

The *digital* HDTV Grand Alliance

May 24, 1993 – Dec 24, 1996

A 10th Reunion Retrospective

Glenn Reitmeier

May 24, 2003

TV Technology Breakthroughs

1996 - HDTV

*5x the picture information, 3x the sound information,
in channels unsuitable for traditional TV*

1987 - Color TV Stereo Sound

3x the sound information - compatibly!

1953 - Color TV

3x the picture information - compatibly!

1941 - Monochrome TV

Television History



Advanced Television

- **HDTV in Japan & Europe**
 - **MUSE and HD-MAC**
- **Broadcasters petition FCC**
- **ACATS formed**
- **23 competing proposals**
 - **EDTV ... 2-channel HDTV**

STATEMENT OF CHAIRMAN ALFRED C. SIKES

TO THE

ADVISORY COMMITTEE FOR ADVANCED TELEVISION

MARCH 21, 1990

With upcoming issuance of the Third Interim Report of the Advisory Committee for Advanced Television, I would like to take this opportunity to thank Advisory Committee Chairman Richard Wiley and the Advisory Committee members for their efforts to date. Additionally, I want to share with the Advisory Committee the Commission's thoughts on the direction and timing of the selection of advanced television systems.

First and foremost, let me congratulate the Advisory Committee on what it has already accomplished. During the three years since NTIA and the Commission introduced high-definition television to the public policy arena, the Advisory Committee's efforts have resulted in substantial progress toward the selection of advanced television systems. We are now at a fortunate point in time. The Advisory Committee, working with industry, has enhanced significantly our ability to measure the quality of competing advanced television systems. At the same time, true progress has been made on both enhancing the current NTSC standard and on delivering a high-definition television signal using existing terrestrial facilities.

This fortunate combination of circumstances makes it both appropriate and timely for the Commission to enunciate its goals for the selection of advanced television systems.

Because of the benefits advanced television can bring to the public, the Commission's initial objective is to be in a position to select a standard for advanced television systems as promptly as possible. We believe that it should be possible to make this selection during the second quarter of 1993. In order to meet this schedule, the Commission requests that the Advisory Committee prepare its Final Report containing its data, analyses, findings, and recommendations for submission to the Commission by September 30, 1992.

The Commission's primary goal in these proceedings is to assure the development of a technically excellent advanced television service that will most efficiently meet the needs and desires of broadcast stations, cable providers and consumers. Consistent with this goal, the Commission's intent is to select a simulcast high-definition television standard, that is, compatible with the current 6 MHz channelization plan but employing new design principles independent of NTSC technology. In making this determination we are aware of the fact that

THE WALL STREET JOURNAL

TECHNOLOGY

Technology
To Enhance
TV Blocked

By BOB DAVIS

Staff Reporter of THE WALL STREET JOURNAL

WASHINGTON — Television viewers who are waiting for TV sets with sharply enhanced pictures will have to keep on waiting.

Federal regulators blocked an improvement in television-set technology that could be ready soon so they could push for a great leap forward in TV technology in the mid-1990s. "Our goal has to be choosing the best," said Alfred Sikes, chairman of the Federal Communications Commission.

At issue is the development of a new generation of television sets, called high-definition television, which promises to bring movie-like quality to television. HDTV sets generally would be bigger and wider than current sets and have far sharper pictures. They would also have far higher initial price tags—about \$2,500, about five times the cost of conventional sets.

Yesterday, Mr. Sikes said the agency wouldn't rule on a proposed transmission technology, called Enhanced Definition TV, which has most of the benefits of HDTV and could be put into place much more quickly, until it ruled on HDTV in the spring of 1993. That has the effect of retarding the development of the enhanced

Technique to Sharpen
Clarity of TV Images
Blocked by the FCC*Continued From Page B1*

the only large U.S.-owned TV maker, has been championing a system called simulcast, favored by the FCC, and is probably the front-runner in the competition to be selected as the standard-bearer. NHK, the Japan Broadcasting Corp., also has a simulcast system, but is unlikely to be chosen. Indeed, the U.S. high-definition TV effort is largely directed at keeping Japanese companies from further domination of consumer electronics.

The company whose technology is chosen stands to reap royalties worth millions of dollars and could get a head start in manufacturing sets that meet the new standard. Moreover, if a U.S. standard is selected that is different from standards in Japan or Europe, foreign manufacturers would have to make different sets for different markets—reducing any potential manufacturing advantage over a U.S. set maker.

Mr. Sikes's decision to delay enhanced television is a blow to a consortium of companies that is pushing to start an enhanced TV system by 1993. The companies include General Electric Co.'s National Broadcasting Co. unit; SRI International's David Sarnoff Research Center; Thomson Consumer Electronics, a subsidiary of Thomson S.A. of France; and Philips Consumer Electronics, a subsidiary of N.V. Philips of the Netherlands.

Consortium members took a low-key view of the decision, saying they would continue developing enhanced TV and also doing research into the technology favored

will flock to buy any form of HDTV sets is anyone's guess. But the FCC is convinced they will. Now it is in the process of choosing among about eight different proposals to set the standard broadcasters will use to transmit programs to HDTV sets.

Simulcast broadcasts two different signals. One signal, carrying conventional images, would be broadcast to existing channels—so TV viewers with old sets could still watch their favorite shows. A second, HDTV signal would go to channels that are now kept purposefully vacant to make sure station signals don't interfere with each other. Viewers with HDTV shows would tune into those channels to get HDTV broadcasts.

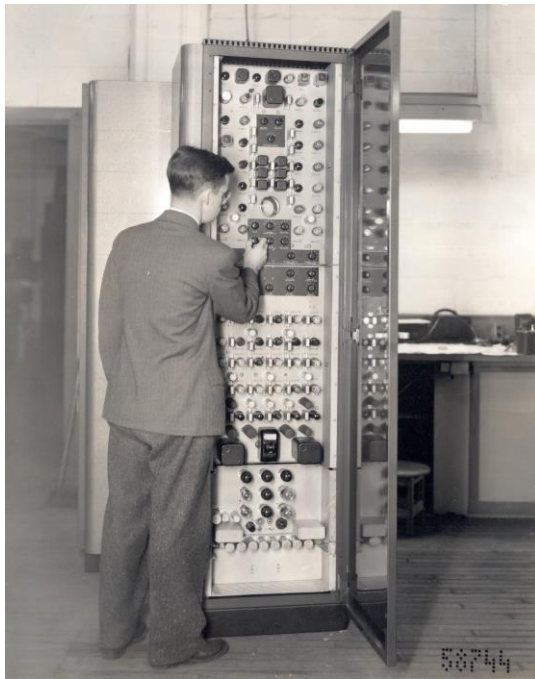
Wayne Luplow, who is in charge of Zenith's HDTV efforts, said if his company was chosen in 1993, it could have the first sets to market within a year. But he predicted that the number of HDTV sets—and the number of shows broadcast in HDTV—would be small at first.

Mr. Sikes didn't rule out enhanced TV entirely. He said the FCC's advisory panel would test how well it worked just as it tested HDTV systems. But he suggested that enhanced TV could be selected if full HDTV wasn't ready to go by the spring of 1993. Hedging his decision that way, though, gave hope to the enhanced-TV proponents.

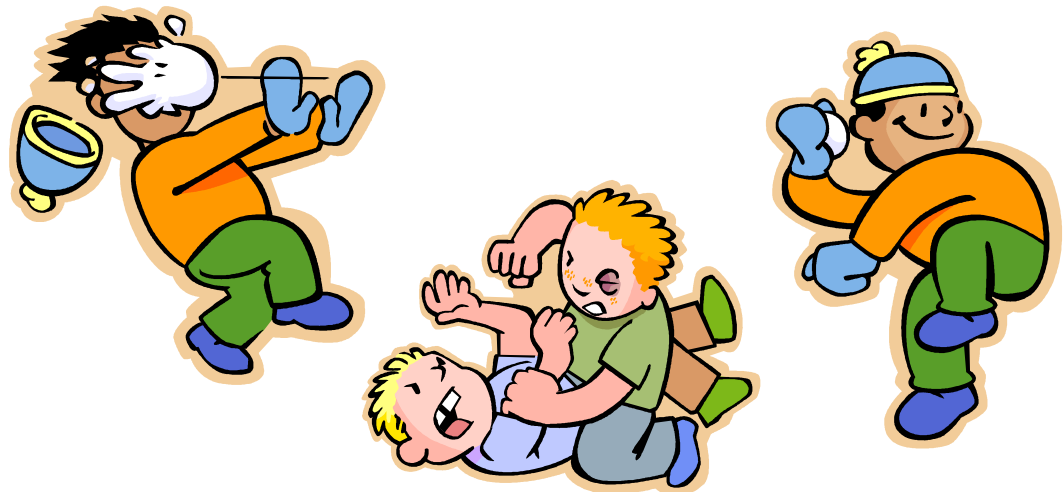
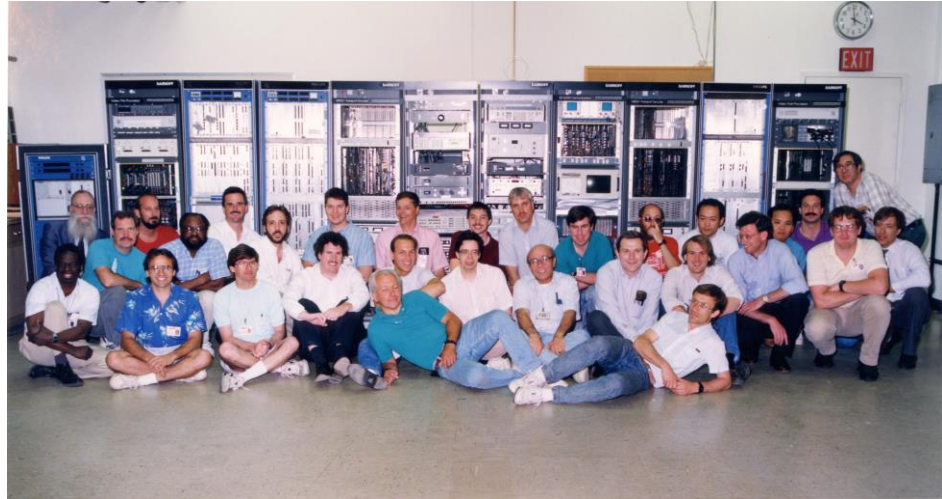
"Simulcast might not make it," said Jack Fuhrer, director of Sarnoff's television-research laboratory. "Enhanced television might have advantages in cost and ease of technology." But, to be on the safe side, Sarnoff is developing a simulcast system too.

Competing *Digital* Systems

Advanced
Technology



Compact Size



ACATS Special Panel - Feb. 1993

Business Day

L D1

FRIDAY, FEBRUARY 12, 1993

The New York Times

Advanced-TV Systems Are Called Flawed

By JOEL BRINKLEY

Special to The New York Times

VIENNA, Va., Feb. 11 — A special committee advising the Federal Communications Commission concluded this evening that all five of the systems competing to be picked as the United States' high-definition television standard were flawed.

The competitors told the committee that they had made improvements to repair problems that turned up in tests last year. So committee members said they would recommend that four of the five systems be retested to gauge those improvements. That could set back the schedule for the introduction of high-definition television by as much as a year.

Officials from all four groups said today they had begun talking about merging their systems into one — an idea that the F.C.C. committee's leaders have been promoting.

The fifth competitor, NHK of Japan, dropped out of the competition Wednesday night after it became clear that its system could not win. That decision came as no surprise. NHK, the Japanese broadcasting network, was the only competitor not to

Four groups may merge their projects.

offer a fully digital transmission system. Its test results were generally inferior to those of the other systems.

Dr. Keiichi Kubota, senior scientist for NHK's American office, said he thought he had been treated fairly. "In my personal view, a digital system is best for this country," he said.

About six years ago, the F.C.C. announced that it would choose a standard for the next generation of American television several years hence, and it invited companies worldwide to compete.

More than 20 companies entered the race, but only five were selected for testing. They included NHK; the General Instrument Corporation, a manufacturer of cable and satellite equipment; the Massachusetts Institute of Technology, and a partnership of Zenith Electronics Inc. and A.T. & T. The fifth was a consortium including the David Sarnoff Research

Center of Princeton, N.J., NBC, the North American Philips Corporation and Thomson Consumer Electronics.

The four remaining systems all offer far crisper, clearer pictures than is possible on televisions in use today. And because the programming will be transmitted digitally, high-definition television promises to interact with computers and other devices, turning TV's into devices that can provide a host of services.

Both committee members and competitors agreed today that when the improved systems are retested, the differences between them are likely to diminish significantly, making it harder to pick a clear winner.

The remaining competitors have each spent several million dollars each on their projects — money not all of them can easily afford. Retesting will cost each of them as much as \$400,000; the broadcast industry-backed test center requires each competitor to pay testing costs.

