



A 150-inch all-digital TV of the future.

Photo: Panasonic

When All-Digital TV Arrives, Will We Be Ready?

By Peter B. Seel

The conversion hour is set: Midnight on February 17, 2009 will mark the end of analog broadcast television transmissions in the United States. At that time, all full-power terrestrial television stations will turn off their analog transmitters and broadcast solely in the Advanced Television Systems Committee (ATSC) Digital Television Standard. This dramatic shift in the fundamental technology of television broadcasting will affect an estimated 113 million television households in the nation, as well as more than

1,700 full-power television broadcast stations that are licensed by the Federal Communications Commission (FCC). Program providers such as cable and satellite operators that re-transmit television programming into American homes will also have to adapt accordingly. Each of these entities has a vested interest in assuring that the transition to digital broadcasting progresses smoothly. If it does not, there will be major repercussions for all involved. As FCC Commissioner Jonathan Edelman noted, "If we don't get this right, we could face a tsunami

of public outrage.”

Will this transition unfold as planned by government agencies and the nation’s broadcasters -- or will national chaos ensue when millions of over-the-air television viewers watch their screens go dark as they watch late-night television on February 17, 2009? A number of key groups have an interest in a smooth transition: over-the-air television broadcasters, the U.S. government, television manufacturers, multi-channel video program distributors (MVPDs), and lastly (and perhaps most important), television viewers and consumers. The nation has less than a year to make the final preparations for the analog to digital television conversion. Will everyone be ready?

Who wants HDTV?

In his influential 1995 book, *Being Digital*, Nicholas Negroponte (then director of MIT’s Media Lab, now managing the One Laptop Per Child project) devoted an entire chapter to high-definition television (HDTV) in which he made an impassioned case that the primary problem with television at that time was not with image resolution or aspect ratio, but that the primary deficiency was *programming content*. Negroponte stated:

There is no proof to support the premise that consumers prefer better picture quality rather than better content. This is particularly true given that the solutions so far proposed for HDTV may not even result in enough noticeable image improvement, compared with the studio quality television available today (which you have probably never seen and might not guess how good it is). HDTV at the current level of HD is just silly.

What a difference a decade makes. It now seems clear that television viewers do, in fact, care about image quality and size. The number of U.S. homes with at least one HDTV-quality set reached 34 million by the end of 2007, according to the Leichtman Research Group. Digital television sets were predicted to outsell analog models in 2006 for the first time in history – and they did so. What has changed since Negroponte made his critical comments is the proliferation of less expensive, high quality, large-screen televisions that use a variety of display technologies. HDTV prices dropped as television manufacturers ramped up the mass production of new and improved high-definition displays. A dramatic increase in the amount of HDTV programming telecast on broadcast and cable channels is also fueling this sales increase. A surprising number of homes with HDTV sets are not subscribing to HD-level programming, which begs the question of what they are watching on these sets. The probable answer is widescreen programs on conventional DVDs and the newer Blu-ray and HD-DVD formats. The new high-definition formats provide very high quality images on HDTV sets, but programs played on conventional DVDs look surprisingly good, especially when viewed in 16:9 wide-screen mode. This may also assist in the sale and rental of compendium DVDs of television series such as CSI, 24 and The Sopranos – and many are available in wide-screen formats in the DVD versions.

What many home viewers may not realize is that the producers of prime time television programming have been filming these shows (a majority of them are shot on film) in wide-screen aspect ratios since the mid-1990s. To future-proof their investments for

possible syndication during and after the transition to digital broadcasting, studios have filmed or taped these series in the 1.78:1 wide-screen aspect ratio of HDTV. Until the advent of HDTV broadcasts in recent years, most of these wide-screen programs were simply cropped to fit the 1.33:1 narrow screens of analog television sets. For total truth in broadcasting, the networks should have been required to insert a disclaimer before each of these analog versions similar to that used for DVDs of feature films – ie. “This program has been formatted to fit your screen...” – indicating that about 30 percent of the image area had been cropped out. As the nation switches to digital broadcasting, viewers with wide-screen sets are finally able to see the extra picture area in episodes of ER that has been on the film negative since 1995. Viewers using older 1.33:1 analog sets will continue to see cropped or letterboxed versions of these programs.

