Digital HDTV Grand Alliance

AT&T

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HDTV Gains Momentum

GRAND ALLIANCE SHOWCASES ITS DIGITAL HDTV SYSTEM AT NAB '96; CBS HDTV BROADCAST OFFERS INDUSTRY GLIMPSE OF DIGITAL FUTURE

LAS VEGAS, Nev., April 15, 1996 -- As the industry urgently awaits FCC adoption of the new advanced television standard based on Digital HDTV Grand Alliance system, preparations for the digital age are already well under way.

Topping the HDTV agenda at this year's National Association of Broadcasters (NAB) convention, Westinghouse Communications and CBS -- both units of Westinghouse Electric Corporation -- will transmit Grand Alliance digital HDTV from KLAS-TV, CBS' affiliate here. The signal will be received at the Westinghouse exhibit at the Las Vegas Convention Center.

Speaking on behalf of the seven-member Digital HDTV Grand Alliance, David Sarnoff Research Center president and CEO James E. Carnes commended Westinghouse and CBS for their "bold leadership and spirit of innovation in offering the broadcast industry a preview of its

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digital future." He noted that "Digital HDTV is one of the dominant themes at this year's NAB, and the developers of this promising technology are delighted that so many exhibitors have chosen to introduce digital HDTV equipment. "Marketplace implementation of digital HDTV requires that the FCC approve the new standard without further delay."

Consensus Choice

Members of the Digital HDTV Grand Alliance are AT&T, General Instrument Corporation, MIT, Philips Electronics, Sarnoff, Thomson Consumer Electronics, and Zenith Electronics Corporation.

In May 1993, the seven organizations joined forces to develop a single, "best-of-the-best" digital HDTV system for the United States. Following exhaustive laboratory and field tests, the Grand Alliance system received a strong vote of confidence from the FCC's Advisory Committee on Advanced Television Service (ACATS). On Nov. 28, 1995, the blue-ribbon advisory panel recommended unanimously that the FCC adopt an advanced television transmission based on the Grand Alliance digital HDTV system as the new standard for over-the-air broadcasting in the U.S.

The Grand Alliance is participating in the Westinghouse/CBS demonstration of digital HDTV. High-definition video was edited by CBS, with video and audio compression of

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the signal conducted by the Sarnoff Research Center in Princeton, N.J. using compression equipment developed by AT&T and General Instrument. A Sarnoff-designed transport stream multiplexer combined the compressed digital video bit stream and the Dolby AC-3 audio bit stream, which were recorded on a standard D-3 broadcast digital VTR using a specially designed recording interface supplied by Zenith.

At the transmitter site, the digital bit stream from the D-3 video tape recorder is being modulated through the Zenith-developed 8-VSB (eight-level vestigial wideband) trellis-coded modulator. An ITS exciter drives Westinghouse's new solid-state, silicon carbide-based RF (radio frequency) transmitter.

At the convention center, the signal is received at the official test vehicle used for field tests of the Grand Alliance system during 1994-95 in Charlotte, N.C. A mast antenna atop the van receives the digital signals, which are then processed through the Zenith VSB demodulator.

Equipment developed by Thomson demultiplexes the signal. The output is an MPEG-2 main profile digital video bit stream, decompressed though a decoder developed by Philips, and AC-3, six-channel, digital surround sound decoded through equipment provided by Dolby Laboratories.

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The HDTV display is located in LVCC Meeting Room 103, adjacent to the Westinghouse booth and convenient to the field test vehicle parked outside.

Transmitter Makers Poised for HDTV

While the over-the-air HDTV broadcast by Westinghouse may enjoy higher visibility, other transmitter exhibitors are also moving in a digital direction. FCC adoption of a standard based on the Grand Alliance system will create a significant new market for these manufacturers, as broadcasters purchase new transmitters from which to broadcast a digital signal.

Unveiling digital HDTV transmission equipment here are Acrodyne, Comark, EMCEE, Harris, ITS, and Larcan-TTC, among others.

