

- Information services.
- Electronic components, e.g., semiconductors, VLSI chips, microelectronics.
- Transmission systems, e.g., satellites, cable, optical fiber, etc.
- Home entertainment (VCRs, compact disc, video games, etc.).
- Video telephones and teleconferencing.
- Professional equipment for broadcasting, studio production, photography, audio applications.
- Computer and computer applications, e.g., medical instruments, "intelligent" cars and appliances, databases for advanced communications by air, sea, road, rail, warehousing, etc.
- Graphic, print and laser applications.
- Defense applications.
- Education applications.
- Information services and Management Information Systems.
- Automatic manufacturing equipment.
- Marketing and sales applications.

Electronics Industry is Largest U.S. Manufacturing Industry

Electronics is the largest durable goods manufacturing industry in the United States and is growing three times faster than all other manufacturing.(reference 9) Electronic sales are absolutely vital to the U.S. economy.

1987 U.S. Sales ($Billions)

Electronics	$235
Chemicals	$215
Automobiles and Parts	$202
Machinery	$156
Petroleum	$130

The worldwide electronics market is a mammoth business with a compounded annual growth rate approaching nine percent.

Worldwide Electronics Market ($Billions)

	1988
Europe	$139
Japan	$246
United States	$258
Other	$127
Total	$770

DATAQUEST

From 1980 to 1987 the United States-World trade deficit in consumer electronics almost tripled.(reference 8) During this period, the overall United States-World electronics trade balance went from +$7.4 billion to -$12.7 billion.

While the United States still has a lead in related fields of consumer electronics, such as computers and telecommunications, these products are vulnerable too.

Loss of Computer Markets Would Bring Major Loss to U.S. Economy
Today the computer market represents 116 billion dollars of sales worldwide and United States controlled companies represent over 60 percent of that amount. A significant loss of market share in the computer market alone would have a major negative effect on the United States economy.

U.S. Participation in ATV A Must
The technology required to produce ATV will advance electronics products across the board. Display systems and supporting technologies will change substantially in the ability to store and process data. The current dominance by foreign competition of the audio visual market will be significantly strengthened by developments in ATV if United States industry does not respond.

If the United States does not participate as a significant supplier of products in the ATV marketplace, the effects on our economy and standard of living may be devastating. If we do not participate as an industry, our diminishing leadership in technology as well as future sales of products and services may be decimated. (reference 5)

Triple Ripple Deficit
The negative effects of non-participation in this industry will ripple into the budget deficit, the trade deficit, and our education deficit.

U.S. Has Already Lost Many U.S. Consumer Electronics Inventions
The VCR was an American invention in the 1960's and yet today, with annual sales of $6 billion a year in the United States, no VCRs are made in this country. ATV is another invention with enormous economic potential, yet today we are lagging seriously behind others in this important technology. The U.S. does not need to dominate, but we need to be among the leaders in R&D, manufacturing and distribution of ATV products and services.

Note: See Attachment B: "HDTV -- An Historical Perspective", Toward a National Strategy, Richard J. Elkus, Jr., Chairman, Prometrix Corporation, November 16, 1988.

Question 5: **What are the potential economic implications of the adoption, in fact or by law, of an HDTV system developed by an American entity as opposed to the adoption of an HDTV system developed by a foreign, particularly European or Asian entity or entities?**

Much has already been said on this question. However, a few basic points, to an extent restatements, are offered.

Why It Matters Who Owns It

Without a thriving indigenous television industry, the temptation is to adopt another nation's standard. But the potentially extraordinarily negative effect on our standard of living, our political, economical and technological leadership, defense and national security considerations dictate that we seek to develop our own. Despite what some say, it does matter where ATV investment comes from and where the profits go.

We have a huge domestic market which presents the unparalleled opportunity for this country to rebuild its largest manufacturing industry, create new and high quality jobs, and make America more competitive.(10) Although there are those who would argue that we can dig a much deeper hole for ourselves, it is time to stop digging the hole and start figuring out how to get America competitive again.

Leave the Door Open

An American standard or standards could be developed to minimize the economic costs to consumers, broadcasters and manufacturers, while allowing for future growth, enhancement, and availability of products and services. An American standard doesn't guarantee domestic entries, but it leaves an inviting door open for participation. We should not close the door to U.S. entry at this time. Instead, it is in the American interest to try to stay independent and develop a strategy to maximize United States interest.

Some Say It's Too Late

Some say it is too late for U.S. companies to re-enter consumer electronics via ATV and that the correct answer is to encourage foreign investment in the United States in the production of goods and services no longer manufactured by United States owned companies.

While this is a help, it is not the cure.

Owners tend to insure that critical technologies do not find their ways into competitive hands. Further they reserve the right to adjust their manufacturing and development plans if economic or political conditions change. Also, owners control the profits which in turn drive the R&D, capital investment and state-of-the-art advances.

Therefore, it is essential that the United States maintain a viable industrial base in strategic end-use markets like ATV that support and nurture equally strategic technology development. This direction is not at the expense of foreign investment, but in addition to it.(reference 9)

The current direction is to proceed without American ownership or an American alternative. This is not the prudent answer for the future of the United States.

Free Trade Depends on Balance

The system of economics and politics within the United States needs balance. Free trade needs balance. No one wants free trade if they have nothing with which to trade. Good partners are strong partners and lasting negotiations are based on strength. Lasting friendships are based on a balance of strength and mutual respect. Weak partners become afraid and create artificial barriers in a last ditch effort to thwart the inevitable.

A weak United States economically is as bad for its competition as it is for itself because weak partners tend to make radical rather than measured transitions in an effort to balance the scale. ATV offers an opportunity for the United States to redress its position in key end-use markets and rebalance the scale. But without a concerted effort, the United States could lose it all. (reference 9)

The next few years are dangerous ones. Currently, no one country or trading group is in a position to impose its will. All must compromise.

The European Community -- The Biggest Trading Force

The European Community is now the biggest trading force in the world. It exports 60 percent more than the United States does, double what Japan exports, and imports as much as the United States and three times the value of Japan's imports. By itself it represents 20 percent of total world trade flow, and its 320 million people are the biggest consumer market in the industrial world.

U.S. Trade Deficits with Japan and West Germany

Another point of comparison shows that Japan and West Germany, two of the most economically stable countries in the world, exported $88.1 billion worth of goods respectively to the United States in 1987. Yet in the same year, we exported only $39 billion worth of goods to Japan and West Germany combined. This is not balance.

We need to seek balance, and deal from a position of reason and strength in our trade relations with Europe and Japan. We need to be a strong trading partner over the long-term. ATV offers a unique and powerful opportunity to improve the sagging competitiveness of the United States.

Question 6: In analyzing the potential impact of advanced television technologies, what do you see as:

1) **Relative importance of domestic or foreign ownership of the company (companies) responsible for the design and development of an HDTV system?**

2) **Relative importance of domestic or foreign ownership of the company involved in the manufacture of an HDTV system or related components as opposed to where they are located for such manufacture?**

3) **Possibility or necessity of licensing arrangement or agreement with foreigns to assist domestic entities to become involved in the development and/or manufacture of an HDTV system or components?**

4) **Consequences of adopting a foreign HDTV standard on the domestic development of products that potentially might be derived from HDTV research, design and development? What effect would the adoption of a foreign standard have on defense, national security and other potential applications of advanced television technologies?**

Restatement: Need for Strong Domestic ATV Position

As mentioned previously, every effort should be made to develop a United States strategy, with goals and timetables, leading to multiple domestic entrants in the ATV or HDTV market. The successful development of a United States ATV industry depends upon controlling licensing rights, having the industrial capability to manufacture the products, and having the ability to protect them by maintaining reasonable control over political, economic and technical forces in the external environment.

This is the lesson the French learned in trying to develop a computer industry; and, in the same way they applied it to a color TV industry, it applies to us in the case of what it will take to build a U.S. ATV industry.

Need for U.S. R&D

It cannot be over emphasized that R&D is vital to not losing control of high-tech jobs, which in turn support numerous other jobs in manufacturing and production. R&D is also critical because of the linkage between ATV technology and the technology needed for defense and national security requirements. Ownership of R&D guarantees a revenue stream from licensing rights which can be used to build the U.S. industry. Bottomline -- R&D is critical to U.S. economic prosperity and maintenance of our technological health.

Need for U.S. Manufacture

U.S. companies need to be actively involved in ATV manufacture, as well as design and development. Since this is essentially a start-up industry for the United States, nurturing will be required. The right environment must be established, one in which vigorous R&D activity by the private sector in concert with the federal government produces products and services benefiting the nation as a whole.

Need for U.S. to Control Licensing

Licensing provides the revenue stream to fund further R&D and technology advances. If U.S. Companies do not control any licensing, an economic loss from revenues not received and an economic deficit from profits leaving the country will result.

Dependence on Other Countries Has Strategic Implications

The problems of becoming dependent on the technology of other countries have been mentioned previously and include a range of political, economic and national security concerns. The issue is not just color television, but the strategic technology capability involved, a technology which impacts defense and numerous other vital industries.