The possibility of merging the systems into one has been the subject of "active discussion" for the last two weeks," said Jae Lim, designer of the M.I.T. system.

He added, "I think it's a good idea, though it should not be a cow's head with a horse's body."

The F.C.C.'s Advisory Committee on Advanced Television Service was

Could HDTV's answer be a 'grand alliance'?

Blue-ribbon committee suggests that four systems vying for acceptance as FCC transmission standard combine best features and work together

By Randy Sukow

Life would be simpler for the television industry and Washington regulators if they could have just one all-digital HDTV transmission system to consider rather than the current four, according to the FCC's Advisory Committee on Advanced Television Service. The advisory committee's "blue ribbon" committee strongly suggested such a "grand alliance" during its Washington meeting last Wednesday (Feb. 24).

"The concept of the grand alliance would be to take the best elements of the different systems and combine them in order to give the advisory committee, the FCC and the nation, ultimately, the best possible HDTV system," said Advisory Committee Chairman Richard Wiley, senior partner, Wiley, Rein & Fielding.

But some, including the National Association of Broadcasters, said an alliance is not necessarily the perfect solution. The four proponents themselves doubted that such an alliance will be possible, at least in the near term.

The blue-ribbon committee's decision last week was to approve a month's worth of additional testing for each of the four proposed systems at the Advanced Television Test Center, to begin as soon as the test center can be ready—between March 15 and April 1. But the committee said it would accept—and recommend—a consolidation agreement, if it can be reached before retesting begins.

The committee did not rule out agreeing to consolidation after testing begins, but now, Wiley said, is the most opportune time to form an alliance without creating great delays.

As recently as a few months ago, it was expected that the blue-ribbon

committee would recommend one of the four digital systems at last week's meeting. But analysis of the first-round tests found that no single system tested high enough on all technical and economic criteria to be considered a winner or tested low enough to be considered a clear loser.

After retesting of the four systems, the advisory committee now expects a final system to be chosen in early 1994. If a grand alliance is formed now, it will take slightly longer to complete the advisory committee's work as the proponents work to fit the pieces of the consolidated system together and then retest it.

Several advisory committee members said their actions should not be seen as simple approval for a one-year delay. Much of the work of the next year's testing will involve system refinements the FCC would have to have done itself had a system been chosen last week, they said.

NAB did not oppose the grand-alliance concept during the meeting, but

Retesting schedule

Immediately after last week's advisory committee meeting, the three competing consortia drew cards to determine the order of retesting to start around April 1, should a grand alliance fail to form: (1) DigiCipher, proposed by General Instrument and the Massachusetts Institute of Technology; (2) Advanced Digital HDTV, proposed by the Advanced Television Research Consortium; (3) GI/MIT's Channel-Computable DigiCipher, and (4) Spectrum Compatible HDTV, proposed by Zenith Electronics and AT&T.

—RMS

did register some concerns later. "If the grand alliance produces a better system [than the four now proposed], then I guess we'd probably be in favor of it," said John Abel, NAB executive vice president, operations, an advisory committee member. But NAB fears it will not be better.

"There might be a proponent out there that wants to build a better system, just as an example, for cable that does not transmit as well on broadcast channels," Abel said, although he refused to name proponent names. If the four proponents continue to improve their systems in competition with each other, NAB believes their incentive to build a system solving all problems for all media will be greater.

NAB's worries may never materialize. As one proponent, Donald Rumsfeld, chairman and chief executive officer of General Instrument, said, the grand alliance "is going to be very difficult to achieve."

Rumsfeld suggested that instead of a grand alliance, the blue-ribbon committee opt for a "current alliance" strategy, based on the GI/MIT/Zenith-AT&T agreement.

The advisory committee heard Rumsfeld's arguments but did not put the current alliance idea to a vote.

Members of ATRC—made up of NBC, Thomson Consumer Electronics, Philips Consumer Electronics, the David Sarnoff Research Center and Compression Labs Inc.—complained that GI was unfairly putting them in the role of "the bad guy."

"We've become involved with discussions with the other proponents within only the last couple of weeks," said Peter Bingham, president, Philips Laboratories, Briarcliff Manor, N.Y. "We would very much benefit from a grand alliance, and we are trying to be very proactive in our approach."

A Grand Alliance?

First Date

VideoCipher Division
6262 Lusk Boulevard
San Diego, CA 92121
Phone (619) 535-2532
Fax (619) 535-2486

FAX TRANSMITTAL FORM

April 12, 1993

TO: Carlo Basile/Philips FAX #: 914/945-6141
TO: Jac Lim/MIT FAX #: 617/253-7302
TO: Wayne Luplow FAX #: 708/391-8555
TO: Arun Netravali/AT&T FAX #: 908/582-3457
TO: Glen Reitmeier/Sarnoff FAX #: 609/734-2124

SUBJECT: Grand Alliance Technology Meeting

The Grand Alliance Technology meeting will be held on Wednesday, April 14 through Thursday, April 15, at Thomson Consumer Electronics, Inc., located at 1200 19th Street, N.W., Suite 601 (19th & M, near Dupont Circle South, Red Line Metro Stop), Washington, D.C.

Lunch will be served at Thomson immediately following the 10:00 a.m. meeting at ATTC. The meeting will convene as soon after lunch as possible but no later than 1:00 p.m. Lunch will again be served on Thursday and the meeting is scheduled to conclude no later than 3:00 p.m.

Hotel and transportation accommodations will not be provided, please make your own arrangements. Please feel free to call Barbara Burnett at (202) 872-0670 for a list of suggested hotels nearby Thomson.

Rules of Engagement

GRAND-ALLIANCE TRANSMISSION SYSTEM DETERMINATION (5/20/93 DRAFT)

The following is a proposed procedure for arriving at a binding choice of transmission systems. The intent would be that this procedure, like the three other technical procedures, would become part of the business agreement. Because it is to be binding, it is necessary for the procedure to incorporate all factors -- technical and business -- bearing on the decision.

- A. Preliminarily define VSB, QAM and SS-QAM systems as improved and modified - DONE, 4/29/93
- B. Establish list of technical attributes/parameters for comparison - DONE, 5/6/93
- C. Establish weighting factors for the technical parameters and how to apply the weighting factors - by 5/20/93
- D. Final definition of candidate transmission systems in relation to C. - outline (which can change) by 5/21 and detail by 5/28/93.
- E. Paper Analysis based on technical attributes/parameters and agreed weighting: - by 7/15/93
- F. Review design parameters considering overall ATV system parameters - by 8/31/93.
 - (1) Use ATTC data as a basis
 - (2) Extend ATTC data to "Improved System" as able
 - (3) Use Updated/Improved PS/WP-3 Computer Program to calculate ATV-Coverage-Area/NTSC-Servision-Area-Loss using data from E.(2).
 - (4) Technical information requested by other proponents will be supplied.
 - (5) Make ~~VSB vs SS-QAM~~ decision (unanimous vote of the proponents; business representatives is required)
- G. If E not possible, then simultaneous Hardware Testing ^{4/23/94} ~~VSB vs SS-QAM~~ ^{4/23/94} ~~SS-QAM vs SS-QAM~~ - by 9/29/93
 - (1) Transmission System Hardware Only - no video coding/decoding

Grand Alliance Technical Proposal

Area	Technical Proposal
Format	<ol style="list-style-type: none"> 1) The Business Groups will publicly support the goal of "1000+" line progressive scan formats, including 60 frames per second, as the eventual U.S. HDTV standard, with backward compatibility to existing HDTV receivers. 2) 60 frame progressive scan display mode will be built into all HDTV receivers of 34W or greater. 3) Film mode transmission will be progressive. 4) The Grand Alliance system will be a multiple format system supporting the following: <ul style="list-style-type: none"> 1050/2:1/60 787.5/1:1/60, 30, 24 1050/1:1/30, 24 5) As technology evolves and improves, 1050/1:1/60 will be supported. 6) Square pixels, as well as lower horizontal resolutions for all formats.
Compression	<ol style="list-style-type: none"> 1) A baseline system is defined as MPEG2 syntax (without B-frames) including adaptive field/frame processing, I-frame and progressive refresh techniques along with syntax elements for 8x8 inter/intra and leaky prediction. 2) Proponent improvements to the baseline system will be tested and evaluated on a cost/performance basis and decided by the Grand Alliance resolution procedure. 3) Parties agree to work with ACATS, Broadcaster Caucus, ATSC and MPEG to harmonize the standard system within the MPEG2 HDTV profile.
Transmission	<ol style="list-style-type: none"> 1) 4VSB, 6VSB, 32 QAM and 32 SS-QAM will be tested and evaluated on a cost/performance basis and will be determined by the Grand Alliance resolution procedure. 2) Weighing of items on the attached list will be decided by the Grand Alliance resolution procedure.
Audio	<p>Musicam 5.1, Dolby AC3 and the MIT AC system will be tested and evaluated on a cost/performance basis, which will include simultaneous testing starting July 6, 1993 and will be determined by the Grand Alliance resolution procedure.</p>
Transport	<p>A packetized, prioritized data format will be supported.</p>

Prenuptual Agreement

Digital HDTV
Grand Alliance



Sarnoff



Marriage

May 24, 1993

WALL STREET JOURNAL.

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ON

MONDAY, MAY 24, 1993

PRINCETON, NEW JERSEY

THE WALL STREET JOURNAL.

MARKETPLACE

TECHNOLOGY

HDTV Bidders Agree to Merge Their Systems

By MARY LU CARNEVALE

Staff Reporter of THE WALL STREET JOURNAL

WASHINGTON — Owners of the four systems competing to be the U.S. standard for high-definition television reached a tentative pact to combine their systems, individuals familiar with the negotiations said. The owners had been under pressure from the federal government to form a "grand alliance" to speed the transition to the new technology.

The owners have decided on ways to blend their technologies and split licensing fees. But current business arrangements involving one of the participants, Thomson SA of France, must be reworked before a final agreement can be signed, the individuals said yesterday.

A group advising the Federal Communications Commission had been pushing for the owners of the four systems to join forces. Though the group had hoped to announce such a deal today, a final accord may be delayed while Thomson redraws licensing agreements on TV technology with General Electric Co. GE had retained certain licensing income from patents when it sold its consumer electronics division, including the former RCA Corp., to Thomson in 1987.

In February, the advisory panel ordered a round of costly testing for the four systems that was scheduled to start today. But the testing has now been postponed, perhaps for a week or two. If the agreement crumbles, the FCC probably will pick a winner sometime next year, raising the possibility of lawsuits against the FCC from the losers and delaying use of

Please Turn to Page B6, Column 3

HDTV Rivals Set Tentative Agreement To Merge Systems

Continued From Page B1

the new technology.

High-definition television promises to deliver crisper pictures and clearer sound to viewers. Perhaps more importantly, the advanced TV system holds the promise of opening up a wide range of video and data services that consumers could obtain through their TV sets. Digital transmission and compression technologies use the airwaves more efficiently and allow broadcasters and cable operators to link their systems with computers more easily.

The tentative pact addresses the competing needs of the television, cable and computer industries. Initially, broadcasters will be able to continue using interlaced scanning, which updates every other line on a TV screen 30 times a second. That means significant savings during the transition to HDTV.

The accord eventually calls for a transition to a computer-friendly technique known as progressive scanning, in which an entire picture frame is updated 60 times a second. Progressive scanning together with the use of square pixels, which are the equally spaced dots that make up a TV picture, is a better way to present data and other computer information.

GE officials familiar with the licensing concerns weren't available for comment.

"There are some business items that have to be cleared up" between parties to the agreement and outsiders, said one participant in the talks.

The contenders are two systems developed by General Instrument Corp. and the Massachusetts Institute of Technology; one by a team of Zenith Electronics Inc. and American Telephone & Telegraph Co.; and one by a group that includes David Sarnoff Research Center, the U.S. units of Thomson and Philips Electronics NV of the Netherlands, GE's NBC unit, and Compression Labs Inc. of San Jose, Calif. All four systems are digital, meaning that signals are transmitted in the 1s and 0s of computer code.

The Grand Alliance

New York Times

NEW YORK, TUESDAY, MAY 25, 1993

75 cents beyond 75 miles from New York C



Not Just 'Pretty Pictures'

The new HDTV system will be digital, meaning the signals will be transmitted in pulses that replicate the ones and zeroes of computer code, instead of the traditional, less precise, technique of transmitting television signals in electromagnetic waves.

"This is not just about pretty pictures," said Richard E. Wiley, chairman of the Federal advisory committee for HDTV. "We are looking for interoperability — not only between broadcasting and cable, but also with computers. This has applications in factory automation, medical imaging and even defense."

The alliance effectively ends a remarkable competition begun nearly five years ago when the Federal Communications Commission announced its intention to choose a standard for advanced television and invited companies from around the world to propose systems.