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For additional information on Grand Alliance activities at NAB '96 or digital HDTV generally, please contact:

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BACKGROUNDER

APRIL 1996

DIGITAL HDTV HIGH-DEFINITION TELEVISION:

Nearing the Finish Line in Nine-Year Process

The television that we watch today uses the NTSC (National Television Systems Committee) standard, finalized in the late 1940s. While that standard has been improved, most notably by the incorporation of color in the 1950s, today's television is based on the same fundamental resolution parameters as the original service, including 525 horizontal lines and interlaced scanning. The introduction of color TV four decades ago was the last major advancement in the NTSC standard. U.S. standardization activities were subsequently emulated throughout the world.

In the early 1980s, Japan's NHK proposed its analog "MUSE" HDTV interlaced system, based on 1,125 horizontal scan lines, and proposed its worldwide adoption. MUSE made the world aware of the goal of "high-definition television" (HDTV) with quality equivalent to motion pictures, including a wide-screen format. The MUSE system renewed concerns in the United States about the capabilities of American technology; many feared that American companies would be shut out of a fundamental new technology.

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In 1987, at the request of U.S. broadcasters, the Federal Communications Commission (FCC) initiated its HDTV rulemaking and established a blue ribbon FCC Advisory Committee on Advanced Television Service (ACATS) for the purpose of recommending a broadcast standard. Former FCC Chairman Richard E. Wiley was appointed chairman of ACATS. Over the past eight years, hundreds of companies and organizations have worked together within the numerous subcommittees, working parties, advisory groups and special panels of ACATS. The ACATS process -- an impressive example of government-industry cooperation -- has been marked by many important accomplishments:

- ACATS developed a competitive process by which proponents of systems were required to build prototype hardware that would then be thoroughly tested. This process sparked innovation and an entrepreneurial response: initially there were 23 proposals for systems submitted to ACATS in September 1988. (Hardware was actually built and tested for six systems.)

- The FCC made several key spectrum decisions that also helped spark innovation. The Commission decided in early 1990 that new ATV systems would share television bands with existing services and would utilize TV channels as presently defined. The Commission also decided that a "simulcast" approach, first proposed by Zenith, would be followed. This meant that the new HDTV signals would be broadcast on currently unusable channels and that broadcasters would be temporarily assigned a second channel to accomplish the transition to HDTV.

- Although the FCC had said in the Spring of 1990 that it would determine if all-digital technology was feasible, most observers viewed it as at least 10 years in the future. That same year, General Instrument became the first to announce an all-digital system. Later, all-digital systems were announced by MIT, the Philips-Thomson-Sarnoff consortium and by Zenith-AT&T.

- Early in the process, the FCC and ACATS anticipated the need for interoperability of the standard with other media. Initially, the focus was on interoperability of the standard with cable television and satellite delivery, both crucial to any broadcast standard. MIT and Zenith-AT&T already had developed systems with computer-friendly progressive (non-interlaced) scanning. And, with the advent of all-digital systems, the value of interoperability with computer and telecommunications applications

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became increasingly apparent. In fact, ACATS formed a special subcommittee that worked for two years to assure that interoperability will be maximized in the new HDTV standard.

- As part of that effort, proponents later incorporated packetized transmission and headers and descriptors with the Philips-Thomson-Sarnoff consortium leading the way in this area. These features maximize the interoperability of HDTV with computer and telecommunications systems. The introduction of all-digital systems had made such interoperability a reality.

- All-digital systems set the stage for another important step, which was taken in February 1992, when the Advanced Television Systems Committee (ATSC) recommended that the new standard include a flexible, adaptive data allocation capability (and that the audio also be upgraded from stereo to surround sound).

- Six systems (four of which were all-digital) underwent extensive testing in 1991 and 1992 at the Advanced Television Test Center (ATTC) in Alexandria, Va. Also participating in testing were Cable Television Laboratories Inc. (CableLabs) of Boulder, Colo., which tested systems over a cable test bed at the ATTC, and the Advanced Television Evaluation Laboratory (ATEL) in Ottawa, Ontario, Canada.

