Digital HDTV
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NEWS RELEASE FOR IMMEDIATE RELEASE

GRAND ALLIANCE DEBUTS DIGITAL HDTV SYSTEM

World-leading Technology Moves Closer to Marketplace Reality

LAS VEGAS, April 10, 1995 -- Delivering stunningly clear digital pictures and surround sound compressed through its prototype hardware, the Digital HDTV Grand Alliance digital high definition television (HDTV) system made its public debut today at the National Association of Broadcasters (NAB) convention.

This world-leading technology, which was delivered for final laboratory evaluation at the Advanced Television Test Center (ATTC) in Alexandria, Va. on March 31, is the result of nearly two years of joint research and development involving seven organizations: AT&T, General Instrument, the Massachusetts Institute of Technology, Philips Consumer Electronics, the David Sarnoff Research Center, Thomson Consumer Electronics and Zenith Electronics Corporation. At the urging of the FCC Advisory Committee on Advanced Television Services (ACATS), the seven joined forces in May 1993 to form the Digital HDTV Grand Alliance, vowing to produce a "best-of-the-best" system for the United States.

(MORE)

Flexibility for Broadcasters

Calling the Grand Alliance's digital HDTV system "ideally suited to the practical needs of broadcasters," David Sarnoff Research Center president and chief executive officer James Carnes emphasized that its rugged digital technology for terrestrial broadcasting "assures broad service area, prevents interference into analog broadcasts and provides immunity from interference into the digital signal."

Equally important, Carnes said, "At a time when rival delivery media are aggressively positioning themselves for digital programming and interactive services, a flexible packetized system enables broadcasters to transmit a virtually limitless mix of video, audio and data services, such as stock quotes, sports scores and statistics, electronic program guides and interactive advertising. These and other data streams should translate into new revenue streams for the broadcast industry."

Carnes added, "Our digital HDTV system offers broadcasters an historic opportunity to gain both a head start and a competitive advantage in the new digital information age."

Vision To Reality

Assuming the Grand Alliance system clears the final test phase, wins ACATS approval and is adopted by the FCC as the U.S. digital HDTV standard, "I would expect the first wide-screen HDTV receivers to be introduced to consumers within just two years," predicted Jerry Pearlman, Zenith chairman and CEO. "In parallel with the debut of the new receivers, I expect that by 1997 broadcasters

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would begin, at a minimum, to offer HDTV programming in prime-time viewing hours," he added, noting that "our highly flexible system gives them the opportunity to transmit other digital programming and services as well."

Pearlman said that, with the successful development of a fully-digital system, "the United States has leaped ahead of the rest of the world in HDTV." He warned, however, that "any undue delay in the standard-setting process may have the effect of squandering our leadership position and competitive advantage."

Original HDTV Program

The centerpiece of the Grand Alliance's exhibit here is a theater presentation of an original HDTV program created expressly for NAB '95. Shown via video projector on a 16:9 aspect ratio, 135-inch (diagonal) screen, the Grand Alliance today demonstrated digital HDTV images and surround sound of unsurpassed quality, processed through its prototype hardware.

The 10-minute video presentation, prepared in the form of a television magazine, features a wide variety of programming, including scenes from the epic film, "Lawrence of Arabia," highlights from the 1995 NBA All-Star Game and original footage shot on location in Southern California at the Petersen Automotive Museum and Universal Studios.

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NEWS RELEASE FOR IMMEDIATE RELEASE

HDTV INTERACTIVE ADVERTISING AND SYSTEM FLEXIBILITY DEMONSTRATED AT NAB

Kiosk Presentations Promote Digital Capabilities

LAS VEGAS, April 10, 1995 -- The Digital HDTV Grand Alliance demonstrated a variety of the unique system features and potential services provided by its high-definition television system today at the National Association of Broadcasters (NAB) convention.