Question 7: What is the utility or viability of several courses of action that have been recommended by some analysts to encourage the development and adoption of a domestic advanced television technologies?

We have put ourselves nationally at a serious disadvantage in world trade, but it is encouraging that there are government authorities and industry leaders ready to try for constructive change.

All policy options should be explored to increase America's competitiveness in this critically strategic technology and this needs to be done with a clear sense of urgency. The studies requested in September, 1988 by the AEA Board of Directors of the National Research Council and the National Academy of Engineering in September [NAE study to define ways government and industry can work together to re-establish a strong U.S. consumer electronics industry] should be given top priority status by Congress and the Administration. We should also make ATV a special action item on the agenda of the "Competitiveness Policy Council" to be formed as part of the new Omnibus Trade Act of 1988.

Question 7A: Should the federal government offer an antitrust exemption to encourage combinations of American companies involved in HDTV research and development?

Antitrust Exemption Needed

Antitrust reform should be employed to put United States interests on a level playing field with the foreign competition. Our government should provide the umbrella wherein antitrust legislation will not impinge on potentially problem solving discussions. An unintended effect of our antitrust legislation has been that the benefits that can come from "talking shop" have been sacrificed.

Government leadership and initiatives will be required to accomplish this. Because this is an industry which will have to be nurtured, government encouragement should extend beyond R&D and into production. A new level of government/industry cooperation must emerge based on a cohesive United States strategy to develop a healthy domestic ATV industry. This must become a bold "national champion" effort to succeed and measures to eliminate antitrust obstacles are needed.

Antitrust policies that constrain U.S. leadership in technology need to be revised further. The relaxation of antitrust policies to permit cooperative R&D efforts has been a plus, but more needs to be done to enable U.S. companies to meet the challenges of today's global marketplace.

(6

Question 7B: **Should the federal government develop a matching grant program to assist in HDTV and related technologies research and development?**

Grants and Other Policy Changes Needed to Foster Competitiveness
Matching grants may be part of the answer. The price tag is too high to expect companies to "go it alone" -- especially ones not in consumer electronics, which have their R&D dollars appropriately allocated to advance their current product lines. Europe and Japan governments have faced the same question and subsequently come forth with significant financial resources.

Grants, however, are only one option. Many other options, such as permanence of the R&D tax credit, reduced cost of capital for U.S. business, increased support for basic R&D at universities, encouraging education and training initiatives to ensure a skilled work force, increased market access in foreign countries for electronics products, etc., need to be considered.

We should not restrict thinking at this point. U.S. participation in ATV is an extraordinary challenge and opportunity that will require extraordinary measures. Success will not be easy and it will take time for the United States to catch up with the competition.

Question 7C: **Should the federal government form or assist the establishment of a consortium along the SEMATECH lines to develop HDTV and related technologies?**

Establishing a consortium along the lines of SEMATECH may be appropriate. It needs, however, to be looked at in the context of what the U.S. strategy and goals are, what we intend to accomplish.

In all likelihood, a SEMATECH approach does not go far enough in the case of ATV. With ATV we need manufacturing and distribution, as well as R&D. This requires considerable investment and a relatively long time to effect entry. Furthermore, given the short term investment approach pervasive in American industry today, ATV will cost too much over too long for a single company to undertake.

Recently, some twenty AEA member companies decided to fund development of a business plan to help define a structure and options for achieving U.S. participation in ATV.

Concluding Thoughts: Question 7

A Variety of Solutions Needed But All With End-use Markets Goals
Solutions can be varied, running the gamut from encouraged cooperation between companies to specific government funding of key projects. The important thing to understand is that every solution must somehow include the maintenance and/or enhancement of the end-use market.

Simple funding of technological developments, without some commitment to become significant as a nation in the relevant end-use market, will result in a lack of direction and a high risk of loss to the competition of any technological achievements. (reference 9)

Sputnik Thinking and Action Required
When confronted with a problem it clearly understands, like Sputnik, the United States is very able to martial its forces and cooperate effectively in reaching a solution beneficial to all. This kind of thinking is necessary to solve the ATV dilemma if we are to maintain our position of world economic leadership.

Need to Re-Establish a Competitive U.S. Environment
The United States should pursue long-term policies to re-establish an environment that encourages a domestic manufacturing, technological and R&D base for semiconductors, ATV products and services and similar commercially strategic industries.

If a collaborative effort can be made to succeed in ATV, it could give America's policymakers and strategic industries a welcome alternative to the extremes of protectionism or economic oblivion. It could establish a new, more productive partnership between the public and private sectors.

America Must Replace Short-term View with Long-term View
The United States cannot continue to focus on the short term to the exclusion of the long term. Our strength is in scientific and technological capabilities which are achieved only through long-term efforts.

Education, research and development, innovation and a skilled and educated workforce require a long-term focus and commitment. Industry, government, and academia should coordinate efforts on critical, emerging and long-term national problems where science and technology play a role. This is not government displacing private industry decision-making. It is government encouraging and "enabling" industry decision-making. ATV is the opportunity.

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(5) Rhonda J. Crane, "Making America Competitive: High Definition TV", Chicago Tribune, October 3, 1988, Op Ed, p. 13.

(6) AEA ATV Task Force Report, September 9, 1988.

(7) Larry Darby, "Economic Potential of Advanced Television Products", Report for the NTIA, April 1988.

(8) J. Richard Iverson, "Looking in the ATV Window", Electronic Engineering Times, October 24, 1988.

(9) Richard J. Elkus Jr., "Toward A National Strategy", analysis of the implications of HDTV, November 16, 1988.

(10) Pat Hill Hubbard, "Advanced TV: A Gamble Worth Taking", Electronics, November 1988.

ATTACHMENT A

AEA ADVANCED TELEVISION TASK FORCE

PARTICIPATING COMPANIES

ADVANCED MICRO DEVICES

ANADIGICS

APPLE COMPUTER

ATARI

AT&T

BIS MacKINTOSH

B.R.I.E.

COHU, INC.

DIGITAL EQUIPMENT CORPORATION

HEWLETT-PACKARD

IBM

INTEL

I.T.T.

MOTOROLA

MRS. TECHNOLOGY

NATIONAL SEMICONDUCTOR

OMNIX SYSTEMS, INC.

OVANICS IMAGING, INC.

KENNETH OSHMAN CONSULTANT

PROMETRIX CORPORATION

RAYCHEM CORPORATION

SUN MICROSYSTEMS

TEKTRONIX

TEXAS INSTRUMENTS

WESTERN DIGITAL

VARIAN

VPL RESEARCH

ZENITH

Excerpt:
Richard Elkus, Chairman, Prometrix, Inc.
"Toward a National Strategy: The Strategy of Leverage"
November 16, 1988

HDTV -- AN HISTORICAL PERSPECTIVE

In 1956 Ampex (a U.S. corporation) invented the video tape recorder and for the next 25 years controlled most of the world's fundamental patents in the field. Prior to that Ampex had become a pioneer in the field of audio tape recording and for many years was considered the worlds predominant supplier of professional audio tape recorders. The technologies implicit in audio and video tape recording, with respect to tape drives, magnetic head technology, and magnetic tape technology, became the basis for audio recording, instrumentation recording, video recording, storage media for computers, tape duplicating, recording on discs, and a whole series of derivative technologies that are fundamental today to a major portion of the consumer electronics industry, computer industry, telecommunications, music industry, and the media in general. When Ampex pioneered magnetic recording technology, the utilization of those recording techniques was still in a conceptual nature as far as the world was concerned. At the time few realized the extent to which Ampex's developments in magnetic recording would impact mankind and how completely they would change daily life.

Technological revolutions like that of magnetic recording come few and far between. They provide tremendous market opportunities. Their viability initially depends upon linkage with the past; in the case of audio magnetic tape recording - wire and radio; in the case of video recording - film and television. Initial products from these new technologies usually tend to expand on existing markets and then grow at a very rapid rate as new markets are created. In time, products from these new technologies tend to become interrelated and interdependent. New markets are created that are often totally unforeseen and it becomes very difficult to determine in advance how far interrelationships between newly created products and markets will extend and what the ultimate impact on society will be.

The Japanese realized at a very early stage that the key to the success for any product within a market was the ability to push that product to its logical extreme since at this point interdependence of products and markets become most pronounced.

AMPEX -- INSTAVIDEO
1970

Ampex knew that a key to success in video recording was to achieve the development and production of a video recorder that was superb in performance, small, lightweight, capable of portability, very easy to operate, and completely reliable. **In other words the VCR.**

The Japanese recognized another major strategic precept: that success in an end-use product such as a VCR required the development of many key supporting technologies and related end-use products. As such there was a tremendous interchange of information and cooperative effort amongst various firms within Japan as they sought to develop the industrial strength necessary to insure ultimate success in capturing a predominant position in key interrelated end-use products pertaining to the entire field of recording technology. The result of this effort included an integration of audio recording, video recording, battery technology, small motor design, magnetic tape development, display technology, optics technology and, of course, semiconductor development. A great deal of the Japanese efforts in becoming proficient in the field of recording technology was done under license from and with the help of Ampex.