- Following testing, the Advisory Committee decided in February 1993 to limit further consideration to the four all-digital systems: two systems proposed by GI and MIT, one proposed by Zenith and AT&T, and one proposed by Sarnoff, Philips and Thomson. The Advisory Committee decided that, while all of the digital systems provided impressive results, no single system could then be proposed to the FCC as the U.S. HDTV standard. The Committee ordered supplementary tests to evaluate improvements that had been made to individual systems since initial testing.

- At the same time, the Advisory Committee also adopted a resolution encouraging the digital HDTV groups to try to find a way to merge the four remaining all-digital systems into a single "grand alliance." The Committee recognized the merits of being able to combine the best features of those systems. With this encouragement, negotiations between the parties began in earnest, and on May 24, 1993, the seven companies involved announced formation of the Digital HDTV Grand Alliance.

- In March 1995, less than two years after its formation, the Grand Alliance successfully delivered a "best-of-the-best" digital HDTV system to ACATS for testing. By October 1995, the Grand Alliance system had distinguished itself in exhaustive laboratory and field tests. And on November 28, 1995, in the culmination of the ACATS process, the blue-ribbon advisory panel recommended unanimously that the FCC adopt Grand Alliance system as the new digital television broadcast standard for the U.S.

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BACKGROUNDER APRIL 1996

DIGITAL HDTV GRAND ALLIANCE

HDTV: A Key Enabling Technology for The National Information Infrastructure

Digital high-definition television (HDTV) represents an immediate opportunity to implement a significant improvement in the evolving National Information Infrastructure (NII).

As important as the entertainment value of HDTV is, digital HDTV brings much more than dazzling pictures and terrific sound. Digital HDTV will bring a broadband, 19 megabit-per-second data channel and high-resolution displays into American homes, and these capabilities can be used to deliver a wide variety of information services in addition to entertainment television. In this way, HDTV represents a broad, paved off-ramp from the information superhighway.

Entertainment services are an important part of the NII in their own right, but they are particularly vital in improving the NII since they can help pave the way for general communications capabilities that are useful for other applications, including education and health care. HDTV is a perfect example of this synergy.

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But beyond this, by using a packetized data transport structure with headers and descriptors, the Digital HDTV Grand Alliance system gives tremendous flexibility to provide a wide variety of video, audio, voice, data or multimedia services in addition to HDTV.

Many of these services could be provided concurrently with the full HDTV program, while others could be provided in place of the HDTV program at different times of the day. For example, a local PBS station could broadcast HDTV programs such as National Geographic specials or ballets during the evening "prime time" hours (along with ancillary data services like weather forecasts or stock quotes that would be accessed only by people who wanted to use them). Then, during school hours, the station could deliver five simultaneous education programs to local schools and homes.

HDTV is a particularly attractive means of improving the NII in that free, over-the-air HDTV holds out the possibility of delivering information services without specific charges, thus helping to avoid a "haves/have-nots" dichotomy that has been a concern to many government policy makers.

Efforts are now under way in government and industry to better understand and strengthen the link between HDTV and the NII. This can be done without delaying the standards process, because the Federal Communications Commission (FCC) and its Advisory Committee on Advanced Television Service (ACATS) have already placed a heavy emphasis on the importance of interoperability with computers and telecommunications -- the essential elements required to ensure compatibility with the evolving NII.

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Ongoing efforts in government and industry to improve the National Information Infrastructure are aimed at using the wealth of information and communications technology to help address the pressing problems facing society today. Digital HDTV represents an immediate opportunity to make significant contributions to that goal.