Designed for the television broadcast industry, these features were demonstrated in four separate kiosks covering RF signal modulation, HDTV picture quality, flexible packetized data delivery and interactive advertising that could potentially be delivered by broadcasters. The kiosk demonstrations underscored the Grand Alliance system's robustness, its ability to support multiple formats, and transmit various combinations of video, audio and data to the consumer.

"These demonstrations clearly show the outstanding picture quality and enhanced services that will attract viewers to HDTV and create business opportunities for broadcasters," said Glenn A. Reitmeier, director high definition imaging and computing at the David Sarnoff Research Center, speaking on behalf of the Grand Alliance.

(MORE)

One of the more popular concepts demonstrated relates to interactive advertising. Using the flexibility of the Grand Alliance system, an HDTV commercial about BMW automobiles and an associated interactive "brochure" could be simultaneously delivered to consumer TV sets. The demonstration allows viewers the opportunity to experience an interactive shopping application that could be delivered by broadcasters to viewers with HDTV sets. Viewers are able to choose models and options and customize their preferences, which were displayed for them on the screen.

The Grand Alliance system affords the possibility of such interactive capabilities to both broadcasters and consumers by virtue of its packetized transport system. By separating video, audio and data into distinct packets that can be transmitted in any order, the system can transmit a variety of programs, movies, stock quotes, sports statistics and interactive programs. This capability will increase the value of HDTV to advertisers, with more flexibility in describing their wares, and for consumers, who will be able to make more intelligent choices prior to making a purchase.

To illustrate how the Grand Alliance's HDTV system transmits this dynamic combination of video, audio and data, an additional "flexible use" demonstration is showing broadcasters how packetized data and digital compression combine to make the Grand Alliance HDTV system as flexible as possible. This exhibit shows a graphic indicating the capacity of alternative data streams (e.g. stock quotes) being transmitted at the same time as high-definition

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programming, with an emphasis on the potential for new revenue streams being created for broadcasters.

Another kiosk features a comparison of Grand Alliance HDTV to both NTSC and 525-line digital picture quality. In this side-by-side demonstration, viewers can see the striking difference between digital HDTV and NTSC, which suffers analog signal impairments like random and impulse noise, and ghosts. Of course, a digital 525-line, MPEG-encoded widescreen picture substantially improves NTSC by eliminating the impairments that consumers are accustomed to seeing. While the move to digital 525-line is an improvement, it is no substitute for true HDTV, which is clearly demonstrated in a further comparison. The digital 525-line picture exhibits softness and artifacts compared to the Grand Alliance system. Higher resolution and full system capabilities provide the greatest impact for viewers.

Finally, a host of transmitter manufacturers are cooperating with the Grand Alliance to provide an RF signal demodulation demonstration (see separate news release). A vestigial sideband signal is being transmitted from the Grand Alliance booth around the floor of the convention center to different transmitter manufacturers. They are receiving the signal and transmitting it back to a prototype HDTV decoder, which is displaying excellent pictures, signifying robust digital transmission.

The prototype Grand Alliance HDTV system was recently delivered to the Advanced Television Test Center for its final round of laboratory tests. Following testing, the ACATS will make its final recommendation to the FCC on a digital HDTV broadcast standard, which is expected by early next year.

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BACKGROUNDER APRIL 1995

DIGITAL HDTV GRAND ALLIANCE

Nearing the Finish Line in Eight-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, approximately 40 years 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 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 FCC initiated its HDTV rulemaking and established a blue ribbon 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 seven 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 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.

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- 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.

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BACKGROUNDER APRIL 1995

DIGITAL HDTV GRAND ALLIANCE

Toward a New Era of Television in North America

On May 24, 1993, the three groups that had developed world-leading digital high-definition television (HDTV) systems agreed to produce a single, "best-of-the-best" system to propose as the standard for the next generation of TV technology. Since then, the three groups -- AT&T and Zenith Electronics Corporation; General Instrument Corporation and the Massachusetts Institute of Technology; and Philips Consumer Electronics, Thomson Consumer Electronics and the David Sarnoff Research Center -- have been working together as the "Digital HDTV Grand Alliance."