Process Began in 1991

The three groups that joined forces today were the sole survivors of a rigorous testing process that began in 1991 and ended this February. One of the three is a team consisting of the General Instrument Corporation and the Massachusetts Institute of Technology. A second team is Zenith Electronics and the American Telephone and Telegraph Company. The third group is a consortium formed by Philips Electronics of the Netherlands, Thomson Consumer Electronics of France, NBC

Continued on Page D2, Column 1

TOP RIVALS AGREE ON UNIFIED SYSTEM FOR ADVANCED TV

DEBUT IN U.S. IS HASTENED

Bright and Clear Digital Picture
Would Enhance Viewing and
Interactive Technologies

By EDMUND L. ANDREWS

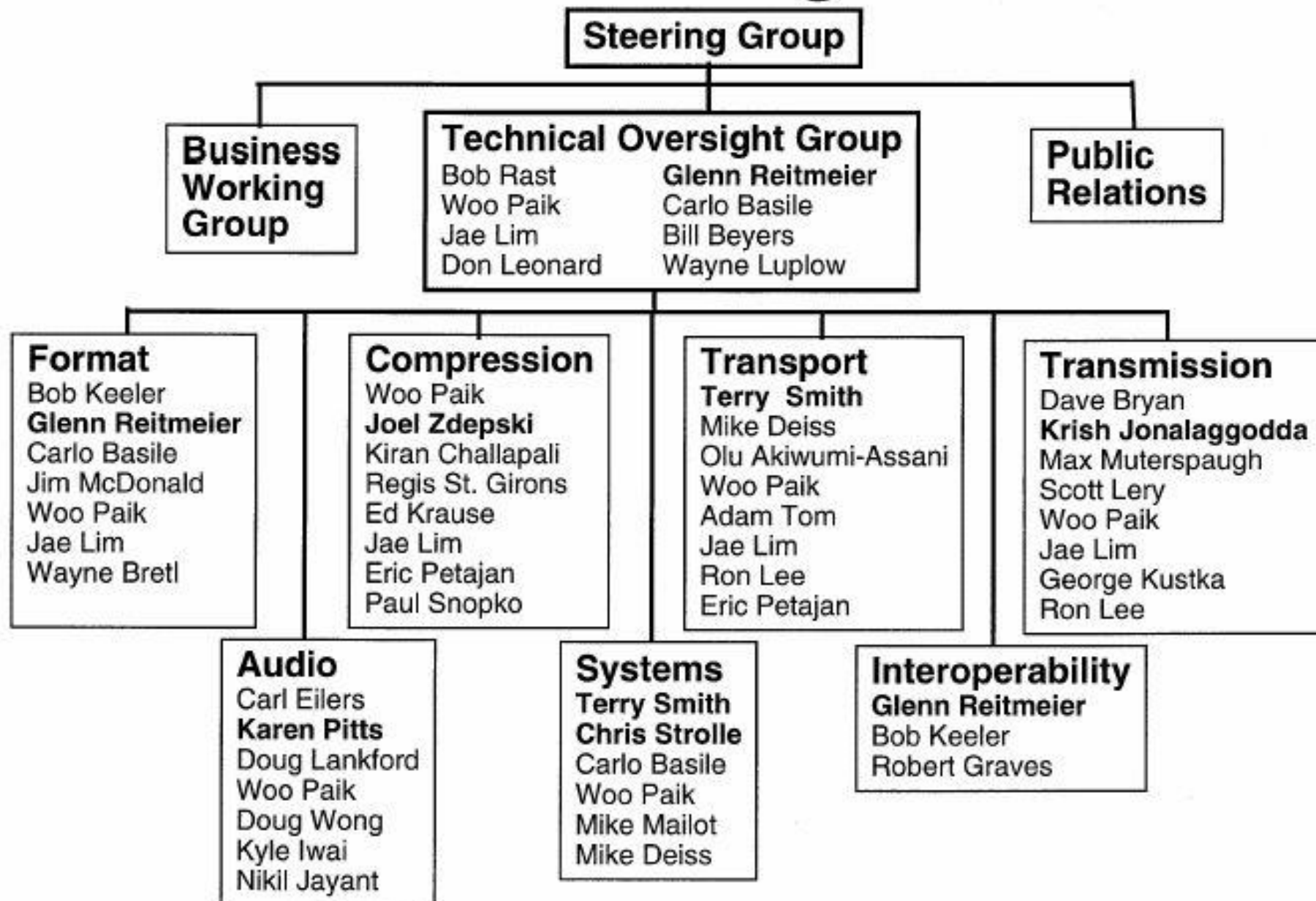
Special to The New York Times

WASHINGTON, May 24 — The three top rivals for the right to develop the next generation of television technology in the United States agreed today to join forces on a single approach, hastening the biggest change in broadcasting since the advent of color.

The agreement to collaborate on high-definition television, a move strongly supported by top Federal officials, eliminates the likelihood of protracted disputes and litigation, which could have delayed the introduction of the technology for years. With today's agreement, HDTV — offering wide-screen pictures nearly as bright and clear as movies and sound approaching the crispness of digital compact disks — could be available as early as 1995.

The agreement to collaborate also represents a broad technical consensus that the next generation of television sets will be much more than boxes to amuse couch potatoes. Instead, the industry has paved the way for television's rapid convergence with the interactive world of computers and high-speed two-way communications.

Grand Alliance Organization



Several Steering Committee Members in Action

Is it time
for
lunch
yet?

Nice
tie,
Joe!!

Consumers
want a wider
picture...



The ToG

Future
Royalties

New Grad
Courses

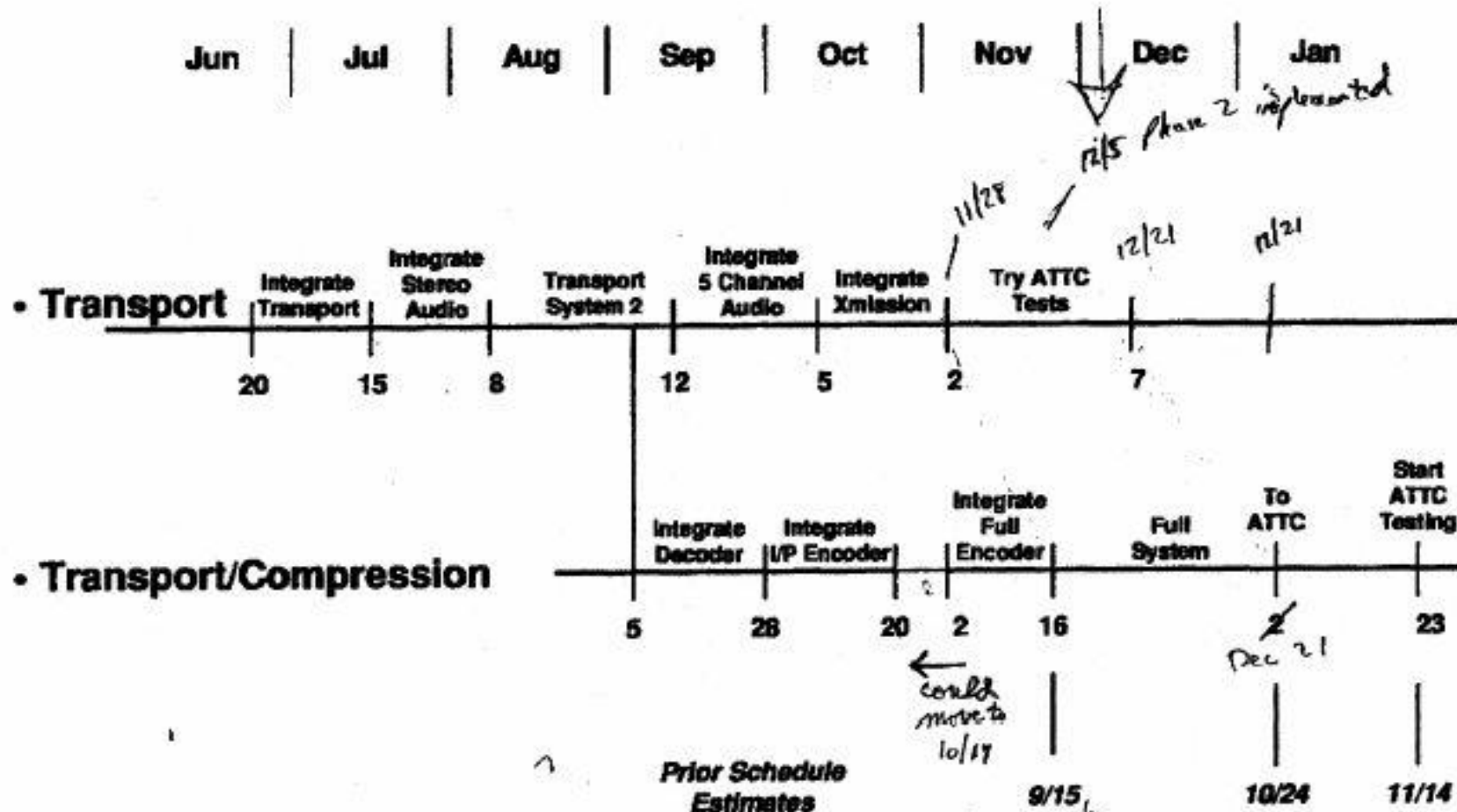
Lots of
Research

Great for
my
resume

A US
standard



Prototype Schedule



July 1, 1994
RMR

Prototype Development Schedule

add 1 week to task

The B-Frame Discussion



GA System Approved by ACATS

Oct. 21, 1993

Grand Alliance Status

...the GA received unanimous approval of the ACATS technical group...

- **Layered digital architecture with header/descriptors**
- **Multiple video formats and frame rates**
- **MPEG-2 video compression (with B-frames)**
- **Dolby AC-3 surround-sound audio compression**
- **Packetized Data Transport based on MPEG-2**
- **Modulation technique for ≈ 19 Mbps in the 6 MHz terrestrial simulcast channel is the only remaining issue**

GA-ACATS-FCC Timetable

- Specifications complete and approved by ACATS Oct. 21, 1993
 - Format
 - Compression
 - Audio
 - Transport
- Transmission approach approved by ACATS Feb. 1994
- Integration (start dates)
 - video encoder/decoder May 1994
 - video encoder/decoder June 1994
 - complete system Sept. 1994
- Start ATTC verification tests Oct. 1994
- ACATS analysis of verification test results Jan. 1995
- ACATS recommendation to FCC March 1995 ??
- FCC NPRM Mid 1995 ??
- Approved standard Late 1995 ??

Timetable (as of 2-1-94)

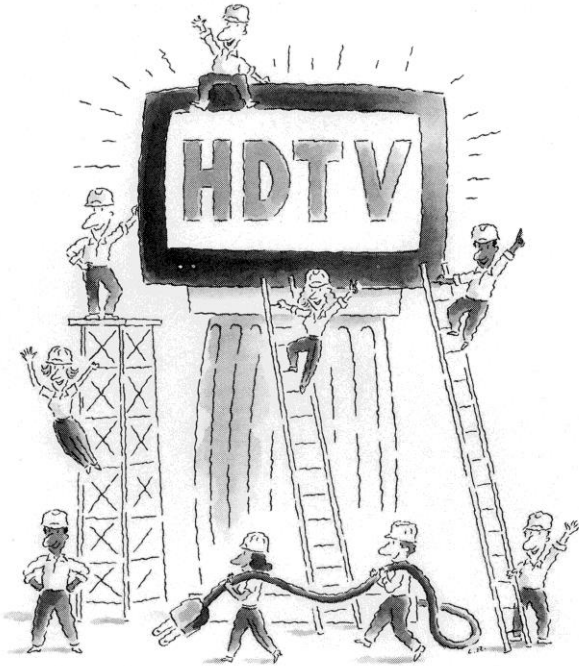
The “Bakeoff” - VSB vs. QAM



PARDON OUR DUST...

SYSTEM UNDER CONSTRUCTION

NAB 1994



Digital HDTV
Grand Alliance



GI General
Instrument

MIT



PHILIPS

Sarnoff

THOMSON

ZENITH

Announcement

Workshop on Advanced Digital Video in the National Information Infrastructure

May 10-11, 1994
Georgetown University Conference Center
Washington, DC

Workshop Co-sponsors

National Institute of Standards and Technology

Technology Policy Working Group
Information Infrastructure Task Force
Committee on Applications and Technology

Electronics Industries Association

Institute of Electrical and Electronic Engineers - USA

Society of Motion Picture and Television Engineers

Advanced Television Systems Committee

Cross-Industry Working Team

NIST

U.S. Department of Commerce
Technology Administration
National Institute of Standards and Technology

Workshop Objectives

In the National Information Infrastructure (NII), digital video is expected to provide vital information to manufacturers communicating with their suppliers, to medical practitioners consulting with patients and specialists, to students and scholars performing research, and to the producers and distributors of entertainment. This wide range of applications imposes a variety of technical demands on the Information Infrastructure, including a degree of flexibility not found in existing computer or television systems. The objectives of this workshop are to:

- Define a vision of the role of digital video within the NII.
- Identify the architectural, scaling, and performance issues in realizing this vision.
- Recommend the research, experiments, and steps to be taken to resolve these issues.