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FACT SHEET

APRIL 1996

DIGITAL HDTV GRAND ALLIANCE

Key Technical Elements of the Grand Alliance System

The technologies that are at the heart of the digital high-definition television (HDTV) system expected to be adopted by the Federal Communications Commission reflect the Digital HDTV Grand Alliance's commitment to system excellence and responsiveness to the needs and concerns of consumers, broadcasters, cable operators, computer interests and the telecommunications industry. Key system elements include:

- **Digital video compression technology based on international standards.** The compression system used in the Grand Alliance system will be based on MPEG-2 (Moving Pictures Experts Group) Main Profile parameters, including the use of "B-Frames." (B-Frame or Bi-directional Frame motion compensation is a compression technique that improves picture quality.)

- **High-performance digital modulation technology for broadcasters and cable operators.** The modulation subsystem used in the Grand Alliance HDTV system, the 8-VSB (vestigial sideband) transmission technology, is rugged digital technology for terrestrial broadcasting that assures a broad HDTV coverage area, reduces interference with existing analog broadcasts and provides immunity from interference into the digital signal. The higher-data-rate cable mode, 16-VSB, will allow operators to transmit two full HDTV signals in a single 6-MHz cable channel.

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- **Telecommunications-like packets of digital data based on proposed international standards.** A packetized data transport system that allows the transmission of virtually any combination of video, audio and data packets -- similar to those used in state-of-the-art digital data communications networks -- will concentrate on features and services of MPEG-2 that are applicable to HDTV and provided for in the MPEG-2 transport layer.

- **Progressive scanning for computer interoperability.** The Grand Alliance uses both progressive and interlaced scanning. The formats are 24-, 30- and 60-frame-per-second progressive scan with a pixel format of 1280 x 720 (number of active picture elements per line times the number of active lines), and 24- and 30-frame-per-second progressive scan with a pixel format of 1920 x 1080. The system will also be capable of 60-frame-per-second interlaced scan with a pixel format of 1920 x 1080. These formats provide a good foundation for the migration to a 60-frame-per-second 1920 x 1080 progressive format as soon as technically feasible.

- **Compact-disc-quality digital surround sound.** The Grand Alliance system will use the 5.1-channel Dolby AC-3 audio technology.

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DIGITAL HDTV: A CHRONOLOGY

1987 --- The Federal Communications Commission (FCC) begins advanced television (ATV) inquiry and establishes the Advisory Committee on Advanced Television Service (ACATS) to advise the FCC on technical and policy issues.

1990 --- FCC receives a total of 23 advanced television proposals.

1990 --- FCC announces a number of key decisions: (1) it decides in favor of simultaneous broad cast rather than augmentation of NTSC signals, and (2) it expresses its preference for high-definition television (HDTV) over less advanced alternatives.

The FCC establishes a transition scenario giving incumbent broadcasters an additional 6 MHz of spectrum for a 15-year period for the conversion to digital.

1990 --- General Instrument Corporation submits the first proposal for an all-digital HDTV system; followed shortly by digital systems developed by MIT, Zenith and AT&T, and the Philips-Thomson-Sarnoff consortium.

1991-92- Initial testing of the competing systems is conducted by the Advanced Television Test Center (ATTC) in Alexandria, VA.

1993 --- At the urging of ACATS, and the FCC, three competing groups (AT&T and Zenith Electronics Corporation; General Instrument and MIT; and Philips Consumer Electronics, the David Sarnoff Research Center and Thomson Consumer Electron ics) join together to form the "Digital HDTV Grand Alliance." Its goal is to develop a single "best-of-the-best" digital HDTV system for the United States.

1994 --- The Grand Alliance constructs a "best-of-the-best" system designed to serve as the basis of a new transmission standard for terrestrial broadcasting.

1995 --- The Grand Alliance system is delivered to ACATS for testing and evaluation. Grand Alliance digital HDTV passes exhaustive laboratory and field tests with flying colors, exceeding stringent performance specifications.

1995 --- On November 28, Grand Alliance digital HDTV receives a strong vote of confidence from the blue-ribbon ACATS panel, which recommends unanimously that it be adopted by the FCC.

Digital HDTV
Grand Alliance