The Grand Alliance has made tremendous progress in a short period of time. Working closely with the Federal Communications Commission (FCC) Advisory Committee on Advanced Television Service (ACATS), The Grand Alliance has finalized the specifications of its proposed best-of-the-best system, developed and constructed a prototype system, and delivered that system to the Advanced Television Test Center (ATTC) for the final phase of laboratory testing. The FCC is expected to adopt the new HDTV standard in late

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1995, or early 1996, and HDTV sets should be available to the public in late 1996 or early 1997 -- dovetailing with the beginning of HDTV broadcasts.

Broad-based benefits. The Grand Alliance represents a unique collaborative effort with a pool of technical talent and financial resources that should assure that digital HDTV is deployed first in North America. While previously the ACATS process of formulating an HDTV standard had concentrated on selecting the best system from among those proposed, the Advisory Committee process now focuses on combining the best features of all the systems to produce a system superior to that of any one of the individual proponents.

The Grand Alliance approach is good news for everyone -- consumers; broadcasters; cable operators; the computer, consumer electronics and telecommunications industries; and U.S. workers. The proposal addresses the needs of these key constituencies and incorporates capabilities that are useful to each of them. For instance, the system incorporates progressive scan transmission capability and square pixel capability, two attributes that are extremely important for promoting interoperability with computers and telecommunications. Likewise, concerns expressed by many broadcasters have been addressed by including interlaced scan transmission in the initial deployment.

The proposal will allow North America to maintain the worldwide technological lead it has established. The rapid adoption of an all-digital HDTV system in the United States,

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Canada and the rest of North America, will promote the creation and maintenance of high-skilled jobs in the design and manufacture of HDTV receivers, displays, studio and transmission equipment, peripheral equipment, programming and software development, and especially in semiconductor products.

Key NII enabling technology. Because of the Grand Alliance system's interoperability between entertainment television and computer and telecommunications applications, the HDTV standard is expected to play a major role in improving the National Information Infrastructure (NII). Digital HDTV can be an engine that helps drive the evolution of the NII by advancing the deployment of receivers with high-resolution displays and creating a high-data-rate path to the home for a multitude of entertainment, education and information services. Specifically, Grand Alliance digital HDTV:

- Provides a broadband 20-Megabit-per-second data pipeline (using a packetized data transport structure with headers and descriptors) into the home for a range of digital services and entertainment on a high-resolution HDTV display.

- Embodies key design elements to promote computer/telecommunications interoperability such as digital data, packetization, square pixels and progressive scanning.

- Offers broadcasters, cable operators and others critical on- and off-ramps for the digital Information Superhighway -- not only for serving consumers with entertainment and related digital services but also for other applications in education, healthcare and commercial services.

In the end, consumers will reap the benefits of the best technical minds collaborating to bring noise-free, theater-quality pictures and sound to American homes, as well as a host of new applications.

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MAJOR PROGRESS

The HDTV standard-setting process has been and will continue to be a public, open process. Since its formation in May 1993, the Grand Alliance has been working closely with the FCC's Advisory Committee to complete the standard and launch HDTV:

- The Advisory Committee assigned its Technical Subgroup to evaluate the Grand Alliance proposal in detail. The Technical Subgroup approved most of the key system elements -- video compression, transport, scanning formats and the audio subsystem -- in October 1993. The final element, the modulation subsystem, was approved by the Technical Subgroup in February 1994.

- In the summer of 1994, the transmission subsystem underwent three months of extensive broadcast and cable field tests in Charlotte, N.C. The tests proved that the Grand Alliance digital transmission technology will outperform today's analog transmission approach.

- Beginning in the spring of 1995, the Advisory Committee will conduct extensive laboratory tests of the entire system in the U.S. and Canada to verify that the system meets its expectations. (The prototype hardware was delivered to the ATTC in late March.)