Agenda (cont'd)

Tuesday, May 10 (cont'd)

6:00-8:00 p.m.—Reception at the Georgetown University Conference Center
Hors d'oeuvres and cash bar

Wednesday, May 11

8:00 a.m.—Continental Breakfast

8:30 a.m.—Panel Discussion: **The Evolution of Standards: Is a New Approach Necessary?**

Moderator: Will Stackhouse, consultant
Panelists: Rex Buddenberg, Naval Postgraduate School; Karen Higginbottom, Apple Computer; Thomas Stanley, FCC; and Julius Szakolczay, Mitsubishi of America

9:30 a.m.—Coffee Break

9:45 a.m.—Continued breakout sessions; prepare report to plenary.

12:00 p.m.—Lunch

What Will the Home Information Appliance Look Like?
Joseph Donahue, Thomson Consumer Electronics, Inc.

1:30 p.m.—Presentation of Breakout Group reports

2:30 p.m.—Discussion, summary and action to be taken.

4:00 p.m.—Adjourn

Thursday, May 12

9:00 a.m.-12:00 p.m.—Optional tours of NIST labs:

- Video Processing Laboratory/Princeton Engine
- Integrated Services Digital Network (ISDN) Testbed Laboratory
- PDES Testbed or other demos of Mosaic/Internet services

If you are interested in attending the tours, please

NIST Workshop

Advanced Digital Video in the National Information Infrastructure

The Grand Alliance HDTV system proposal won high grades from computer industry executives reviewing the system during a National Institute of Standards and Technology (NIST) seminar last week. Participants from the alliance, a seven-company consortium building an HDTV broadcasting system, discussed the ability of their system to operate with computer networks and equipment. Asked to vote on whether they thought the alliance should proceed with its design plan, computer industry representatives gave the project a thumbs up, with no opposing votes.

May 16 1994 **Broadcasting & Cable**

Interoperability Review

Georgetown – Sept. 1994



Interlace

=

AIDS

Final 1

GRAND ALLIANCE WASHINGTON DEMO - FALL 1994

Screen

Script

Interface Section

GA Graphic

Shots of Rocky mountains fading up from black, Interspersed with white messages on black background also fading from Black.
Music Enya (Approx :30)
(This is similar to NIST Demo)

(Messages: GA HDTV, Superb Picture, Dynamic Sound, Digital Transmission, New Services, Coming Soon)

Dome baseball opening with dynamic upbeat music.(Approx:45)
Changes to mountains, Music fades to allow VO (Approx 1:30)

Digital High Definition Television (Pause)-- The world's highest quality broadcast picture and sound (Pause) that's what the Grand Alliance HDTV system will deliver to millions of homes across North America.

GA Digital HDTV Graphic

Use shock wave from Star Trek, first shown on NTSC projector, then HD projector

Let's look at some of the benefits of Grand Alliance HDTV technology. What you're watching now is today's NTSC television showing a dramatic scene from Star Trek VI. For many of us, Star Trek was our first glimpse at the promise of the information-age "explosion".

Now watch the same scene again --but in Digital High Definition -- as the stunning quality of six digital sound channels surrounds you.

Roller Coaster

HDTV presents the consumer with a sharper picture and more of it -- a full, wide-screen image -- as opposed to the smaller sized picture received on today's NTSC television. HDTV will bring the fun and thrill of a 'theater-in-the-home' experience to American viewers.

(Audio through Proj Switch)

Progressive Section

(Approx 5-10 Secs of Picture + music.)

Music fades under VO

Use still life and fox scene on both NTSC and HD projectors

NTSC has noise + Ghost added

Grand Alliance HDTV goes far beyond these improvements, and offers other major enhancements to picture quality -- like eliminating the 'snow', ghosting and other interference that can often be seen in a NTSC picture.

Today's analog

Contrast that with the brilliant High Definition images that are delivered by the precision of computer-like all-digital transmission.

**Washington
DC**

(Demo Central)

Washington On The Brain...

Man, I'll bet
that hurts...

WOW - a
Vulcan mind
meld...



Meanwhile, Back in the Field Lab...



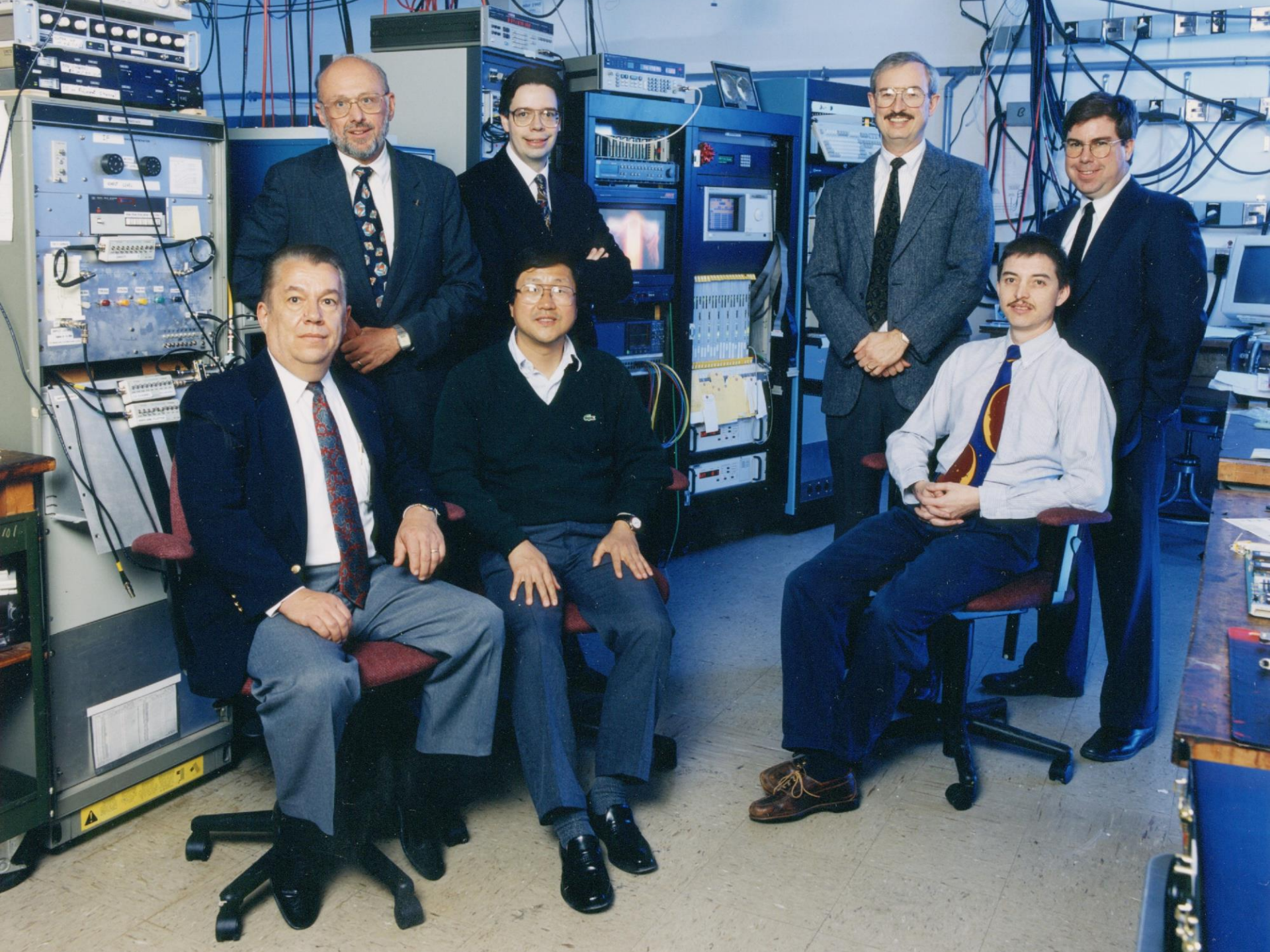
Grand Alliance Prototype

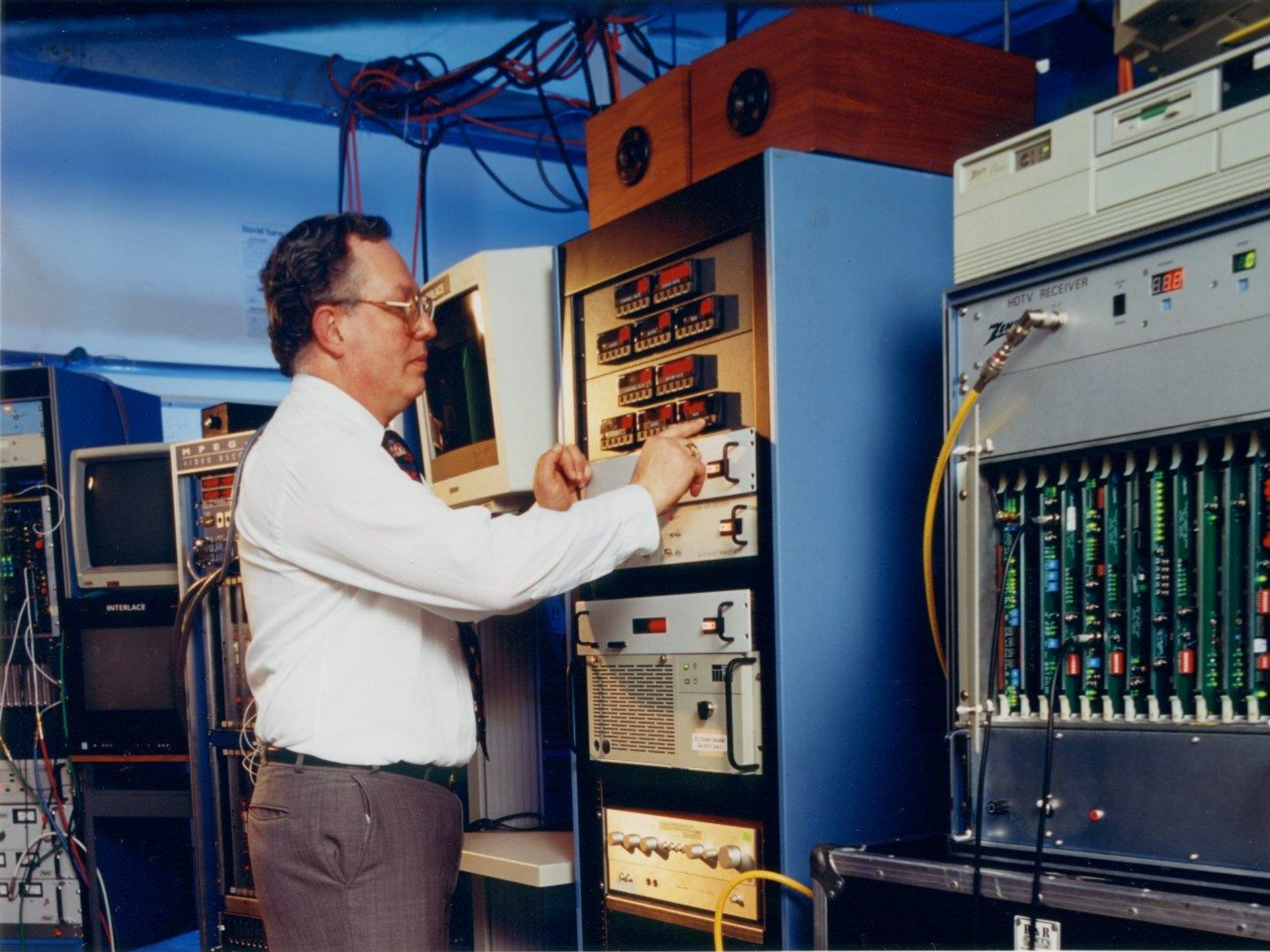


GA-HDTV Ships to ATTC and NAB

March 31, 1995











Bringing the Digital Age to Broadcasting

Digital HDTV
**Grand
Alliance**



GI General
Instrument



PHILIPS

Sarnoff

THOMSON



NAB95 Grand Alliance Booth



“What’s Happening?”