Broadcaster organizations

Broadcaster groups led by the National Association of Broadcasters (NAB) and the Association for Maximum Service Television (MSTV) were among the first organizations to petition the FCC in 1987 to create an advanced television standard. Terrestrial broadcasters were concerned that competitors such as cable and satellite services were planning to provide high-quality digital programming services (including HDTV) and perhaps drive viewers away from over-the-air television. The concern was that terrestrial broadcasters might be left behind in the national conversion to digital television. This concern was misplaced, as terrestrial broadcasters have become, by necessity, the first adopters in the conversion.

Once a national digital-television standard was set in December of 1996, broadcasters were required by the FCC to meet a series of transmission benchmarks to get their DTV signals on the air. Eighty stations in the top 30 markets transmitted a DTV signal by November, 1999. Not all U.S. television stations are presently transmitting in DTV at full power, but as of October 2007 the FCC reported that 1,706 stations (99 percent) were granted a DTV construction permit or license, and 1,636 were broadcasting a digital signal. Broadcasters have made significant progress over the past decade in converting their production and transmission facilities for the DTV transition. Almost all prime-time network programming is now produced and simulcast in HDTV, even if viewers with analog sets cannot see the higher quality. Local broadcasters have been retransmitting these programs in DTV to viewers with HDTV sets, but much local programming (e.g., local news) is still produced in the analog NTSC standard. Over the coming year local broadcasters will need to convert their news operations to DTV and gradually increase the output of their DTV transmitters to 100 percent of licensed transmission power by the 2009 deadline. One incentive for local stations to make the switch to DTV-only broadcasting is to eliminate the substantial expense of operating two transmitters during the transition period. In fact, some stations may shut down their analog transmitters in advance of the conversion date in 2009 if they notify their viewers and the FCC of the decision. Most local broadcasters, their DTV investment complete, will look forward to turning

Declining Prices for Flat-Panel Digital Television Sets

Top selling flat-panel screen sizes based on unit	Average selling price in 2005	Average selling price in 2006	Average selling price in 2007
32-inch LCD TV	\$ 1354	\$ 796	\$ 745
37-inch LCD TV	\$ 2096	\$ 1113	\$ 963
40-inch LCD TV	\$ 3014	\$ 1606	\$ 1200 (720p)
46-inch LCD TV	n/a	\$ 2601	\$ 2300 (720p)
52-inch LCD TV	n/a	n/a	\$ 3000 (720p)
42-inch Plasma TV	\$ 2034	\$ 1265	\$ 900
50-inch Plasma TV	\$ 3574	\$ 2052	\$ 1555

Source: retail survey for 2007 data with NDP Group (2007) for 2005 and 2006.

off their analog transmitters and cutting their transmitter power bills in half.

Television manufacturers and consumer electronics companies: It is estimated that the industry took in over \$32 billion in DTV sales last year.

Television display manufacturers have an obvious significant economic stake in the DTV transition. The Sony Corporation and other television manufacturers played a major role in the global development of HDTV technology in the 1970s and 1980s. Business is booming for DTV manufacturers –the Consumer Electronics Association (CEA) stated that 27.1 million DTV units of all types were sold in 2007. Of these sets, LCD models were by far the most popular display technology with sales of 16.7 million sets (sales for plasma televisions were 3.5 million, 1.9 million for rear projection models and 1.1 million for home-theater front-projection systems). Assuming that the average selling price for a DTV set in 2007 was \$1,200 and that 27 million displays were

sold, it is estimated that the industry (manufacturing and retail) took in over \$32.4 billion in DTV sales last year.