During the period of Japan's concentration in these technological areas of development, Ampex and other U.S. companies involved in similar areas remained as separate circles, each guarding carefully its own sphere of influence and ultimately its own potential gain or loss. If there was to be cooperation of any sort it often tended to be more international than domestic because of the seemingly apparent need to insure market dominance at home.

Japan started years behind the United States as it attempted to enter the video recording market. By 1970 when Ampex introduced Instavideo, its entry into the VCR market, Ampex represented 70 to 80% of the dollar value of video recorders sold in the world and a virtual 100% hold on basic patents.

But Ampex resources were heavily leveraged. Financial problems loomed. Domestic joint ventures were rejected in favor of manufacturing opportunities in Japan. Finally in 1972, amidst cash flow and profit problems, Ampex dropped the Instavideo project. But key technology remained in Japan. In 1975 Sony introduced Beta Max. By 1985 sales for video recorders had grown, in dollar terms, 50 times those of 1970. Unit volume jumped 1600 times and the

Japanese represented more than 90% of all product sold. The U.S. position in the market dropped to less than 3%.

During the period of the development of the VCR, the Japanese industrial complex proceeded to dominate or take a major position in the following markets:

The video tape recorder market including professional, commercial and consumer applications.
The video camera market including professional, commercial and consumer applications.
Lens manufacturing capability.
Small precision electronic motor design.
Automatic focusing systems for 35 mm and video cameras.
The 35 mm camera market.
The consumer television receiver and monitor markets.
The consumer and commercial audio recorder markets.
The compact disc playback system market.
The video disc market.
High speed digital fiber transmission equipment.
(And incidentally -- the market for digital watches and solar powered calculators, radios and television sets.)

In support of the demands of these end-use and ancillary component markets, Japan developed a merchant semiconductor chip industry greater than that of the United States and nearly three times that of Europe; and a semiconductor equipment industry estimated to be greater than that of the United States and three times that of Europe.

The end result of the strategy of domination of interrelated end-use markets by United States competitors is that today few manufacturers of end-use products in the United States are able to produce without dependence on some foreign sourced materials, components or ancillary products.

From: RDVAX::FULLER "SAM FULLER, ML12-2" 24-JAN-1989 12:17
To: DELUCA
Subj: print and file in HDTV High Definition

From: ABLE::TOM "Let's heal each others wounds" 23-JAN-1989 18:16
To: @STF,HENRY,SAM,BJ,RICH
Subj:

[Sent to STF, Sam,Henry,Paul Curtin, Rich,BJ FYI]

890123.hdtvbite1 HDTV AND DEC

The first thing to understand is that commercial HDTV standards will be 30Hz interlaced which is NOT ACCEPTABLE in our industry for close viewing. We need 66 or 72 or 75 Hz refresh (depending who you listen to) non-interlaced (which the TV industry calls progressive scanning).

So, we want the wide-screen glass from the industry. I vote for literally "B" size of 11 x 17 inches (11 x 18.33 if 5:3 aspect ratio, 11.7 x 19.5 for 2 metric "A" sizes side by side plus margins for menu) or perhaps 92% of that if you had to keep the height to present values for the desktop (22.7 inch diagonal).

But we can't use their electronics nor any frame buffers they come up with. Instead of 15,750 (US) or 16,750 (Europe) the horizontal scan needs to be around 90 KHz (1152 x 72 x 1.05 for retrace). The European proposed standard is in fact 90 KHz (1200 x 75) for their DIGITAL standard, not analog so they may be the ones to watch out for/capitalize on.

I believe we (Crouse and Curtin) should try one time to get Zenith as a U.S. vendor to make this size tube by agreeing to buy the early output at some cost which is exorbitant for the TV industry but OK for our high end markets. Only the Flat tension mask in my opinion can make it to the 150 dpi needed in the future although the Trinitron, which is tensioned in one direction has a long headstart.
set up to make this size tube

HDTV

RECEIVED

AUG 2 9 1989

SAM FULLER

digital

Memorandum

To: Henry Crouse

cc: Paul Curtin
Sam Fuller

Date: 24 August 1989
From: Tom Gannon TG
Dept: TP&D
Dtn: 223-3828
Loc/ms: MLO1-3/B10

1st page only

TG: cc.

Subject: Defense Manufacturing Board Workshop —High Definition Systems

Tom, Good summary & glad you attended.
* Someone from OBC (Paul Pyron?) should be on application.
Tks for.
Sam
9/7/89

On August 22, I attended the Defense Manufacturing Board Workshop on High Definition Systems (HDS) on your behalf. Attached is a copy of the agenda and list of attendees for the workshop, along with copies of the position statements and presentations prepared by various invited speakers from a wide variety of government agencies and industry associations.

A majority of the workshop presentation consisted of summaries of current activities underway within various government agencies to address specific issues related to HDTV/HDS. There were no surprises and very little new information presented.

Rather than repeat the information outlined in the attachments, I thought that you would be interested in a summary of my observations and general themes that emerged from the various presentations and discussions.

IAH: file this set in HDTV

The most informative presentations were given by Dick Elkus (Prometrix) and Mark Eaton (MCC) which focused on a discussion of Japan's strategies. They argued that Japan is focusing on gaining control of a broad range of world-wide end-user applications markets and that by dominating these markets Japan can acquire/control the introduction of new technologies through their industrial oligopoly. They also proposed that the U.S. must develop an industrial policy and strategy for our electronics industry to address this challenge, or U.S. industry will become increasingly dependent upon the Japanese industrial base for a wider range of products, components and subsystems. There appeared to be a consensus among all participants on these observations.

From my point of view, the most disappointing session of the workshop was Wayne Berman's (Commerce) description of the current climate in Washington regarding HDTV/HDS. He pointed out that sharp controversies continue to exist within industry and government sectors in several areas:

— Is HDTV/HDS largely an entertainment (consumer) threat or a longer-term threat to the information processing (commercial) industry?

— Should the government play a more active role in helping industry (or not)?

— Should the government adopt transmission standards that would effectively create a trade barrier to Japan for HDTV/HDS products (or not)?

The good news is that there is a general consensus in Washington and among the workshop participants that a problem exists. However, strong opinions still prevail within the government sector that cost of capital is not an issue and that the government should not develop an industrial policy/strategy to deal with this problem.

The discussions which took place during the morning sessions generally supported these areas of sharp controversy, and no resolution was reached in any area.

After lunch, the workshop was adjourned and the HDS Task Force met to discuss the next steps. This meeting was chaired by Alex (Sandy) Trowbridge. The Task Force will be subdivided into three working committees to develop recommendations to DARPA within the next 6-9 months on what should be done to address the HDS issue. These committees will cover these areas:

— Consumer Applications Committee - (Chair, TBD)

— Non-consumer Applications Committee - (Barry Whalen, MCC - Chair)

— Government Policies Committee - (Howard Miller, PBS - Chair)

A draft of the mission and objectives of the Task Force and its committees is attached for your information.

Each member of the Task Force was asked to contact Roy Beasley within one week to discuss their preferences for participation in one of these committees. I suggest that you consider participating in the Non-consumer Applications Committee since its mission is the most closely related to our business needs.

The next meeting of the Task Force was scheduled for Wednesday, September 27 in Washington.

Please let me know if you would like to discuss any of the attached information or my observations regarding the workshop in more detail.

THE STRATEGY OF LEVERAGE

RICHARD J. ELKUS, JR.
PROMETRIX CORPORATION

END-USE MARKETS MEANS:

MARKETS FOR THOSE STAND-ALONE PRODUCTS WHICH HAVE SIGNIFICANT VALUE TO THE INDIVIDUAL CONSUMER

AMPEX -- INSTAVIDEO
1970

WHY ARE WE HERE?

THE ECONOMICS OF:

THE DEAL

STARS
CASH COWS
DOGS

THE ECONOMICS OF:

COMMITMENT

STRATEGY
RELATIONSHIP
COMMITMENT

1956 SHOCKLEY TRANSISTOR CO. -
AMPEX CORP. VTR

1960 AMPEX SONY EXCHANGE

1970 AMPEX INTRODUCES
INSTAVIDEO (DEVELOPMENT
COST $2 - $3 MILLION)
INTEL INTRODUCES 1 K DRAM
NHK - COMMENCES HDTV
DEVELOPMENT

1972 AMPEX CANCELS INSTAVIDEO

1975 SONY INTRODUCES BETAMAX

1980 MITI ANNOUNCES CONCEPT OF
INFORMATION SOCIETY

1981 U.S. SHARE SEMICONDUCTOR MARKET 57% JAPANESE 33% MAJOR RAMP UP IN VCR PRODUCTION IN JAPAN

1983 JAPAN SURPASSES U.S. IN INVESTMENT IN SEMI-CONDUCTOR TECHNOLOGY

1985 VCR PRODUCTION REACHES 2.5 MILLION UNITS PER MONTH (EXCEPT FOR MICRON AND TI) U.S. ABANDONS DRAM BUSINESS

1987 SONY ANNOUNCES PURCHASE OF CBS RECORDS (SONY REVENUES W/O CBS $11.6 BILLION)

1988 AMPEX REVENUES $700 MILLION
COST OF FULLY INTEGRATED
VCR FACILITY $600 MILLION
U.S. SHARE SEMICONDUCTOR
MARKET 38.5% JAPAN 50%