NAB 95 – Data & Interactivity



NAB 95

Technical Session

SUNDAY, APRIL 9, 1995

OPENING SESSION

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FCC Demo Tour



ATSC Formats



Format

Aspect Ratio

Frame Rate

TV	1920 x 1080 (square pixels)	16:9		60 I		30 P	24 P
	1280 x 720 (square pixels)	16:9		60 P		30 P	24 P
	704 x 480 (CCIR 601)	16:9	4:3	60 P	60 I	30 P	24 P
	640 x 480 (square pixels)		4:3	60 P	60 I	30 P	24 P
Computer		Film	TV	Computer	TV	Computer	Film

Supported frame rates include both 60.0 and 59.94 Hz related rates

An abstract graphic design on the left side of the page. It features a prominent magenta horizontal bar with a vertical line intersecting it. Above this bar are several overlapping circles in white, grey, and dark blue. Below the bar, there are various geometric shapes including rectangles, squares, and circles in shades of grey, blue, and white, some with internal patterns like horizontal lines. Thin magenta lines connect different parts of the composition.

ATSC DIGITAL TELEVISION STANDARD

ATSC A/53
DTV
Standard
Sept. 1995

ACATS Technical Subcommittee 10-31-95

31 Oct 95

Final Technical Report

In brief, terrestrial transmission testing of the complete system supports the conclusion that HDTV service will be available where NTSC service is presently available, and in many instances where NTSC service is unacceptable.

The complete system, with both 8 VSB and 16 VSB modulation, was tested also in cable environments in Charlotte, including existing cable systems and fiber optic links. Tests of 16 VSB were the more stringent. The 16 VSB receiver worked at all locations where the delivered signal met FCC specifications, and at many sites where it did not. Some systems were tested at frequencies beyond their maximum design frequency, resulting in less than FCC-specification conditions. Also, strong in-band beats were observed on some systems that affected both the NTSC and HDTV signals. The 16 VSB receiver continued to operate in these situations until the carrier-to-noise threshold was reached.

6. CONCLUSIONS

Based on Advisory Committee approved specifications, and thorough laboratory and field testing of the prototype ATV system as designed and constructed by the Digital HDTV Grand Alliance, the Technical Subgroup finds the following:

1. the Grand Alliance system meets the Committee's performance objectives and is better than any of the four original digital ATV systems;
2. the Grand Alliance system is superior to any known alternative system; and
3. the ATSC Digital Television Standard, based on the Advisory Committee design specifications and Grand Alliance system, fulfills the requirements for the U.S. ATV broadcasting standard.

Accordingly, the Technical Subgroup recommends that the ATSC Standard be adopted as the U.S. ATV broadcasting standard.

ACATS Technical Subcommittee

10-31-95



ACATS Final Report

I. INTRODUCTION

This is the final report and recommendation of the FCC's Advisory Committee on Advanced Television Service. It was adopted by the Advisory Committee at its ninth and final meeting, held in Washington, DC, on November 28, 1995.

This year is the 100th anniversary of radio broadcasting. Television is only half as old; was introduced in 1941 when the FCC adopted the current NTSC standard.¹ Subsequently, TV was improved in 1953 when the Commission approved the NTSC color standard. Only a few minor improvements (most notably, the addition of stereo audio in 1986) have been made in the ensuing four decades. This report heralds the greatest advance in broadcast television technology since its inception over fifty years ago. The possibilities for the future include dazzling pictures, CD-quality sound, the flexibility for multiple programs and data streams, and interoperability with alternative media and systems including computers.

In 1987, the FCC and Advisory Committee began to study the potentially great technical improvements that might be possible with advanced television ("ATV").² At the time, new transmission systems were being developed for direct broadcasting satellite and other media. It was not certain, however, whether a complete ATV system could work in 6 MHz over-the-air channels. Now, eight years later, after countless public meetings involving hundreds of industry

volunteers and a rigorous program of testing and analysis conducted on seven prototype ATV systems at three futuristic laboratories, the Advisory Committee on Advanced Television Service herein recommends that the Federal Communications Commission adopt the "ATSC Digital Television Standard" as the U.S. standard for ATV broadcasting.

This standard represents truly world-leading technology. It will allow American television broadcasters and viewers to participate in the digital age and is equally available for cable TV providers and subscribers. In addition, more than any other ATV system in the world, the technology is interoperable with other imaging media and systems.

The present document has two principal sections. First, the Advisory Committee reports on its history, progress and results, including the final tests on a prototype advanced television system from a consortium of companies known as the Digital HDTV Grand Alliance. Second, the Committee sets forth the details of its recommendation.

II. REPORT OF THE ADVISORY COMMITTEE

A. Purpose of the Committee

In early 1987, the Federal Communications Commission ("FCC" or "Commission") initiated a rule making proceeding on advanced television ("ATV") service "to consider the technical and public policy issues surrounding the use of advanced television technologies by television broadcast licensees."³ Later that year, and in order to assist the FCC "in gathering and

¹ The NTSC standard, which is named after the National Television Systems Committee which developed and modified it, is embodied in Part 73 of the Commission's Rules, See 47 C.F.R. § 73.682 (1994).

² The FCC defines ATV to "include any system that results in improved television audio and video quality . . ." *Tentative Decision and Further Notice of Inquiry* in MM Docket No. 87-268, 3 F.C.C. Rcd 6520, 6521 note 1 (1988). High definition television ("HDTV"), a subset of ATV, generally refers to systems that provide quality approaching that of 35 mm film. *Id.* HDTV "has a resolution of approximately twice that of conventional television in both the horizontal (H) and vertical (V) dimensions and a picture aspect ratio (HxV) of 16:9." ATSC Digital Television Standard at 5.

³ *Notice of Inquiry* in MM Docket No. 87-268, 2 F.C.C. Rcd 5125, 5126 (1987).



MAXIMUM SERVICE TELEVISION

9th ANNUAL

ADVANCED TELEVISION UPDATE

The Final Countdown

November 9, 1995
ANA Hotel
Washington, DC

10:55 - ATTC REPORT:

Peter M. Fannon, President,
Advanced Television Test Center

11:00 - ATSC REPORT:

James C. McKinney, Chairman, Advanced
Television Systems Committee

**11:05 - GRAND ALLIANCE PRESENTATION/
BROADCAST TRANSMISSION**

Introduction: **Victor Tawil**,
Vice President, MSTV

Jerry K. Pearlman, Chairman,
Zenith Electronics Corp.

Robert M. Rast, Vice President,
HDTV Business Development,
General Instrument Corp.

Glenn A. Reitmeier, Director, High
Definition Imaging & Computing Lab,
David Sarnoff Research Center

11:45 - Break for Luncheon

12:00 - LUNCHEON

Colonnade Restaurant, Lobby Level

12:45 - LUNCHEON KEYNOTE:

The Honorable Jack Fields, Chairman,
House Subcomm. on Telecommunications

**1:30 - UNDERSTANDING THE TECHNOLOGY/
PLANNING FOR DIGITAL**

Moderator: **Gregory M. Schmidt**,
Vice President, LIN Television

John D. Abel, President/CEO,
Datacast Partners

Alan Braverman, Vice President/
General Counsel, CapCities/ABC

Joseph A. Flaherty, Sr. Vice President/
Technology, CBS; Chairman, ACATS
Planning Subcommittee

MSTV Update Nov. 1995

Top Ten Achievements (Bob Rast)

- 1. Fits in one TV channel**
- 2. All-Digital**
- 3. Superior picture quality**
- 4. Equivalent service areas**
- 5. Flexible transport**
- 6. The *digital* HDTV Grand Alliance**
- 7. System definition**
- 8. Building it**
- 9. Testing it**
- 10. ATSC standard**

Top 10 HDTV Myths (Jerry Perlman)

There really is a Santa Claus and he brings “free lunch.”

The world can get to digital at little cost.

Life would be great (or at least good enough) if there were no Halloween.

Get rid of ghosts and add features with digital and SDTV would be fine.

Joe Six Pack can't afford HDTV and Ruthie Rolex isn't reachable efficiently with TV advertising.

The market will be narrow given the high cost of sets.

I'll think about this tomorrow at Tara.

HDTV costs too much to think about now.

Election year budgeting leads to logical conclusions.

Auctions are profitable, fair, efficient and fun for everyone.

Tomorrow's a better day.

Some future compression invention will obsolete all this effort, so let's wait to set a standard.

Computer folks are smarter than broadcasters.

Let's outlaw interlaced to ensure computer interoperability.

Newt's 10 points forbid this process.

Isn't this an example of Industrial Policy that adds to government cost and regulation?

The Clark Kent to Superman model would be better.

Stations could switch from NTSC to digital overnight with some advance planning.

It's your problem, Kimo Sabe.

Broadcasters funded the testing but want no part of HDTV.

The Great Interoperability Demo



Demonstration Overview

You are Watching...

Apple Macintosh

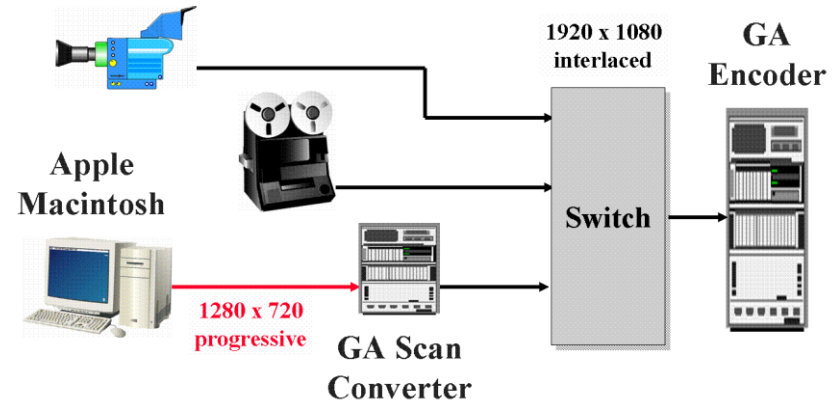
Broadcast

on GA-HDTV

via ATM
and Satellite

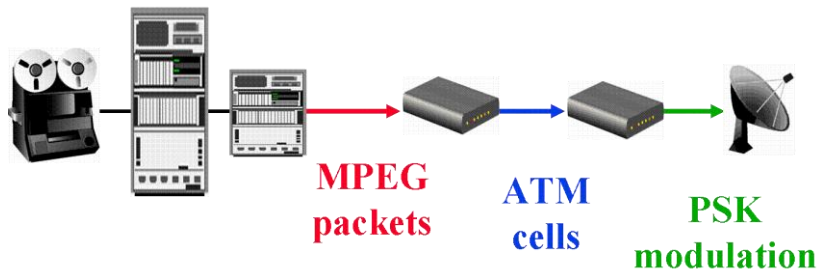


Interlaced and Progressive

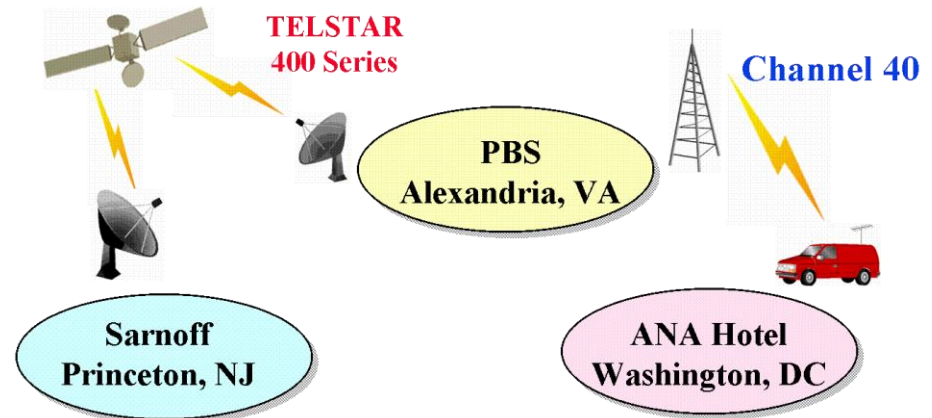


Sarnoff...

Grand Alliance
Compression & Transport



Demonstration Overview



Digital TV standards face growing opposition

By JEANNINE AVERSA
Associated Press

WASHINGTON — The government's plan to set standards TV broadcasters would use to deliver super-sharp, digital television signals is meeting with growing industry opposition.

The cable TV industry urged the Federal Communications Commission yesterday not to adopt a standard, joining the computer industry and segments of the Hollywood movie-making community led by Steven Spielberg, who also are against the establishment of government standards.

"The drawbacks of government-mandated standards are well-established: They freeze technology, limit innovation and ultimately reduce consumer choice and competition," said National Cable Television President Decker Anstrom.

Anstrom's group's position may help solidify FCC Chairman Reed Hundt's efforts to persuade his fellow commissioners to drop their support for a government-mandated standard.

Opposition from the cable group comes as the FCC reviews industry feedback before moving to a final decision later this year.

In May the FCC proposed that a system, called the Grand Alliance, be the standard U.S. broadcasters would use to transmit in digital and in an even sharper format called high definition television.