The consumer electronics industry is taking in billions of dollars in revenue selling digital television sets in the

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United States and this volume will certainly increase over the next year as the DTV transition date approaches. The industry will also directly benefit from the \$1.5 billion converter-rebate program administered by the National Telecommunications and Information Administration (NTIA) – these funds will go directly to consumers in the form of rebate coupons for converters that can be rebated at a local consumer electronics store. However, it seems that there is extreme pressure on net

income for both television retailers and television manufacturers caused by the intense competition in making and selling flat-panel displays. During the key end-of-year sales period in 2006, the Syntax-Brilliant Corporation sold its 32-inch Olevia-brand LCD HDTV displays at Circuit City Stores for a record low price of \$475. The sets quickly sold out at these loss-leader prices and gained the market share Syntax desired, but this price competition drove down the entire LCD market during a crucial sales period. The low profit margins in the high-volume LCD market may have also negatively affected the net income of the retailers involved. Circuit City was in such dire financial shape in 2007 that it laid off 3,400 (eight percent) of its highest-paid sales staff in the U.S. and replaced them with lower-paid workers.

As set prices decline and set sizes increase, LCD and plasma HDTV displays have become a commodity market driven by volume. Manufacturers have responded with ever-larger (and more expensive) displays and new technologies. At the 2008 Consumer Electronics Show in Las Vegas, Matsushita (Panasonic brands) displayed a prototype 150-inch (diagonal) plasma display with twice the horizontal resolution of present HDTVs. This enormous display featured a screen ten feet wide by six feet high. It may be time to expand the TV room at home. The Sony Corporation displayed ultra-thin "OLED" televisions that provide a remarkably bright and sharp (1080p) image with a display depth of 3 mm – about the thickness of three credit cards. The OLED displays are small and very expensive (the 11-inch model is now on sale for \$1,700), but they point to the future of high-definition

television. The future will bring large, very thin and wide-contrast displays with screen resolutions doubling that of HDTV.

Multi-channel Video Programming Distributors

Until 2007, multichannel video program distributors (MVPDs) were the least enthusiastic stakeholders in the DTV transition. Both cable and satellite television providers have bandwidth constraints that limit the amount of HDTV programming that they can simulcast during the transition period and beyond. To not disenfranchise customers with analog television sets, they will need to continue providing analog versions of the programming they receive in the new digital standard. In a September 2007 decision, the FCC required that U.S. cable television systems either continue to distribute the analog signals of all channels carried (in addition to the digital versions) or provide a set-top converter box that will down-convert digital programming for display on older analog televisions. Since about 85 percent of the nation's TV households subscribe to a MVPD-provided service, televisions in these households will continue to function after February 17, 2009.

Direct Broadcast Satellite services do have one major advantage over cable: Their transmission system has been all-digital since high-power DBS services were launched in 1994. The set-top box provided to satellite subscribers is essentially a digital-to-analog converter, similar to what the NTIA is promoting with its coupon program. Satellite services do have to deal with bandwidth issues during this transition. The only way they can squeeze in more programming is to launch additional satellites at enormous

expense, which both DirecTV and Echostar (DISH Network) have done in the past two years to prepare for the DTV conversion. The multi-channel video program distributors are earning extra income selling premium HDTV programming to their early adopters, so the DTV conversion has not been a financial loss. HDTV owners with DirecTV service pay \$10-15 extra a month to add HD channels to their programming choices. In television commercials the satellite companies are hammering their cable competitors with the fact that they will offer 100 channels of HDTV programming in 2008, before cable can ramp up to that level.

The Federal Government has a major stake in DTV transmission.