1989 4 M DRAM PRODUCTION
US/JAPAN
NHK HDTV DECODER BOARD -
HDTV BROADCAST
JAPAN INVESTMENT IN SEMI
EQUIPMENT TWICE U.S.
HIGH DEFINITION PRODUCTS
AVAILABLE

1992 PROJECTED 16 M DRAM
PRODUCTION JAPAN

1995 PROJECTED 64 M DRAM
PRODUCTION JAPAN

2000 INFORMATION SYSTEMS
MARKET TO BECOME
PREDOMINANT

UNDERSTANDING HIGH DEFINITION PRODUCTS AND THEIR IMPLICATIONS TO THE ECONOMY OF THE WORLD INVOLVES THE UNDERSTANDING OF ONE WORD --

STRATEGY

1987 UNITED STATES SALES (BILLIONS OF DOLLARS)

ELECTRONICS	$235
CHEMICALS	$215
AUTOMOBILES AND PARTS	$201
MACHINERY	$156
PETROLEUM	$130

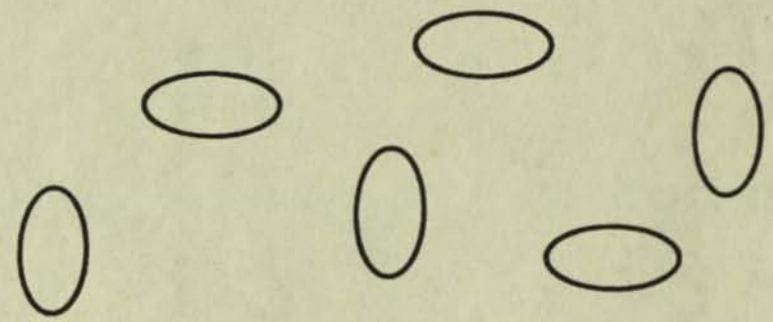
CAHNERS

WORLDWIDE ELECTRONICS MARKET
(BILLIONS OF DOLLARS)

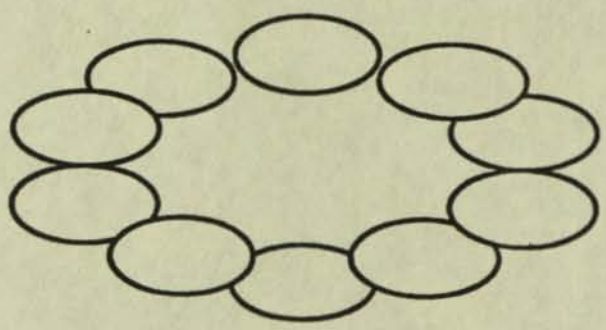
	1988	1992
EUROPE	$139	$182
JAPAN	$246	$360
UNITED STATES	$258	$332
OTHER	$127	$200
TOTAL	$770	$1074

DATAQUEST

LINKS IN A CHAIN



UNITED STATES



JAPAN

THE STRATEGY OF LEVERAGE

WITH THOSE STATISTICS AS A FRAME OF REFERENCE, IT IS IMPORTANT TO UNDERSTAND THE INDUSTRIAL STRATEGY OF THE JAPANESE VERSUS THAT OF THE UNITED STATES.

1. LIKE INDEPENDENT CIRCLES, WE IN THE UNITED STATES APPROACH PRODUCTS, MARKETS AND BUSINESSES AS SEPARATE ENTERPRISES WITH LITTLE DESIRE OR MECHANISM TO COORDINATE STRATEGY AND DIRECTION.

2. THE JAPANESE, ON THE OTHER HAND, WHILE PROMOTING INDIVIDUAL INITIATIVE, ASSUME THAT ALL CIRCLES ARE INTERRELATED AND INTERDEPENDENT AND AS SUCH FEEL THAT COORDINATION OF STRATEGY AND DIRECTION IS ESSENTIAL.

3. THUS IN JAPAN:

   EVERY TECHNOLOGY BECOMES THE STEPPING STONE FOR THE NEXT.

   EVERY PRODUCT BECOMES THE BASIS FOR ANOTHER.

   AND THE RESULTING EFFICIENCIES OF SCALE ARE ENORMOUS.

PUSH THE DEVELOPMENT OF A

PRODUCT TO ITS LOGICAL EXTREME

AND IT BECOMES RELATED TO

OTHER PRODUCTS.

PUSH A

MARKET TO ITS LOGICAL EXTREME

AND IT BECOMES RELATED TO

OTHER MARKETS

THE JAPANESE NOW DOMINATE OR HAVE A MAJOR POSITION IN:

1. THE VIDEO TAPE RECORDER MARKET INCLUDING PROFESSIONAL, COMMERCIAL AND CONSUMER APPLICATIONS.

2. THE VIDEO CAMERA MARKET INCLUDING PROFESSIONAL, COMMERCIAL AND CONSUMER APPLICATIONS.

3. THE 35 MM CAMERA MARKET.

4. THE CONSUMER TELEVISION RECEIVER AND MONITOR MARKETS.

5. THE CONSUMER AND COMMERCIAL AUDIO RECORDER MARKETS.

6. THE COMPACT DISC PLAYBACK SYSTEM MARKET.

7. THE VIDEO DISC MARKET.

8. HIGH SPEED DIGITAL FIBER TRANSMISSION EQUIPMENT.

9. THE OPTICAL DISC MARKET

10. (AND INCIDENTALLY - THE MARKET FOR DIGITAL WATCHES AND SOLAR POWERED CALCULATORS, RADIOS AND TELEVISION SETS.)

BECAUSE OF THE LOSS IN STRATEGIC INTERRELATED END-USE MARKETS, THE U.S. POSITION IN THE FOLLOWING COMPONENT MARKETS HAS EITHER BEEN LOST OR SHARPLY REDUCED

OPTICS
DISPLAYS
SEMICONDUCTORS
SEMICONDUCTOR EQUIPMENT
SEMICONDUCTOR MATERIALS
VARIOUS MASS MEMORY SYSTEMS (INCLUDING FLOPPY AND HARD DISK DRIVES)

DOMINATION OF INTERRELATED END-USE MARKETS LEADS TO:

DOMINATION OF SEMICONDUCTORS

CONTROL OF ELECTRONIC PRODUCTS

INFLUENCE ON ALL OTHER MARKETS

DOMINATE STRATEGIC
INTERRELATED END-USE MARKETS
AND YOU CAN DOMINATE THE USE
AND DIRECTION OF:

TECHNOLOGY
AND
INTELLECTUAL PROPERTY RIGHTS

NOT THE OTHER WAY AROUND

WE FACE
A GRAND STRATEGY:

THE DOMINATION OF INTERRELATED END USE MARKETS

AGAINST WHICH

NO SINGLE TECHNOLOGICAL DEVELOPMENT OR EXPERTISE CAN BE A SIGNIFICANT THREAT

We are leaving the industrial age

and

Entering the information age.

THE MARKET FOR HIGH DEFINITION PRODUCTS SPANS THE PRODUCTION, TRANSMISSION, RECORDING, PROCESSING, AND DISPLAY OF TREMENDOUS AMOUNTS OF VIDEO AND AUDIO INFORMATION.

HIGH DEFINITION PRODUCTS ARE USUALLY DISCUSSED IN TERMS OF BROADCAST TELEVISION AND RELATED EQUIPMENT.

BUT BROADCAST TELEVISION IS ONLY ONE SEGMENT OF THE MARKET FOR HIGH DEFINITION PRODUCTS.

THE MARKET FOR HIGH DEFINITION PRODUCTS EMBODIES A LARGE NUMBER OF TECHNOLOGIES. MOST WILL BE EVOLUTIONARY.

HOWEVER, FOR THOSE POTENTIAL COMPETITORS WHO ARE NON-PARTICIPANTS IN INTERRELATED END-USE MARKETS, HD PRODUCTS MAY GIVE THE APPEARANCE OF REVOLUTIONARY PRODUCT DESIGN.

THREE KEY STRATEGICALLY INTERRELATED END-USE MARKETS WILL BECOME THE BASIS FOR THE INFORMATION SYSTEMS MARKET:

1. SOFTWARE / MEDIA

2. TELECOMMUNICATIONS

3. ELECTRONIC PRODUCTS INCLUDING:
   - •COMPUTERS
   - •IMAGE PROCESSING
   - •CONSUMER ELECTRONICS

IN TIME THE MARKET FOR HIGH DEFINITION PRODUCTS WILL BECOME AN INTEGRAL PART OF AND ULTIMATELY SYNONYMOUS WITH THE INFORMATION SYSTEMS MARKET.

PROJECTED YEAR 2000

INFORMATION SYSTEMS MARKET

33% OF ALL CAPITAL INVESTMENT

22% OF GROWTH FOR ALL INDUSTRIES

41% OF NEW JOBS

THE GOAL IS:

ACHIEVEMENT OF A PREDOMINANT POSITION IN THE WORLD OF ADVANCED INFORMATION SYSTEMS.