THE SYSTEM was developed by AT&T, General Instrument, the Mas-

The system was developed by AT&T, General Instrument, the Massachusetts Institute of Technology, the David Sarnoff Research Center, Thomson Consumer Electronics, Philips Consumer Electronics and Zenith. It also will provide the blueprint for making new digital TV sets, which could become available as early as late 1997.

sachusetts Institute of Technology, the David Sarnoff Research Center, Thomson Consumer Electronics, Philips Consumer Electronics and Zenith. It also will provide the blueprint for making new digital TV sets, which could become available as early as late 1997.

Broadcasters and the consumer electronics industry argue that the FCC must set a digital TV standard, which they say is needed to give broadcasters certainty in the marketplace; TV set makers an incentive to build new digital TV sets; and consumers protections from signal interference and guarantee that new digital TV sets will work anywhere in the country.

Supporters also say a digital TV standard under consideration by

• see **STANDARDS**, D2

Standards

• continued from D1

federal regulators can easily accommodate new technological innovations that may develop in the future.

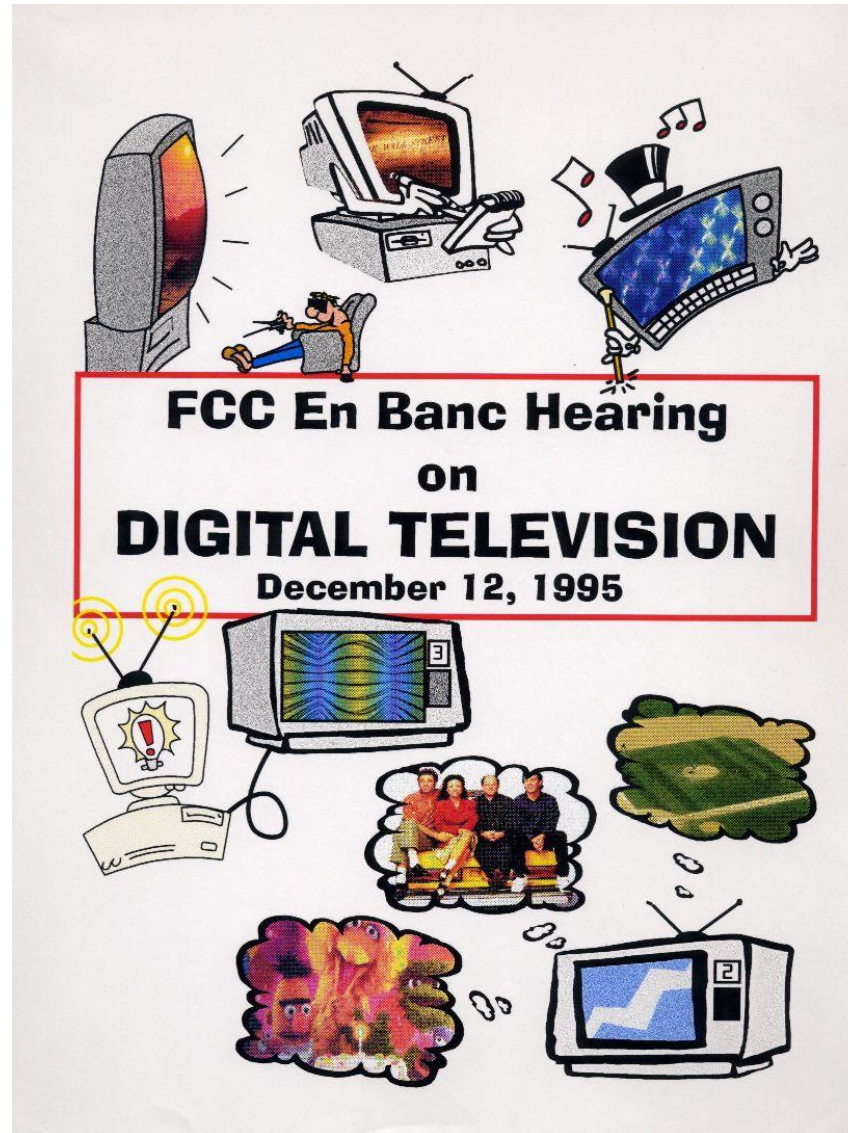
"We're astonished that after the cable industry fully participated for a decade in developing a new digital TV standard, it is abandoning its position for its own, anti-competitive and anti-consumer purposes," said National Association of Broadcasters spokesman Dennis Wharton.

Cable and wireless cable companies plan on introducing digital TV services to their customers this year. Direct-broadcast satellite providers already transmit in digital. People can't view such digital signals in their full splendor, however, until they buy new digital TV sets. Existing TV sets receive only analog TV signals.

Broadcast rivals have developed their own digital transmission methods and are not reliant upon the proposed FCC standard. But broadcasters are.

You ain't seen nothin' yet...

FCC En Banc



NEW ERA
TELEVISION
HERE

LET'S GET THE PICTURE RIGHT.



Digital technology is the future of television. The future can offer astonishing possibilities — clearer and crisper pictures with better sound, movies seen and heard as they are experienced in theaters, and PCs able to receive digital TV broadcasts.

But there are clouds on this sunny horizon . . . because the Federal Communications Commission is being asked to adopt regulations favoring the interests of foreign TV set manufacturers — and push the public interest aside. If the FCC adopts these regulations, American consumers will be the big losers.

Costing Consumers: The proposed regulations would cost consumers more than \$91 billion over the next ten years. There are much cheaper ways to go digital.

Undermining U.S. Industry: TV set manufacturing is dominated by foreign-owned firms. America leads the world in other kinds of technology, like film and television programming, computers and software — industries that employ over three million workers. Why not help the hometown team, for a change?

Freezing Technology: The proposed regulations are too rigid, limit consumer choice, bring us TV sets that are too expensive, and lock in obsolete technology.

The proposed regulations would stifle innovation and competition, and jeopardize the possibility that the highest quality entertainment and computer technology can be wrapped into a single system affordable to all.

Better, lower cost technology already exists.

The last time the federal government made a decision about television this important was a half-century ago. The decision the FCC is about to make will chart the course for television for the next 50 years. Let's make sure we do it right.

American Society of Cinematographers • Apple Computer, Inc.
Business Software Alliance • Compaq Computer Corporation
Digital Theater Systems, LP • Directors Guild of America • Intel
Corporation • International Photographers Guild, Local 600, IATSE,
AFL-CIO • Media Access Project (endorsement only) • Microsoft
Corporation • Panavision International LP • Todd-AO Corporation
American Homeowners Foundation • Computing Technology
Industry Association

Americans for Better Digital TV • 703-715-6045 • <http://www.dga.org/dga>

**“Americans for
Better TV”**

***(Microsoft, Intel,
Compaq, Apple...)***

**Ad in
Washington Post
July 26, 1996**

Technical Details of the Proposed Base-Line Format of the Computer Industry Coalition on Advanced Television Service (CICATS)¹

July 10, 1996

Overview

The CICATS² technical proposal for the US digital TV standard is briefly this:

- **Adopt ACATS Low Levels:** That the FCC adopt all ACATS proposals for modulation, error correction³, data packetization, and compression for the new digital TV channels.
- **No Video Format:** That the FCC not specify a video data format.

In other words, adopt all low-level ACATS standardization proposals, where low-level means all levels except the video data level, which is not to be standardized by the FCC.

CICATS understands that the FCC may find it impossible to honor the second point above (No Video Format), in which case we propose an alternative second point:

- **One Required Video Format (Alternative):** That the FCC specify a single 480-line (nominal), progressive-scan video format with square pixel spacing, utilizing a base-layer technology concept. Others could be implemented but only one would be required.

May 27, 1996

WRC-TV wins \$6 million HDTV grant

NBC O&O to build model station in Washington

By Glen Dickson

WRc-TV, the NBC O&O in Washington, last week was chosen to create a fully operational HDTV station by the Model HDTV Station Project Inc., a \$6 million grant sponsored by the Association for Maximum Service Television (MSTV) and the Electronic Industries Association.

The model station will test a full range of HDTV equipment—from production to transmission gear—in a working broadcast environment. It also will provide public demonstrations of HDTV in the Washington area and will train broadcast station personnel in the new technology.

"We're excited about taking it out of a lab and into the real world," says Michael Sherlock, NBC executive vice president of technology.

The three-year project is being funded equally by the Consumer Electronics Manufacturers Association (CEMA), a sector of the EIA, and MSTV. MSTV's \$3 million contribution is being split between major broadcast manufacturers, such as Sony, Matsushita, and Toshiba, and broadcasters themselves. "The money is

flowing in, with checks arriving already," says Model Station project director James McKinney.

The David Sarnoff Research Laboratory of Princeton, N.J., has been contracted to provide systems design and integration for the new station, which will be co-located at WRC-TV's existing site.

"It will be a living, breathing systems-integration job," says Glenn Reitmeier, senior director of Sarnoff's HDTV and multimedia research lab. "As we integrate the transmitter and the [8-VSB] exciter, we will use our RF expertise; as we work with the encoders, we'll use our knowledge of MPEG compression."

Other Washington-area stations that bid for the MSTV/CEMA grant included WETA-TV, the PBS station that already plans to build an HDTV station and has filed for an experimental FCC license; WJLA-TV, the Allbritton Communications-owned ABC affiliate, and WNCN and WNCN, two public stations in suburban Virginia. Gannett-owned CBS affiliate WUSA didn't bid.

"This is a wonderful opportunity," says Allan Horlick, WRC-TV president/GM. "We knew it would be a



tough competition."

MSTV/EIA made their selection of WRC-TV based on technical criteria such as available space and the breadth and location of transmission equipment. As the largest NBC news bureau, with both

FOR IMMEDIATE RELEASE

WHD-TV DEDICATED AS MODEL HDTV STATION BROADCASTS FIRST LIVE, ON-AIR GRAND ALLIANCE HDTV SIGNAL

Washington, D.C., August 6, 1996 -- WHD-TV, the Model HDTV Station funded by equipment manufacturers and some 250 television stations nationwide, was formally dedicated today with the first public on-air demonstration of the broadcast and reception of live and taped digital high definition television (HDTV). The broadcasts used the Grand Alliance system on which the proposed FCC digital television standard is based.

WHD-TV, which became the first commercial station to broadcast and receive live HDTV on July 30, is operated at host station WRC-TV (Washington, D.C.), owned and operated by NBC.

WHD-TV has obtained an experimental license from the FCC to operate on channels 27, 30 and 34. Its purpose is to provide broadcasters and equipment manufacturers hands-on experience with the design, operation and evaluation of equipment needed to transition the nation's analog NTSC broadcast system to the digital era. The Model HDTV Station Project is sponsored by the Association for Maximum Service Television (MSTV) and the Consumer Electronics Manufacturers Association (CEMA), a sector of the Electronic Industries Association (EIA). The project is being implemented by the David Sarnoff Research Center.

"We are delighted that both the broadcast and reception of a Grand Alliance HDTV signal were successful and ahead of schedule," said Jim McKinney, Model HDTV Station Project Director. "Both video and audio signals were broadcast as were data signals. Importantly, full high definition television pictures and digital audio signals were received, decoded and displayed as part of the first transmissions."

"This adds tremendous momentum toward HDTV's real-world introduction," said MSTV President Margita White, Chairman of the Model HDTV Station Project. She and CEMA President Gary Shapiro expressed appreciation to the Grand Alliance for its support in committing its equipment to the Model Station's use and to WRC-TV for its outstanding facilities, staff and equipment support. Shapiro added, "This is a great step forward for HDTV. As soon as the digital HDTV standard, recommended by the FCC Advisory Committee, is adopted by the FCC, HDTV will become a reality."

FCC sets three-step process for ATV

Advanced television (ATV) licenses will be on the way next year, according to the FCC's current plan.

The commission means to set ATV rules through a three-step process. The first part calls for establishing general service rules for using the advanced TV channel that broadcasters will receive to deliver the service. The FCC issued a proposal last summer and since has accepted comments on a range of issues, including what public interest obligations the ATV channels should carry, whether there should be a minimum requirement to deliver HDTV, and the status of must-carry rules in the digital age. But the commission has held off on setting final rules to give Congress a

chance to consider whether it wants to auction the ATV channels.

The second rulemaking concerns the transmission standard that broadcasters will use to deliver the service. The FCC this month proposed establishing the Grand Alliance ATV system as the mandatory standard. Comments on the proposal are due July 11.

The third part of the plan concerns the allotment and assignment of ATV channels. Commission officials this summer hope to propose a plan for assigning each broadcaster a new digital channel. The FCC hopes to have all three of the rulemakings wrapped up in time to start assigning licenses in 1997.

—CM



Jim McKinney, Model HDTV Station Project Director, addresses guests at the Dedication Ceremony.



Margita White, Model HDTV Station Project Chairman, presides at the Dedication Ceremony.