The U.S. government has a major stake in the DTV transition that goes beyond setting the new television standard and defining the details of the conversion. In 1990, each of the 1,700 television stations in the country was assigned an additional 6 MHz of spectrum for the conversion period between 1997 and 2006 (now 2009) so that they could transmit their programming in both analog and digital versions on two channels simultaneously. As an aggregate, this is a significant amount of spectrum. When the conversion is complete, these television stations, by law, must return this "loaned" spectrum to federal government. A sizeable portion of the former UHF analog television spectrum will be auctioned off and the proceeds used for reducing the federal deficit (after paying for the coupon program). Bidding in 2008 by companies as diverse as AT&T, Cox Communications and even Google on this spectrum has already exceeded \$15 billion. Congress has been eyeing this potential revenue

for almost a decade since the passage of the Balanced Budget Act of 1997. One impetus behind the decision on the February 17, 2009 shutoff date for analog television transmissions was the desire of Congress to recover that spectrum and put it up for auction.

For agencies of the U.S government, especially the NTIA, the transition will be a time of high anxiety. Congress is taking a calculated risk that consumers will not seek converter boxes for all the television sets that are now dependent on over-the-air analog television signals. The NTIA will be on the hot seat if it burns through the \$1.5 billion loaned to them from the treasury for the converter box program. These funds, after all, are an advance on spectrum auction revenue that the government will not see until June 30, 2008. Every dollar diverted to the converter- box program is one less that can be used for deficit reduction. The unknown factor here is consumer behavior. If enough consumers decide to buy a new digital television set in the coming year, it will take a great deal of pressure off the converter box program. One can see why there is such great urgency in Congress, the FCC and the NTIA for consumer- education programs that may assist in averting a broadcasting melt-down on February 17, 2009. Members of Congress understand that they will be inundated with complaints if their constituents' televisions go dark that night because of a federal mandate.

The same act of Congress that set the new deadline also included a provision that \$990 million in federal funds be allocated to pay for the coupon program. If needed, the NTIA has authority from Congress to borrow an additional \$500 million from the

Treasury Department for the program with these disbursements repaid from spectrum auction revenues. The first boxes are now on sale at electronics retailers for \$60 dollars, so each \$40 coupon would defray about two-thirds of the retail cost at these prices. Any resident can apply to the NTIA between January 1, 2008 and March 31, 2009 for two coupons which will be sent to them via U.S. mail (the coupon site is at <https://www.dtv2009.gov>). The coupons cannot be combined, have no cash value and will expire three months after issuance.

The NTIA's converter box coupon program is off to a rousing start. In the first two weeks of 2008, there were 1.78 million applications for 3.3

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million coupons, according to the NTIA. It appears that most households are requesting the maximum two coupons. The NTIA plans to award 22.25 million of the coupons to any U.S. television household (even if they have cable or satellite service). After these are distributed another 11.25 million coupons will be available only to applicants with analog-only over-the-air television service. This policy was set after a debate over whether the coupons should be allocated only to the latter group. The split allocation decision will assure that some coupons are held back for households with only over-the-air TV reception.

However, there is a basic problem with the math involved – it is estimated

that there are 73 million analog television sets in the U.S. that rely on over-the-air transmissions and the \$1.5 billion allocated for the program will only provide converter-box coupons for half of those sets (33.5 million). The government is making a calculated gamble that many viewers will upgrade to new DTV sets before the transition date, or simply put these older sets away. If the government is miscalculating here, the NTIA could run out of coupon funds before the program ends.

There is another factor in the digital television transition that is influencing national policy and it stems from the tragic events of September 11, 2001. Of the analog television spectrum that will revert to the United States in 2009, the area now occupied by UHF channels between 52 and 69 in the 698-806 megahertz range will be reserved for emergency communication by first responders. The Digital Television Transition and Public Safety Fund authorized by the Act will provide up to \$1 billion through 2010 to provide grants to public-safety agencies at all levels of government to purchase new emergency communication systems that are interoperable. One problem that became painfully apparent on 9/11 was that the varied radio systems used by first responders were not communicating between agencies. This is still a significant national problem seven years after 9/11. The upgrades to emergency communication systems, as with those allocated for the digital set-top box program, will be funded through DTV auction revenue. There are issues of national concern in the DTV transition that extend beyond the acquisition of the auction funds.