A MARKET EXPECTED TO DOMINATE THE 21ST CENTURY.

A MARKET EXPECTED TO PROVIDE A KEY INFLUENCE ON ALL OTHER MARKETS.

A MARKET EXPECTED TO BE THE PRECURSOR TO THE INFORMATION AGE.

AGENDA

High Definition Systems Workshop

U.S. Department of Commerce Building

14th and Constitution -- Room 6808

Washington, DC

Tuesday 22 August 1989

0830 -- 0900	REGISTRATION (Room 6802)
0900 -- 0915	Welcoming Remarks -- Thomas J. Murrin DMB Chairman & Deputy Secretary, U.S. Dept. of Commerce -- Howard D. Samuel Chairman, Industrial Base Committee, DMB & President, Industrial Union Dept., AFL-CIO
0915 -- 0925	Introductory Remarks by Workshop Chairman -- Alexander B. Trowbridge President, National Association of Manufacturers
0925 -- 0950	DARPA's High Definition Systems Initiatives -- Dr. Craig I. Fields Director, Defense Advanced Research Projects Agency (DARPA)
0950 -- 1050	Japanese High Definition Strategies -- Richard J. Elkus, Jr. Chairman, Prometrix Corporation -- Mark Eaton Director, International and Associated Programs Microelectronics and Computer Technology Corporation (MCC)
1050 -- 1100	BREAK

- Define metrics for health + goals to target for industry.

→ National Advisory Comm on semiconductors. Parallels → DMB.

1100 -- 1130	Federal Communications Commission (FCC) Initiatives
	-- Dr. Thomas P. Stanley Chief Engineer
	-- Richard E. Wiley Chairman, FCC Advisory Committee on Advanced Television Service
	-- James C. McKinney Chairman, Advanced Television Systems Committee (ATSC)
	-- Peter M. Fannon Executive Director, Advanced Television Test Center (ATTC)
1130 -- 1200	U.S. Department of Commerce Initiatives
	-- Wayne L. Berman Counsellor to the Secretary
	-- Dr. John Lyons Director, Natonal Engineering Laboratory National Institute of Standards and Technology (NIST)
	-- Dr. Charles M. Rush Chief Scientist National Telecommunications and Information Administration (NTIA)
1200 -- 1230	Other Federal Initiatives
	-- Donald W. Eiss Deputy Assistant USTR for Industry U.S. Trade Representative
	-- Warren Richards Deputy Director, Office of Radio Spectrum Policy U.S. Department of State
	-- Robert J. Shafer, Director, Television Development National Aeronautics and Space Administration
	-- Dr. Frank L. Huband Director, Division of Electrical and Communications Systems National Science Foundation
1230 -- 1330	Comments and Discussion/Working Lunch
1330	ADJOURN WORKSHOP
1400 -- 1530	Discussion Group

AGENDA

Discussion Group

U.S. Department of Commerce Building

14th and Constitution -- Room 1410

Washington, DC

Tuesday 22 August 1989

1400 -- 1415	Introductory Remarks by the Chairman of the Discussion Group -- Alexander B. Trowbridge President, National Association of Manufacturers
1415 -- 1430	Discussion of the Mission of the Task Force
1430 -- 1530	Discussion of the Missions of the Working Committees -- Consumer Applications Committee TBD -- Non-consumer Applications Committee Barry Whalen -- Government Policies Committee Howard Miller
1530	ADJOURN DISCUSSION GROUP

Chairs

ADDENDUM

COMMENTATORS

Dr. Robert Cohen
Consultant

Mr. Fred Branfman
Director
Rebuild America

Ms. Pat Hubbard
VP, Education and Science Policy
American Electronics Association (AEA)

Mr. Alan H. Magazine
President
Council on Competitiveness

Dr. Alan McAdams
Professor, Cornell University
IEEE-USA Technology Activities Council

Mr. Michael C. Rau
VP, Science and Technology
National Association of Broadcasters (NAB)

Colonel Will Stackhouse
Assistant for High Leverage Technology
Space System Division
U.S. Air Force

Dr. David H. Staelin
Professor, M.I.T.
IEEE-USA Technology Activities Council

HIGH DEFINITION SYSTEMS TASK FORCE WORKSHOP

ATTENDEE LIST

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Executive VP, Operations
National Association of
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Mr. Wilsie H. Adams, Jr.
Partner
McKenna, Conner & Cuneo

Lt. Col. Joyce K. S. Babiak
Military Assistant to the Director
DARPA

Mr. Morton Bahr
President
Communications Workers of America

Mr. Julius Barnathan
Sr. VP, Technology and Strategic
Planning
Capital Cities/ABC, Inc.

Mr. John (Jack) Barry
President
IBEW

Mr. Milton Beach
Defense Legislative Assistant
U.S. Congress

Dr. Roy L. Beasley
Consultant

Mr. Juan A. Benitez
Deputy Assistant Secretary for
Science & Electronics
U.S. Department of Commerce

Mr. Wayne L. Berman
Counsellor to the Secretary
U.S. Department of Commerce

Mr. Harold E. Bertrand
Research Staff Member
Institute for Defense Analyses

Mr. Charles Bostian
Congressional Fellow (IEEE)
U.S. Congress

Mr. Fred Branfman
Director
Rebuild America

Dr. D. Allan Bromley
Director Designate
Office of Science & Technology Policy
The White House

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Executive VP, Customer Systems
AT&T Bell Laboratories

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Chairman
Post-Newsweek Stations, Inc.

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Consultant

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VP, Strategic Relations
Digital Equipment Corporation

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Assistant Deputy Under Secretary
of Defense (M&IP)
U.S. Department of Defense

Dr. Irwin Dorros
Executive Vice President
Bellcore

Mr. Grant Dove
CEO & Chairman
Microelectronics and Computer Technology (MCC)

Mr. Mark Eaton
Director, International and
Associated Programs
Microelectronics and Computer
Technology Corporation (MCC)

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Deputy Assistant USTR for Industry
U.S. Trade Representative

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Chairman
Prometrix Corporation

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Executive Director
Advanced Television Test Center (ATTC)

Mr. Alex D. Felker
Chief of Mass Media Bureau
FCC

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Research Associate
Center for Technology, Policy and Industrial Development
M.I.T.

Dr. Craig I. Fields
Director
DARPA

Mr. Christopher Galvin
Senior Vice President
Motorola

Mr. Thomas M. Gann
Director of Legislation
U.S. Congress

Mr. Thomas Gannon
Director of Technical Planning and Development
Digital Equipment Corporation (DEC)

Dr. James E. Geoll
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PCO

Mr. Carlos Girod
VP, Satellite Technology
Public Broadcasting System (PBS)

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Vice President
Hughes Network Systems

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President & CEO
Cable Televsion Laboratories, Inc.

Dr. Robert Hebner
Deputy Director
Center for Electronics & Electrical Engineering

Dr. Robert E. Henderson
Director
South Carolina Research Authority

Mr. Edward D. Horowitz
Senior VP for Technology & Operations
Viacom International

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Director, Divison of Electrical and Communications Systems
National Science Foundation

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VP, Education and Science Policy
American Electronics Association (AEA)

Mr. Larry Irving
Senior Counsel
House Telecommunications & Finance Subcommittee
U.S. Congress

Mr. Kenan P. Jarboe
Professional Staff Member
Subcommittee on Government Information and Regulation
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Sun Microsystems

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Professor of Business Administration
George Washington University

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VP, Technology Group
Tektronix

Dr. John Lyons
Director
National Engineering Laboratory

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President & CEO
Cable Television Laboratories, Inc.

Mr. James I. Magid
Senior Advisor
Needham & Company, Inc.

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Program Manager of Microelectronics
& Instrumentations
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U.S. Department of Defense

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Institute for Defense Analyses

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Chairman
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Mr. Renville H. McMann
Consultant
HDTV Experts

Mr. Howard Miller
Sr. VP, Broadcast Operations
& Engineering
Public Broadcasting System (PBS)

Mr. W. David Montgomery
Assistant Director for Natural
Resources and Commerce
Congressional Budget Office (CBO)

The Honorable Thomas J. Murrin
Deputy Secretary, U.S. DOC
Chairman, DMB

Dr. Robert N. Noyce
President
SEMATECH

Mr. Jerry K. Pearlman
Chairman
Zenith Electronics

Dr. Andrew Procassini
President
Semiconductor Industry Association
(SIA)

Mr. Griffith L. Resor, 3rd
President
MRS Technology, Inc.