FCC Commissioners James Quello and Susan Ness formally dedicate WHD-TV by cutting a ribbon of one-inch, high-definition video tape being held by Gary Shapiro, President of CEMA and Vice Chairman of the Model Station, and Margita White, President of MSTV and Chairman of the Model Station.

GA-HDTV at the Model Station



	Format	Aspect Ratio		Frame Rate		
TV	1920 x 1080 (square pixels)	16:9		60 I	30 P	24 P
	1280 x 720 (square pixels)	16:9		60 P	30 P	24 P
	704 x 480 (CCIR 601)	16:9	4:3	60 P	60 I	30 P
	640 x 480 (square pixels)		4:3	60 P	60 I	30 P
		Film	TV		TV	Film
	Computer			Computer		Computer

VESA Conference 18 ATSC formats

Supported frame rates include both 60.0 and 59.94 Hz related rates

The preferred way to think of the CICATS proposal is in terms of a reference decoder. The CICATS Reference Decoder has a memory capable of supporting 1024 horizontal by 512 vertical pixels. This plus the requirement for square pixel spacing implies that the Reference Decoder is capable of decoding any resolution up to and including 1024x512. The following table shows several examples supported by the Reference Decoder on TV displays of various aspect ratios:

vs.

Aspect	Horizontal	Vertical	Remarks
1.33:1 (4:3)	640	480	Current TV format
1.78:1	854	480	Approximately the ACATS 16:9 format
1.85:1	944	512	Most popular Hollywood format
2:1	960	480	Acceptable to Hollywood
2:1	1024	512	Acceptable to Hollywood
2.37:1	1024	432	Popular widescreen Hollywood format

1 CICATS format

Rather than propose a single video format, CICATS proposes that the FCC mandate the Reference Decoder. Then the choice of horizontal resolution becomes a secondary choice. This choice would be left to industry – that is, to market demand.

Citizens for HDTV Ad - Washington Post Oct. 28, 1996



American industry is poised to bring consumers the crisp images and crystal clear sound of digital High Definition Television (HDTV). However, the process is stalled due to "technical difficulties."

The problem is not in your set. The problem is that some in government are being confused by special interests in the computer and entertainment industries who oppose the consumer-friendly and flexible broadcast standard -- a proven, world-leading standard that is the result of a nine year, multi-industry testing process.

Should we allow almost a decade of consensus building and common sense consumer protection to be thrown out in favor of these special interests?

We think not. American consumers deserve the opportunity to experience digital television as soon as possible, not on a delayed schedule.

Let's get on with it, America. For more information on how you can help end the "technical difficulties," call us.

Citizens For
HDTV
(703) 527-7001

Communications Workers of America/National Association of Broadcast Employees and Technicians • Consumer Electronics Manufacturers Association • Digital HDTV Grand Alliance
• EIA ATV Committee • Electronic Representatives Association • Home Recording Rights Coalition • Home Theater Magazine • International Brotherhood of Electrical Workers
• National Consumers League • National Council for Senior Citizens • North American Retail Dealers Association • Professional Audio/Video Retailers Association • WideScreen Review Magazine

BUSINESS & TECHNOLOGY

HDTV unplugged

Digital television is almost here. But there's a dust-up over standards

It was a lame, but highly revealing, joke: While presiding last week over a panel of broadcasters and television set manufacturers who are trying to persuade the Federal Communications Commission to approve a new standard for transmitting digital high-definition television, or HDTV, Edward Fritts suddenly produced a birthday cake. It was for Microsoft's Bill Gates, who turned 41 that day—and who, in between epic battles against software and computer rivals, is also leading the opposition to the new broadcast plan. After leading an improbable chorus of "Happy Birthday" for Gates (who wasn't present, of course), Fritts, president of the National Association of Broadcasters, insisted that only with their proposal "can the American people have their cake and eat it, too."

But it's too early to start setting out dessert plates—and not just because of Gates's lack of appetite for the HDTV plan. The television industry, which earlier this year believed that its painstakingly crafted new standard would be approved as a matter of course and usher in a glorious new era of crystal-clear, wide-screen TV, has, for the moment at least, been stymied. Gates and his allies in the computer and software industries, as well as entertainment business heavies such as director Steven Spielberg, are dead set against certain key provisions in the plan, which they claim could hurt the computer and movie business. Even the cable industry, which worked side by side with broadcasters throughout the development process, has now bailed out, citing its own commercial concerns. And though the FCC has long pushed the TV industry to develop digital television, Chairman Reed Hundt has begun wondering aloud whether a new government-mandated standard is needed at all.

As a result, a frantic effort is now underway to forge a compromise among the warring parties so that HDTV can go forward. FCC Commissioner Susan Ness recently dispatched a letter to each of the combatants—broadcasters, set builders, computer companies, film-

FAST FORWARD

Change of signals in air

ANALOG TELEVISION



A. Familiar television for the past half century will be phased out in a couple of decades.

HIGH-DEFINITION TELEVISION



B. Digital TV will have better pictures and sound and also display data from the Internet.

COMPUTER TELEVISION



C. New computers can show television pictures along with digital text and graphics.

makers—demanding that they resolve their differences by Thanksgiving Day. Ness, a strong supporter of digital television, told them that "rapid adoption of a standard would serve the interests of all parties"—not the least of whom are couch potatoes, who don't need but may soon have another reason to keep their sets on: the mind-blowing quality of HDTV (box, page 56).

Religious wars. But if it comes at all, compromise will not come easy. While all sides praised Ness's initiative and promised to cooperate, the dispute looks more and more like an interminable religious war waged by irreconcilable cultures.

The broadcasters argue that the exhaustively tested standard—developed at a cost to the industry of more than \$500 million—is a technical miracle that squeezes digital HDTV into a standard television channel, a feat universally believed to be impossible as recently as the late 1980s.

The computer industry, which was part of a broad-based consortium that developed the standard, wants the TV screen to work well with computers. The reason: As all such media become digital, data will be exchanged among televisions, computers and other information appliances. How this happens is the issue.

In computer monitors, an electronic gun scans rows of horizontal pixels (picture elements) in sequence, top to bottom, a technique called "progressive" scanning. The proposed broadcast standard is a series of formats, most of which utilize progressive scanning.

But here's the rub: Because of technical limitations, the best possible HDTV broadcast would require computer makers to jump through hoops. For the highest broadcast resolution—1,080 scanning lines at 60 frames a second—present digital compression techniques simply can't squeeze the video enough to allow progressive scanning. As a result, old-fashioned interlaced scanning is employed (with interlace, even-numbered rows of pixels are scanned, then odd-numbered, resulting in flicker).

This, for some computer people, is not just a heresy; it is potentially more expensive, since circuits would have to be added to computers to "de-interlace" certain TV signals. They suggest, instead, decreasing the number of lines on a digital TV set in order to get all progressive scanning. But that would reduce the quality of the picture.

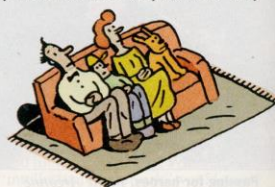
To broadcasters, of course, this is unacceptable. If they don't get at least 1,000 lines at the outset, they say, they may never be able to provide a truly

high-resolution picture. Besides, they argue, compression technology is improving so rapidly that interlace scanning soon can be abandoned. One idea being proposed is to put a "sunset" provision into the standard. After a certain date, interlace couldn't be used.

Cinematographers have their own wish list for HDTV. Spielberg and others are pushing for sets with a wider aspect ratio than the proposed 16:9 (that is, 16 units wide, nine units high, compared with televisions now, which are four wide, three high). That would give films on TV the same aspect ratio as

theatrical releases. But they are not likely to get their way. For one thing, the movie industry does not have a standard aspect ratio today; it adjusts for different formats by moving the curtains in and out in the multiplex. Moreover, the Motion Picture Association of America helped define the proposed ratio for HDTV and supports it.

That leaves the cable guys. If the new standards are approved, prime-time shows would probably be the first to be shown in full HDTV, broadcasters say. During the day, however, each station's digital channel could be divided into as many as four standard channels offering resolution somewhat better than present television. An NBC affiliate could,



**REPORT OF AD-HOC PANEL OF BROADCASTERS
AND TELEVISION EXPERTS
CONCERNING
DEMONSTRATION OF HDTV CODING
BY
DEMOGRAFX INC, SANTA MONICA CA**

11 October, 1996

Draft: Two

Prepared by: Kenneth P. Davies

Approved by:

Date: 96 10 17 November 11, 1996

EXECUTIVE SUMMARY

Following a review of the DemoGraFX system of layered coding, as proposed in the CICATS filing to the FCC in response to DTV NPRM 5, an ad hoc group of broadcasters and television industry experts evaluated the system in light of a demonstration and discussion session with DemoGraFX personnel. The panel determined that the DemoGraFX system does not demonstrate any new fundamental breakthroughs in compression coding, but it does demonstrate an innovative attempt to recast the tradeoffs that are inherent in the design of a compressed video system. Because of its reliance on "soft borders" and excessive channel change time to enable the data stream to fit within the limited data rate available in the 6 MHz terrestrial channel, the DemoGraphX system is not a viable alternative for television broadcasting. However, its system attributes are worth further study and may be suitable for other delivery media and applications.

NEWS



National Association of Broadcasters
1771 N Street, NW
Washington, DC 20036-2891

DIGITAL TELEVISION PROPONENTS CHARGE THAT OPPONENTS OF UNIVERSAL STANDARD ARE ANTI-COMPETITIVE

Urge FCC To Adopt Proposed Standard By Thanksgiving

WASHINGTON, DC, October 28, 1996 -- Broadcasters, electronics manufacturers and consumers today charged that Microsoft and a handful of other computer companies are blocking competition and progress in digital television. They called upon the Federal Communications Commission to approve by Thanksgiving a consensus universal broadcast standard developed over the past decade.

"It's been eleven months since the FCC Advisory Committee on Advanced Television Service submitted a flexible digital TV plan that addresses private sector concerns. Now we are being held up at the eleventh hour by a single group that wants to stifle competition," said National Association of Broadcasters President/CEO Edward O. Fritts. "Until the FCC adopts a digital standard, America's lead in digital television technology is at risk, and so are the tens of thousands of jobs for Americans who will bring the new technology to the public."

The flexible digital plan was developed by the Advanced Television Systems Committee (ATSC) in response to an FCC request for an industry consensus on a broadcast transmission standard for digital television (DTV). The ATSC standard is based on three basic video scanning formats (each with several screen-shape and picture-rate options). Those formats accommodate both the progressive scanning used by the computer industry and television's international standards, which all use interlaced scanning. The combination of formats allows broadcasters to smoothly make the transition to high definition television (HDTV), while providing consumers with the most flexible data and picture transmission technology known to mankind.

"Free broadcast television is perhaps the last great common American experience," said Neil Braun, president of the NBC television network. "For 50 years, Americans have known that the set they buy in Los Angeles will work in New York and will keep working for years no matter how technology changes. We stand at the threshold of a breathtaking advancement in the quality and potential of television to bring even more information, entertainment and now interactive services into American homes."

"I believe adoption of the digital TV standard will unleash a new wave of technology investment as did the addition of color to television," said Joseph P. Clayton, executive vice president of Thomson Consumer Electronics and chairman of the Consumer Electronics Manufacturers Association.

DTV Summit

DTV

PRESS CONFERENCE

October 28, 1996

SPEAKERS (in order of appearance):

Edward O. Fritts

President and Chief Executive Officer
National Association of Broadcasters

Richard E. Wiley

Partner, Wiley, Rein & Fielding
Former Chairman, Federal Communications Commission
Chairman, FCC Advisory Committee on Advanced Television Services

Joseph P. Clayton

Executive Vice President
Marketing and Sales - Americas and Asia
Thomson Consumer Electronics

Linda F. Golodner

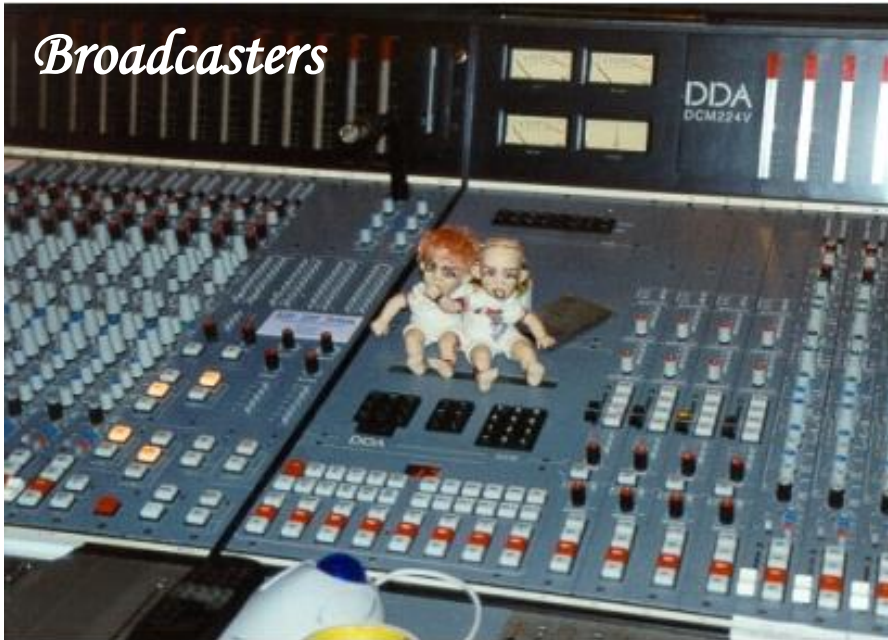
President
National Consumers League

Neil S. Braun

President
NBC Television Network

11th Hour Negotiations

Broadcasters



"Cinematographers"



"Computer Companies"

CE Companies



November 27, 1996

The Deal

**The Honorable Susan Ness
Commissioner
Federal Communications Commission
1919 M Street, N.W.
Room 832
Washington, D.C. 20554**

Dear Commissioner Ness:

As we reported to you yesterday, broadcasters, computer industry representatives ("CICATS"), receiver manufacturers, and the Film Coalition have engaged in lengthy and numerous discussions over the past four weeks concerning the proposed DTV standard. The first three of these groups have reached the following agreement:

(1) The FCC should adopt no later than December 31, 1996, the voluntary ATSC DTV Standard (A/53), except for the video format constraints described in Table 3, including the aspect ratios ("the FCC standard"). The ATSC DTV Standard, including the Table 3 video format constraints, remains unchanged.