- The Advisory Committee could then recommend the system to the FCC and simultaneously begin final field test verification of the system's performance.

- The FCC, in turn, would consider the Committee's recommendation in a rulemaking proceeding which should be concluded in late 1995 or early 1996. In accordance with FCC requirements, the technology will be licensed to anyone on reasonable terms.

- It is anticipated that our Canadian and Mexican neighbors will simultaneously initiate similar, appropriate procedures to assure rapid adoption throughout North America. Moreover, because of early North American implementation, it is hoped that the rest of the world will adopt many of the elements of the North American HDTV standard.

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NEWS RELEASE FOR IMMEDIATE RELEASE

TRANSMITTER MANUFACTURERS SUPPORT GRAND ALLIANCE HDTV SYSTEM

Live VSB Demonstrations at NAB '95

LAS VEGAS, April 10, 1995 -- Helping broadcasters prepare for the launch of high-definition television (HDTV), six leading broadcast transmitter manufacturers are demonstrating compatibility with the digital HDTV system developed by the Digital HDTV Grand Alliance.

At the National Association of Broadcasters convention, the manufacturers -- Acrodyne Industries, Comark Communications Inc., EMCEE Broadcast Products, Harris Allied, ITS Corporation and Larcan-TTC Inc. -- are using real-world transmitter systems to show broadcasters how simple it will be to implement the Grand Alliance's proven vestigial sideband (VSB) digital transmission system as they launch digital broadcasting service following adoption of the HDTV standard by the Federal Communications Commission (FCC).

Real Hardware, Real Signals

At their booths in the Las Vegas Convention Center, each of the transmitter companies is receiving a digitally modulated eight-level vestigial sideband (8-VSB) Grand Alliance

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HDTV signal from the Hilton Pavilion. At each site, the signal is then processed through each company's equipment and transmitted back to the Grand Alliance booth in the Hilton Pavilion on a standard analog 6-Mhz channel. There, it is being received, decompressed and displayed -- in real time, using prototype hardware identical to the system delivered on March 31 to the Advanced Television Test Center.

In the Grand Alliance booth (#301), engineers are switching "channels" between transmitter manufacturers to demonstrate the capabilities of each transmitter in handling the VSB signal. As part of the demonstration, the Grand Alliance also is transmitting HDTV pictures and sound for display in transmitter manufacturers' booths as well. Also at the show, the Grand Alliance is feeding HDTV signals to the Pioneer New Media Technologies booth in the 1125/60 Group area, to the David Sarnoff Research Center display, to the General Instrument exhibit and to Turner Engineering's studio supporting NAB meeting rooms.

Proven Transmission Technology

The Grand Alliance's VSB digital transmission system is proven technology. Three months of extensive broadcast and cable field testing -- conducted last summer in Charlotte, N.C., on behalf of the FCC Advisory Committee on Advanced Television Service -- showed that the Grand Alliance system will significantly outperform today's analog transmission system.

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The Grand Alliance VSB system is rugged technology for terrestrial broadcasting that assures a broad HDTV service area, prevents interference into existing analog broadcasts and provides immunity from interference into the digital signal. And, as shown at NAB '95, the system works well with equipment available now from transmitter manufacturers.

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BACKGROUNDER APRIL 1995

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, 20 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 NII in their own right, but they are particularly vital in improving 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 reallocate the digital bitstream to provide a wide variety of video, audio, voice, data or multimedia services over the HDTV channel.

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 only be apparent to 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 is a concern to many government policy makers.

Efforts are now underway in government and industry to better understand and strengthen the link between HDTV and 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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ACATS and the Advanced Television Systems Committee, an industry group working to develop standards for advanced television, have jointly commissioned a liaison group to interact with other government and industry teams working on the NII. These efforts will help ensure that the various NII working groups understand the contributions to NII that digital HDTV offers, and will accentuate the importance of completing the HDTV standards process rapidly.

The 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 1995

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 being proposed to 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. They are:

- **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) 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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