Mr. Michael C. Rau
VP, Science and Technology
National Association of Broadcasters
(NAB)

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Deputy Director
Office of Radio Spectrum Policy
U.S. Department of State

Mr. John V. Roach
CEO & Chairman
Tandy Corporation

Dr. Harry B. Roberts
Professor of Statistics
Graduate School of Business
University of Chicago

Dr. Charles M. Rush
Chief Scientist
National Telecommunicatons &
Information Administration (NTIA)

Mr. Howard D. Samuel
Chairman, Industrial Base Committee
President, Industrial Union Dept., AFL-CIO

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Professor
HDTV Experts

Dr. Bruce R. Scott
Professor
Harvard Business School

Mr. Robert J. Shafer
Director, Television Development
National Aeronautics & Space Administration (NASA)

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Chief Engineer
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Consultant

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MCI Communications Corporation

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VP and General Manager
IBM Corporation

Mr. Alexander B. Trowbridge
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Chairman
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WKBN Broadcasting Corporation

Mr. Patrick H. Windham
Professional Staff Member
Committee on Commerce, Science and Transportation
U.S. Congress

Mr. Steve Wooley
Research Staff
Institute for Defense Analyses

JAPANESE RESEARCH, DEVELOPMENT, AND DEPLOYMENT OF HIGH DEFINITION SYSTEMS

Mark Eaton, MCC, ILO
August 22, 1989

Since the early 1970s, a concerted effort has been under way in Japan to develop a "high-level information society," one in which economic value is created in industries which require higher degrees of knowledge and training, and in which goods and services have a high information content. This does not mean that the idea of a "post-industrial service economy" is favored; to the contrary, Japanese government planners foresee a continuing emphasis on manufacturing, and in fact have forecast an increase in the share of national product originating in manufacturing from the mid-1980s to the end of the century. Japanese manufacturing will take place in higher value-added industries, there being a rough correlation between value-added and information content in work. Successive policy documents have declared this shift to higher value-added information industries as a simple necessity, given Japan's geoeconomic position and steady competitive pressure from newly industrializing countries. Semiconductors, termed the steel (sometimes the rice) of the information society, were the first major industry to receive industrial policy attention under this new banner. A host of measures was employed to promote this industry, including a large cooperative research project in the late 1970s which spread state-of-the-art manufacturing equipment throughout the Japanese electronics industry.

High-definition systems are now being viewed as the medium of the information age, precisely because they can transmit a higher information content. They too are the subject of a variety of government and private promotion efforts. Japan's national broadcasting company, *Nippon Hoso Kaisha* (NHK), developed in 1964 what is now considered to be the basic standard for high-definition systems, and began research and development in collaboration with Japanese electronics companies to demonstrate this technology for television (HDTV) and devise production, transmission and information processing standards. NHK has spent approximately $150 million on high-definition systems in the past two decades, and has set the pace for corporate development efforts estimated to have cost between $667 million and $1.3 billion. Since NHK does not manufacture, it has typically developed some basic technology and then licensed (or given) it to one or several corporations, which then produce systems and components to NHK specifications. NHK coined the term "Hi-Vision" to denote high-definition television and created the MUSE (Multiple Sub-Nyquist Encoding) standard for the compression of analog direct satellite broadcast television signals. NHK, with some support from Japanese electronics companies, is trying to make the MUSE system a world standard for HDTV, even though it is not compatible with existing sets. NHK and other television transmission concerns are also promoting broadcasts of Extended Definition TV, which can be received on existing sets.

The Hi-Vision promotion effort is now at a critical stage. Standards and basic technologies have already been developed. Substantial research work remains to be done on consumer-oriented television sets, but experimental broadcasts have already begun. They will increase in frequency and coverage through the 1990s. Hi-Vision is only one aspect of high-definition systems, however. Japanese business and government planners view high-definition systems as a strategic technology which will dominate all media. They are therefore attempting to exploit economies of scope, through the the development of several different types of high-definition markets, in the hope that one application will lead to another. Both the Ministry of International Trade and Industry (MITI) and the Ministry of Posts and Telecommunications (MPT) have forecast the Japanese market for "Hi-Vision" systems to be over $20 billion by the year 2000, but both ministries, especially

MITI, realize that demand may have to be seeded in other applications before it takes off in home entertainment use.

The likelihood of this process occurring in high-definition systems is enhanced by the fact that the component technologies of any particular HDS are key to several other applications, making HDS a good example of what Japanese technologists term "technology fusion." Such technologies are especially well-suited to synergistic cycles of improvement, as economies of scale in one yield economies of scope in others. Japanese electronic corporations are well-structured to take advantage of these opportunities, by virtue of their vertical and horizontal integration. They have already developed and are now producing high-definition systems of various sorts, well ahead of European or U.S. competition.

As has been mentioned, NHK has taken a lead role in promoting one type of HDTV broadcast, but there are others, including all-digital broadcasting. The electronics companies have done most of their work in conjunction with NHK teams, but are now increasing independent development efforts, as they move into actual production and as they begin to exploit economies of scope in the component technologies. Both MITI and MPT have begun several efforts to seed demand through "model cities" and applications demonstrations, and encourage the production of high-definition systems through the provision of low-cost finance and the establishment of special leasing corporations. NTT will promote HDS in its ISDN network. The Japan Key Technology Center has lent substantial sums for the development of HDS technologies and has established several consortia, three of which are directly related to HDS. One will develop 40" diagonal displays and display processors. Another will develop several different types of wide-area electronic circuit technology, which will find application in many fields. Another is already developing new algorithms for image processing.

HDS represent key, generic technologies in several ways. Components of HDS are interoperable, with Hi-Vision screen technology being applicable to computer displays and military displays, for example. There is a general merging of technology as information systems develop, especially between computers and video systems. HDS will serve as the platform for a host of peripheral devices, all taking advantage of the high-resolution processing capabilities of HDS. Several underlying technologies being used in HDS -- parallel processing, device packaging, and device technologies such as gallium arsenide -- are strategic in the development of many other types of systems. Finally, HDS will likely lead to the development of several new types of technologies, such as advanced networking and visualization.

Contact:

Mark Eaton, Director, International Liaison Office, 512-338-3315
Dr. Barry Whalen, Senior Vice President for Plans and Programs, 512-338-3711

Charts:
1. Vertical and Horizontal Integration of Japanese Electronics Companies
2. Japanese Research, Development, and Production of High Definition Systems
3. Place of High Definition Systems in the Information Society
4. Division of Effort In High Definition Systems
5. Place of HDTV in Media
6. Technology Fusion of High Definition Systems
7. Industrial Uses of High Definition Systems
8. Hi-Vision Communities Financing

DEFENSE MANUFACTURING BOARD
"HIGH DEFINITION SYSTEM" WORKSHOP
AUGUST 22, 1989

FEDERAL COMMUNICATIONS COMMISSION

The FCC is an independent government agency directly responsible to Congress. It was established by the Communications Act of 1934 and is charged with regulating interstate and international communications by radio, TV, wire, satellite, and cable.

o Notice of Inquiry (NOI), July 1987: In the Matter of Advanced TV Systems and Their Impact on the Existing TV Broadcast Service, MM Docket 87-268.
- Responds to Petition for NOI, February 1987 from nearly 60 broadcast organizations and companies; explores issues arising from the introduction of ATV systems, especially relating to spectrum allocation.
- Wide ranging inquiry to consider the technical and public policy issues surrounding the use of ATV technologies by TV broadcast licensees.

o Tentative Decision and Further NOI, September 1988.
- Tentative findings:
  -- Providing for terrestrial broadcast use of ATV techniques would benefit the public
  -- The benefits of this technology could be realized by the public most quickly if existing broadcasters are permitted to implement ATV.
  -- Any spectrum allocated to ATV should come from the spectrum now allocated to broadcast television.
  -- Existing service to viewers using NTSC receivers must be continued at least during a transition period, regardless of the manner in which ATV services are delivered.
  -- Systems that would require the assignment of more than 6 MHz of additional spectrum per broadcast station would not be authorized.
  -- Retarding the independent introduction of ATV in other services or on non-broadcast media would not serve the public interest.
- Further inquiry:
  -- Comment on the Advisory Committee's Interim Report
  -- Additional information on ATV systems, including interference limitations in VHF and UHF spectrum.
  -- Advantages and disadvantages of spectrum options.
    - Providing no additional spectrum, i.e., ATV in existing 6MHz channels.
    - Providing each broadcaster an additional 3 MHz for an augmentation signal.
    - Providing an additional 6 MHz either for an augmentation signal or for dual non-compatible ATV signal.
  -- How standards should be established and whether to relax or repeal the NTSC standard.
  -- If additional spectrum is decided upon, propose plans for its distribution and assignment.
  -- Comment on permitting licensees to negotiate with each other regarding service areas.

o Points-of-Contact
- Lex Felker, Chief, Mass Media Bureau--632-6460
- Tom Stanley, Chief Engineer--632-7060

THE FCC'S ADVISORY COMMITTEE ON ADVANCED TELEVISION SERVICE

I. History

- **A.** Established in November 1987
- **B.** Mandate: assist FCC in selecting new TV transmission standard (and to understand economic, technical and spectrum trade-offs involved).
- **C.** Membership: 25 leaders of major broadcast, cable, program production and TV receiver manufacturing companies, plus ex officio government representatives.
- **D.** Organization: three primary subcommittees (Planning, Systems and Implementation), each with numerous Working Parties; in all, hundreds of private sector individuals involved.
- **E.** Funding: self-supported ($5,000 per member).