(2) The FCC's Report and Order adopting the FCC standard should include language clarifying that data broadcasting is a permitted use under the standard. Data broadcasting is defined as the transmission of any type of data other than real-time video and audio programming.

(3) The parties agree that the FCC standard provides for extensibility of services and that this extensibility feature can be used as long as such services comply with the FCC standard. Video and audio services may be enhanced by providing augmentation data in the manner described in the ATSC "Guide to the Use of the ATSC Digital Television Standard," A/54, Section 8.1.1.3. See Attachment A hereto.

(4) Subject to applicable legal restrictions, if any, neither CICATS nor its member companies nor their representatives will directly or indirectly seek to oppose or delay -- before the FCC, by judicial review, legislatively or otherwise -- final adoption of the positions urged by broadcasters and consumer electronics manufacturers in MM Docket No. 87-268 to the extent such positions are not inconsistent with this letter. Nor will they support efforts in Congress or elsewhere for auctioning of spectrum allocated or to be allocated for digital television in MM Docket

No. 87-268 or other proceedings related to the launch of digital television. After December 31, 1997, CICATS and its member companies may address other spectrum issues, provided that they do not support efforts for the auctioning of spectrum allocated or to be allocated for digital television in MM Docket No. 87-268 or other proceedings related to the launch of digital television. The purpose of this understanding is to further the common goal of expeditious launch of digital television and is not intended to impose restrictions with respect to future regulatory or legislative issues.

In addition, consistent with the target date recognized in your letter to us, the parties will no longer be bound by this agreement if the FCC standard is not adopted by the FCC by December 31, 1996.

The parties agreed beforehand to maintain the confidentiality of the positions taken by them in the discussions, if not agreed to as part of a final resolution of the DTV standard issue. All parties continue to be bound by that agreement.

Respectfully submitted,

BROADCASTERS CAUCUS

By _____
Michael J. Sherlock (NBC)
Chairman CONSUMER ELECTRONICS MANUFACTURERS ASSOCIATION

By _____
Gary J. Shapiro
President COMPUTER INDUSTRY COALITION ON ADVANCED TELEVISION SERVICE

By _____
Paul E. Misener
(Intel Corporation)

cc: **Chairman Reed E. Hundt**
Commissioner James H. Quello
Commissioner Rachelle B. Chong
Honorable Larry Irving
Secretary, FCC (for filing in MM Docket No. 87-268)

The New York Times

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NEW YORK, TUESDAY, NOVEMBER 26, 1996

\$1 beyond the greater New York metropol...

INDUSTRIES AGREE ON U.S. STANDARDS FOR TV OF FUTURE

A SHARP IMAGE PROMISED

First Sets Possible in Early '98
as Computer Makers Settle
Rift With Broadcasters

By MARK LANDLER

Ending years of industry squabbling, the broadcasting, consumer electronics and computer industries will announce an agreement today on a technical standard for the next generation of television.

The accord, which is subject to approval by the Federal Communications Commission, opens the door for the crystal-clear pictures and expanded services promised by digital television. It also sets up a titanic battle for the nation's living rooms between computer companies and television set manufacturers, both of which want to build the digital device that will display these images.

Representatives of the industries worked out the deal in marathon talks over the last several weeks after one F.C.C. commissioner, Susan Ness, urged them to resolve their disputes so the commission could ratify a standard for digital television by the end of the year.

Although the negotiators were still haggling over the fine points of the agreement, they met late yesterday in Washington with Ms. Ness to present the broad outlines of the deal, which will be formally announced today.

"I'm delighted by the resolution of this controversy," Ms. Ness said. "This deal will provide the American consumer a future rich with digital broadcasting and computer-friendly programming."

Ms. Ness said yesterday that she was confident the F.C.C. would adopt the compromise as its standard before Christmas.

Despite yesterday's breakthrough, several things have to happen before digital television sets appear on the shelves of electronics stores. For one, the F.C.C. must assign broadcasters digital frequencies — something it plans to do by April.

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of)
)
Advanced Television Systems) MM Docket No. 87-268
and Their Impact Upon the)
Existing Television Broadcast)
Service)

FOURTH REPORT AND ORDER

Adopted: December 24, 1996

Released: December 27, 1996

By the Commission: Commissioners Ness and Chong issuing separate statements.

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Appendix A

Appendix B

I. Introduction

1. In this, the Fourth Report and Order in our digital television ("DTV") proceeding, we adopt a standard for the transmission of digital television.¹ This standard is a modification of the ATSC² DTV Standard proposed in the Fifth Further Notice of Proposed Rule Making and is consistent with a consensus agreement voluntarily developed by a broad cross-section of parties, including the broadcasting, consumer equipment manufacturing and computer industries.³ As explained below, the Standard we adopt does not include requirements with respect to scanning formats, aspect ratios, and lines of resolution.⁴ For clarity, we will refer to this modified standard as the "DTV Standard."

2. This proceeding demonstrates how competing industries, working together, can develop de facto industry selected standards that satisfy the interests of contending parties. We commend these industries for their efforts. We also commend the many dedicated individuals and entities who voluntarily contributed their talents and resources to the development of a world leading digital broadcast television technology.

3. We conclude that adoption of the DTV Standard will serve the public interest. It will bring many benefits to American consumers. By providing a requisite level of certainty to broadcasters, equipment manufacturers and consumers, the benefits of digital broadcasting will be realized more rapidly. The public will receive more choices in video programming with dramatically better visual and aural resolution. In addition, new and innovative services can be made available by the data

¹ This standard will apply only to terrestrial digital television broadcasting and not to other video delivery services.

² "ATSC" is the Advanced Television Systems Committee. When it adopted the ATSC DTV Standard, the ATSC had 54 members including television networks, motion picture and television program producers, trade associations, television and other electronic equipment manufacturers and segments of the academic community. It was formed by the member organizations of the Joint Committee on InterSociety Coordination ("JCIC") for the purpose of exploring the need for and, where appropriate, to coordinate development of the documentation of ATV systems. The JCIC is composed of the Electronic Industries Association, the Institute of Electrical and Electronics Engineers, the National Association of Broadcasters, the National Cable Television Association, and the Society of Motion Picture and Television Engineers. The membership of the ATSC when it adopted the ATSC DTV Standard is at Appendix C of the Fifth Further Notice of Proposed Rule Making in MM Docket No. 87-268, 11 FCC Red 6235, 6269 (1996) ("Fifth Further Notice").

³ See letter of Broadcasters Caucus, Consumer Electronics Manufacturers Association and Computer Industry Coalition on Advanced Television Service, dated November 26, 1996 ("the Agreement"), at "(1)".

⁴ According to the Agreement, id., the "ATSC DTV Standard, including the Table 3 video format constraints, remains unchanged."

WEDNESDAY, DECEMBER 25, 1996

F.C.C. Clears The Standard For Digital TV

By JOEL BRINKLEY

WASHINGTON, Dec. 24 — The Federal Communications Commission voted unanimously today to approve the standard for the next generation of television, formally beginning the nation's transition to digital, high-definition television, the first fundamental change in television service in almost 50 years.

The first digital TV's are not expected to go on sale until early 1998, and the first high-definition broadcasts will not begin until then. But today's vote began a process that will affect every American TV viewer. Under the commission's plan, digital television — offering sharper pictures and a host of new digital services — will gradually replace today's analog television service until finally, about 15 years from now, conventional television broadcasting will end.

decisions to the industries that will build the new TV receivers.

"We're giving a huge shot in the arm to free, over-the-air, digital television," said Reed E. Hundt, chairman of the F.C.C.

The commission's next task will be to assign a second television channel to every TV station in the nation early next year. The stations will use their second channels for the new digital programming while continuing to broadcast conventional programming on their original channels. Viewers will not be able to receive the digital programming until they buy digital televisions, or convertor boxes.

At first these new TV's are expected to cost \$1,000 to \$1,500 more than a roughly equivalent analog TV. But that price differential is expected to narrow as consumers switch to the new digital TV's. And then, sometime in the next decade, the old analog programs will go off the air and the channels that ran them will given back to the Government and auctioned for other uses.

In the meantime, the inter-industry agreement reached last month is expected to generate fierce competition between the consumer electronics and computer businesses, both of which want to build the new TV's.

Digital television — TV that is transmitted in the zeros and ones of computer code — can be used to send information from the Internet, stock-ticker data, computer programs, video games, customized news reports or anything else.

Computer companies say they in-

The Grand Alliance

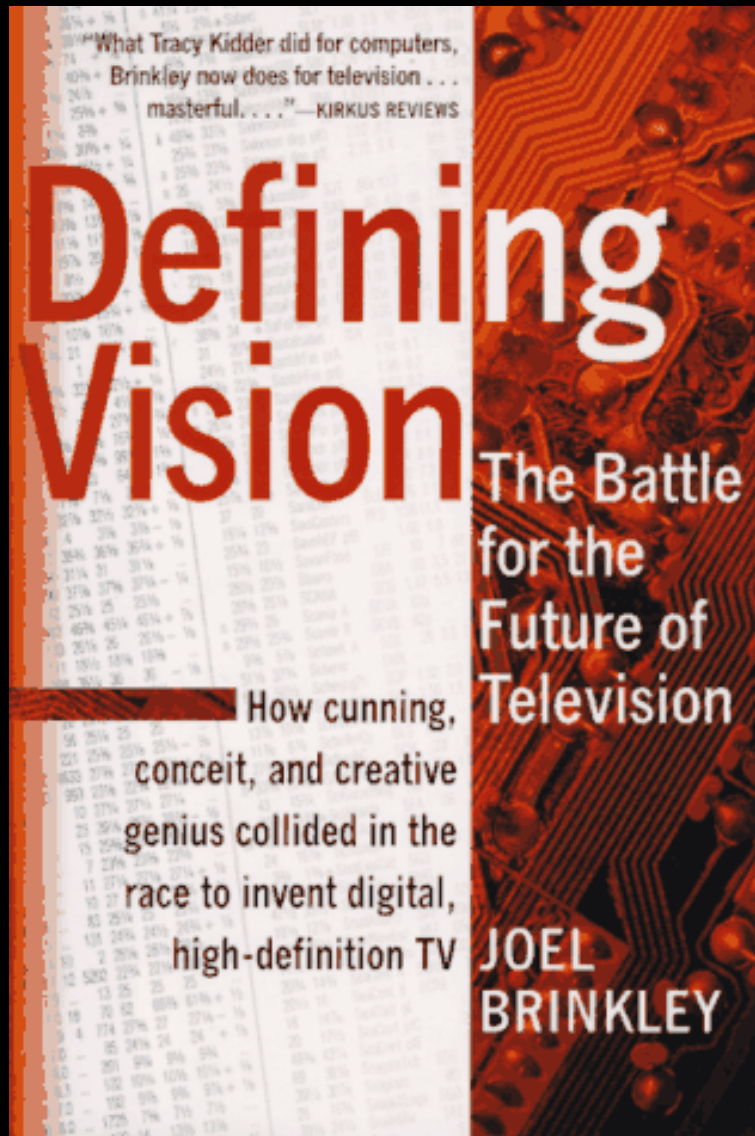




Emmy Award



The Book...



The Movie...



Technical Emmy Award





1998 ICCE Award



Digital Media Family Tree