II. Current Activity: Testing Phase

- **A.** 23 system concepts introduced by 14 proponents; they fall into three categories:
  1. enhanced: 6 MHz
  2. augmentation: 9 or 12 MHz
  3. simulcast: 12 MHz
- **B.** 8 proponents, involving 11 concepts, have indicated willingness to submit "complete" (video/audio) systems, in hardware form, for testing in 1990 time frame.
- **C.** Testing will be performed by ATTC (broadcast) and Cable Labs (cable), pursuant to Advisory Committee specifications; testing fees will be required to offset costs.
- **D.** Testing of each system will consume about six weeks; thus, approximately a year will be required to test all systems.

III. Future Activity

- **A.** Advisory Committee expects to recommend single terrestrial broadcast standard (perhaps a blending of proponent concepts), with interfaces to other video delivery systems:
  1. family of compatible standards?
  2. multiport receiver?
  3. other?
- **B.** Advisory Committee will complete work in late 1991 and present final report to FCC; will allow FCC to select new standard in 1992 time frame.

ADVANCED TELEVISION SYSTEMS COMMITTEE

ATSC

DEFENSE MANUFACTURING BOARD "HIGH DEFINITION SYSTEMS" WORKSHOP
22 August 1989

--ATSC is a private sector organization composed of all television networks (ABC, CBS, NBC, PBS), equipment manufacturers (AMPEX, ZENITH, SONY THOMSON, PHILIPS, etc.), Associations (e. g., NAB, NCTA, IEEE, EIA, SMPTE), telephone companies, satellite firms, and educational institutions. It has a single goal; development of HDTV and other advanced television standards.

--ATSC works closely with the FCC and its Advisory Committee, the broadcasting and cable labs, DoS, DoC, and others involved in HDTV issues.

Key Points:

--Production Standards in U. S. Television have always been established by the private sector. Distribution or transmission standards are the prerogative of the FCC.

--Technical Standards should not be used as non-tariff trade barriers. History shows the disadvantages:
- --Brazil and its unique PAL standard.
- --France/USSR and SECAM

--80% of all television equipment already comes from abroad. There is no U. S. base on which to rebuild a television equipment industry. We should focus on saving what we have left; not in a futile effort of "jump-starting" a new television manufacturing base.

DoD should NOT move in directions that would:
- --require TV consumers to pay a premium price for TV receivers.
- --require telephone subscribers to pay for fiber optic cable they do not want.
- --require more sophisticated equipment than the public wishes to own.

--We should search for areas of convergence of interests:
- --display technology
- --compatibility between TV and computer displays

--No action should be taken which holds the U. S. television industry or the U. S. television viewer hostage to military or other industrial interests in improved imaging. Rather, DoD and DoC efforts should be aimed at a decision-making process which strives for balanced representation of all sectors interested in HDTV. The debate is not one which is solely the province of the semiconductor and computer industries; rather, it is one in which the United States television industry has a primary and over-riding interest.

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ADVANCED TELEVISION TEST CENTER

1320 Braddock Place · Suite 710 · Alexandria, Virginia 22314
(703) 739-3850 · FAX (703) 739-3230

DEFENSE MANUFACTURING BOARD: "High Definition Systems" Workshop

Background:

- The Test Center is a private, non-profit corporation organized by the television broadcasting industry to examine the options for a terrestrial transmission standard for advanced television (ATV) service. This will be accomplished by laboratory and field testing of ATV systems via the broadcast and cable media.
- The Test Center is developing specialized laboratory test facilities, conducting propagation tests, and undertaking consumer/market research in support of the efforts of the FCC and its Advisory Committee on Advanced Television Service, and the needs of the U.S. television industry and private standards-setting bodies (e.g. ATSC).
- The Test Center is supported entirely by private contributions, from: 1) its members (ABC, CBS, NBC, PBS, Association of Independent Television Stations, Association of Maximum Service Telecasters, and National Association of Broadcasters); 2) other industry organizations (e.g. Cable Television Laboratories, Electronic Industries Association, etc.); and, 3) key cooperating organizations and interests (e.g. Canada's Communications Research Centre, Eastman Kodak, etc.).

Key Points:

- The effort to establish a single, compatible ATV terrestrial transmission standard should be pressed with all deliberate speed in order to:
  - --Ensure adequate spectrum for broadcast ATV implementation
  - --Assist alternative media in planning toward such a standard
  - --Support established public policy goals of accessible, high-quality, diverse, and independent information and entertainment services via television--with continued, primary reliance on the private, competitive market to provide such services.

- Full, fair, and impartial testing of ATV transmission system hardware is the best way to:
  - --Determine the best possible approach for the US/North America
  - --Encourage more rapid development, and appropriate synthesis, of ATV ideas
  - --Help create and support a realistic foundation for the broadest possible HDTV applications throughout society.

- Proper recognition must be given the practical, economic implementation of HDTV systems--including television applications--in order to:
  - --Permit reasonable consumer prices for ATV products
  - --Sustain cost-effective program production and maximum access by program/information suppliers in television
  - --Focus public and private attention on developments with the potential to speed HDTV implementation for the public good.

Contact: Peter M. Fannon, Executive Director

(8/22/89)

THE NIST TECHNICAL PROGRAM WHICH WILL SUPPORT HIGH DEFINITION TELEVISION

Program Objective: The NIST program provides industry with the research results and the evaluated test methods needed for the next generation of digital data and image processing. This technology is important in consumer electronics, telecommunications, computers, and advanced manufacturing. The program provides the technical support needed for high definition television.

Program Structure: The focal point of the NIST program will be a facility to evaluate the performance of digital data systems. This experimental facility, which will include the necessary apparatus to acquire, convert, transmit, and display data and images, is needed to evaluate test methods for digital components and systems and to perform engineering research on information conversion and transmission.

The specific technology elements which underlie high definition television, in particular, and digital data and imaging systems, in general, include:

- Magnetic and magneto-optical data storage.
- Theory, evaluation, and implementation of data compression algorithms.
- Analog-to-digital and digital-to-analog conversion.
- Network components, including optical components, e.g. fibers, integrated optic circuits, multiplexers, etc., and microwave components, e.g. antennas and microwave integrated circuits.
- Network standards and protocols, e.g. ISDN.
- Dynamic random-access memories.
- Digital processors.
- Displays.

The NIST program, as currently envisioned, addresses all of these topics, except display technology. Any work on displays is being deferred until the effects the DoD-funded program can be assessed. NIST has technical programs, directed toward other objectives, in all of the areas related to HDTV in which it intends to work. Specifically, NIST has evaluated measurements of magnetic tape performance as well as microscopic measurements of magnetic materials on surfaces. Data compression algorithms have been developed for high performance computing applications. Characterization of the process of converting between analog and digital signals is being carried out to support the electronic instrumentation industry. Optical and microwave components are being characterized to support advances in telecommunications as are network standards. Finally, the standards needed to manufacture semiconductor memories and processors are being developed.

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UNITED STATES DEPARTMENT OF COMMERCE
National Telecommunications and Information Administration
Washington, D.C. 20230

NTIA High Definition Systems Activities

The National Telecommunications and Information Administration (NTIA) is the Commerce Department agency which deals with telecommunications issues, both domestic and international. We have been actively involved with HDTV for more than two years, working with the Department in the development of ATV-related policies. This work also includes conducting technical studies regarding HDTV at our Institute for Telecommunication Sciences (ITS).

NTIA has been, and will continue to be, a major contributor to U.S. efforts within the CCIR that are directed at the development of a uniform, worldwide production standard for HDTV material. We will be active participants in the October CCIR Final Meeting dealing with television as well as in the May 1990 Plenary Assembly.

Relying heavily on the in-house technical capabilities resident at ITS, we will be undertaking propagation measurements and channel assignment studies to further assess the likelihood that frequencies already allocated to the television broadcasting service can be used to augment or supplement over-the-air broadcasting of ATV signals.

Looking further into the future and to broadband ISDN applications, we are undertaking a major study to develop objective performance standards for digital video transmission. We will continue our leadership role in the CCITT, the T1 Committee, and other fora, as appropriate, to ensure that performance standards are adopted that permit U.S. manufacturers to effectively compete in domestic and international telecommunication and advanced video markets.

Working closely with the Navy, NTIA/ITS is continuing its efforts to apply CAD/CAM techniques to provide the capability to maintain and repair any vessel at any time anywhere in the world.

NTIA plans to study the economic and policy implications of differing transmission performance standards for the different methods of delivery of advanced television services i.e., over-the-air, cable, VCR, satellite, fiber.

<u>NTIA Advanced Television Contact Point</u>

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OFFICE OF THE UNITED STATES TRADE REPRESENTATIVE

I. Statutory responsibilities for international trade policy and relevance to high-definition systems.

II. Current Work and Contacts
- A. Interagency
- B. Europe
- C. Japan

III. Issues
- A. International trade flow implications
- B. International trade policy implications
- C. International cooperation
- D. Implications for trade in final product
- E. Implications for trade in key technology components

For further information contact: Donald W. Eiss, Deputy Assistant United States Trade Representative, (703) 395-5656.

Department of State
Initiatives with Respect to HDTV Systems

The Role of the Department of State

The Department of State, in consultation with the Department of Commerce, the Federal Communication Commission, and other government agencies has the responsibility for U.S. participation in the International Radio Consultative Committee (CCIR) an organ of the International Telecommunication Union. The CCIR serves as the global focal point for conducting studies and developing recommendations on technical and operational radiocommunications questions.

In our policy coordinating role, we systematically bring together private sector and other U.S. Government input through advisory committees. Our key advisory committee for international broadcasting issues is the U.S. National CCIR Organization. This Committee is open to any interested federal agency, private company, individual consultant, industry group, standards body, and the public in general. Its purpose is to advise the Department of State on appropriate contributions and positions to be taken in the international CCIR meetings.

The National CCIR Organization is chaired by the State Department with the FCC and the National Telecommunications and Information Administration (NTIA) of the Department of Commerce as vice chairmen. The major broadcasting organizations and organizations of broadcasting equipment manufacturers are represented and provide valuable input for policy decisions, such as our position on an international HDTV production standard. These positions are evaluated in a CCIR National Committee review process, including interagency review, before a final determination is made by the State Department.

In the case of HDTV and other broadcasting matters, the pivotal role played by the private sector is natural, since privately owned and operated stations, networks, and program producers are directly affected by our policies. In fact, private sector studies have been underway for more than a decade. Three prominent private sector organizations that have played decisive roles in our work are the Advanced Television Systems Committee, the Society of Motion Picture and Television Engineers, and the American National Standards Institute.

The CCIR - Scope, Status of work, and Schedule

The issue of HDTV is treated in CCIR Study Group 11 (Television). Normally this Study Group meets at two year intervals although this year an Extraordinary Meeting was convened in May. Between meetings of the Study Group, nine Interim Working Parties study various aspects of HDTV by means of meetings and by correspondence.

The scope of the CCIR work is illustrated by the topical areas treated at the recent Extraordinary Meeting. Generally, the status of work is in the study stage although some Recommendations related to Subjective Assessment and Recording have been adopted. The topical areas include;

-Subjective assessment of HDTV picture quality,
-Protection ratios applicable to HDTV terrestrial systems,
-Compatibility of HDTV systems with existing terrestrial systems,
-An HDTV standard for the studio and international program exchange,
-Possible approaches to encoding parameters,
-Digital aspects of HDTV,
-Characteristics of HDTV satellite broadcasting systems,
-Recording of HDTV programs, the use of film for HDTV, and the harmonization of broadcasting and non-broadcasting equipment, and
-Data broadcasting.

While the overall scope of HDTV activities is relatively large, the focus of attention has recently been on the HDTV standard for the studio and international program exchange. The Extraordinary Meeting adopted a Draft Recommendation, "A Number of Basic Parameter Values for the HDTV Standard for the Studio and International program Exchange". To date there has been agreement on eighteen of thirty four parameter values. It is expected that additional parameter values related to colorimetry and transfer characteristics will be adopted at the next meeting of Study Group 11 in October. Within this context, the U.S. will promote the concept of "Common Image Format" with the expectation that a complete Recommendation and final treatment of parameters such as frame rate and the number of lines will be decided during the next study cycle from 1990 to 1994. The CCIR Plenary Meeting will take place in May 1990.

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NASA'S ROLE IN ATV/HDTV DEVELOPMENT

Television systems are imbedded in many of the communications capabilities designed and developed by NASA and its contractors to operate in space, conduct scientific investigations, and disseminate information.

NASA television systems typically include both space and terrestrial elements. The space elements are designed and developed to be used only in that environment, where operating conditions are generally quite different if not more demanding of the designer of electronic devices, and for the most part they would be considered highly specialized applications of television technology.

The design and development of the terrestrial elements of NASA's television systems, on the other hand, follows reasonably conventional concepts. Many of the components are readily available as professional consumer products, the same as those one would expect to find in a well equipped terrestrial broadcasting production, distribution and transmission complex.

The Television Development Division's Advanced Video Systems Program focuses modestly funded contractor efforts on design and development issues associated with NASA's acquisition and operation of advanced video systems which will conform to standards and practices now under consideration for the use of video by the media during the next decade.

The principal design issues under study at this time are the design implications of the increase in bandwidth or bit rate required for high definition television transmission and distribution, and the trade-offs between analog/digital conversion and signal processing and the implementation of end-to-end digital systems.

NASA's on-site television distribution systems are analog for the most part, coaxial cable with some optical fiber. Point-to-point and point-to-multipoint satellite television transmission systems are analog. Space-to-ground relay satellites are presently operated in an analog mode for television transmissions, but will soon be operated as a digital relay system. Future space-to-space television transmissions will be digital.

This mix of transmission systems and analog/digital configurations makes NASA's conversion to high definiiton television a model for looking at the range of issues media will encounter as high definition television systems are developed for broadcasting, cable and fiber optic distribution and satellite transmission.

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National Science Foundation activities related to High Definition Systems (HDS)

Prepared for distribution at the Defense Manufacturing Board Workshop on High Definition Systems

by Dr. Frank L. Huband, Director
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The National Science Foundation (NSF) is a Federal agency that funds fundamental scientific and engineering research and education, primarily in educational institutions.

Since it does not fund development activities, NSF is not directly engaged in the support of HDS. However, several of NSF's programs fund research activities which will potentially affect the technology and personnel available for development of HDS. These programs include:

Computer Systems Architecture, in the Division of Computer and Computation Research;

Circuits and Signal Processing, in the Division of Microelectronic Information Processing Systems;

Microelectronics Systems Architecture; in the Division of Microelectronic Information Processing Systems;

Ceramics and Electronics Materials, in the Division of Materials Research;

Quantum Electronics, Waves, and Beams, in the Division of Electrical and Communications Systems; and

Solid State and Microstructures Engineering, in the Division of Electrical and Communications Systems.

NSF also carries out assessments of Japanese research and technology in a broad class of technology areas, through the JTEC program. The recently completed assessment of High Definition Television prepared under the leadership of Richard Elkus, is an example of these assessments.

MEMORANDUM

Tuesday 22 August 1989

TO: Participants in the Defense Manufacturing Board's Discussion Group on High Definition Systems

FROM: Dr. Roy L. Beasley
Consultant

SUBJECT: Background notes for the afternoon "Discussion Group"

I. High Definition Systems Task Force

A. Sponsor: Defense Advanced Research Projects Agency (DARPA)

B. Mission

The mission of this Task Force will be to develop an affordable, comprehensive plan whose execution by DARPA and by other relevant entities in the public and private sectors will assure that U.S. national security is not jeopardized by the inadequate participation of U.S. firms in the development of the domestic market for high definition systems. In other words, its final report will specify who should do what and when.

Recognizing the fragmented nature of our system of government, the Task Force should try to function as a forum for the development of the broadest possible consensus on its recommendations. In particular, it should invite all of the relevant entities in the public and private sectors to provide input to its deliberations. However, its final report will note the significant points on which consensus was not achieved.

C. Operations & Composition

-- Chartered for one year. (Objective: 6-9 months)
-- Subdivided into three working committees: "Consumer Applications", "Non-consumer Applications", and "Government Policies".
-- Full Task Force will meet quarterly; committees will meet as required.
-- Members (approx. 30) nominated from highest ranks of management, labor leadership, and academia.
-- Members nominated from full range of electronics sectors relevant to consumer and non-consumer applications of high resolution technologies: broadcasting, cable, telecommunications, workstations, semiconductors, components, and consumer electronics.

II. Missions of the Working Committees

A. Consumer Applications Committee

Most analysts agree that consumer applications of high resolution technologies will be impeded by high prices until the end of the next decade when prices are expected to come down to levels more acceptable to the average consumer. The current consensus suggests that television will probably undergo a series of "evolutionary", moderately priced enhancements prior to the high definition "revolution".

This committee should, therefore, produce a comprehensive vision of the full range of consumer applications of high resolution technologies for the year 2000 -- e.g., high definition television, electronic photography, video disk, VCR's, video games, etc. -- together with recommended strategies for developing these applications. This vision should also encompass the programming innovations -- i.e., the changes in the format and the content of the medium's entertainment and information programs -- required to exploit the full potential of these anticipated innovations in hardware.

B. Non-Consumer Applications Committee

Whereas consumer markets tend to be price sensitive, the prices of non-consumer products are usually evaluated by investment criteria, i.e., in terms of the product's potential contribution to the purchaser's productivity and/or profitability. Hence, this committee should develop a comprehensive vision of the high margin applications of high resolution technologies which U.S. firms might successfully exploit during the 1990's.

Market segments might include (among others): military (dual use), civilian aviation, engineering and architectural design, medical, industrial, and marketing & sales. The committee's vision should also recommend appropriate strategies for developing these applications, including suggestions as to the timing and the sequence of these developments, if possible.

C. Government Policies Committee

This committee should recommend a coherent set of government policies designed to enhance the capacity of U.S. manufacturers to become major participants in the emerging consumer and non-consumer markets for high definition products.

Specific issues which might be addressed include, among others: procurement policies by DOD and/or other government agencies which would guarantee substantial initial markets for U.S. producers; protection of U.S. intellectual property; U.S. access to foreign technology; U.S. access to foreign markets; foreign dumping; industry standards; cost and "patience" of U.S. capital; clarifications and/or modifications to current anti-trust laws.