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that will affect every TV household in the nation.

Consumers are the key group on which the success of the conversion to DTV depends.

While consumer awareness of HDTV is high in the U.S., the most significant problem with the DTV transition as it concerns consumers is that many are unaware that the nation is planning to convert television systems in 2009. In a 2006 survey of 2,000 U.S. television households conducted for the Association for Public Television Stations (APTS), 61 percent of the respondents said “they had no idea that the DTV transition was taking place.” While some respondents indicated they were aware of the forthcoming DTV transition, 53 percent did not know when analog transmissions were scheduled to end. With the end of analog broadcasting less than a year away, there is clearly a major knowledge gap among U.S. citizens about a change that will affect every TV household in the nation.

Awareness is improving with the national consumer education campaign. A 2007 survey of 1,300 U.S. households by the Leichtman Research Group indicated 43 percent of the individuals surveyed said that they knew of the 2009 analog shut-off date. However, only 37 percent said that they understood how this conversion was going to affect their household. On the cost-benefit scale, the percentage of respondents who reported that HDTV is too expensive decreased from 76 percent in October 2003 to 66 percent in November 2005. It is interesting to note that in a 2005 survey by the Consumer Electronics Association, consumers reported that nearly half of those with HDTV displays indicated that seeing sports in high definition was a primary reason

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The NTIA was allocated \$5 million in the DTV transition bill for consumer education, an amount that administrator and DTV transition manager John Kneuer stated in a C-Span

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interview was “a drop in the bucket.” He elaborated that this comment was made in the context of significant in-kind contributions pledged by the affected broadcasting and consumer electronics industries.

The affected industries are ramping up a major public-education campaign focused on the DTV transition. A “DTV Transition Coalition” was formed early in 2007 by broadcast organizations (APTS, NAB, MSTV and the NCTA) with the Consumer Electronics Association. The coalition will use “marketing and public education strategies including paid and earned media placements to distribute consistent, unified and accurate information on the transition.” The campaign will include public-service announcements about the transition on broadcast and cable television, and the use of point-of-sale posters and on-screen graphics in consumer-electronics stores. Cable-television providers, coordinated through the NCTA, plan to participate by cablecasting DTV awareness spots in English and Spanish in commercial time slots valued at \$200 million.

Television viewers and consumers are the crucial group in the DTV transition

process. They hold the keys to the success of the converter-box program in terms of their adoption of DTV technology between now and 2009. If television set prices continue to drop and more programming is available in HDTV, they are more likely to adopt the new technology. If large numbers of consumers adopt DTV, there will be fewer households with older analog sets that will need to apply for coupons for converter boxes. This situation would make officials in Congress, at the NTIA and the U.S. Treasury very happy.

Consumers will benefit from the ability to see entertainment and sports programming with a remarkable level of image clarity and sound fidelity. A ticket to the Super Bowl costs \$2,000 as part of a travel package – a price that puts this event out of the financial reach of most football fans. With a large-screen HDTV, a fan can enjoy the game as if she or he were sitting in a luxury box at the stadium. All the visual and auditory excitement is provided, with the added convenience of a refrigerator and bathroom nearby. The installation of home theaters is a rapidly growing sector of the HDTV market. A film shot in a wide-screen aspect ratio should be seen in that same aspect ratio and it has a much greater impact if it can be displayed on a large screen in home theater setting. In the future, television viewers will marvel that people used to watch movies and sporting events on an oval 19-inch cathode ray tube.

In summary, the United States will benefit from the DTV transition in several ways. Viewers will see higher-quality programming that will actually use less of the television spectrum. Analog television is a notorious bandwidth hog and DTV will facilitate more efficient use of the broadcast

spectrum. Once the analog- television spectrum is returned to the federal government at the end of the transition, the FCC will release channels 52-69 for allocation to public- safety agencies to improve radio interoperability. This reallocated spectrum may prove crucial if the nation is attacked again or for dealing with a Katrina-scale natural disaster in the future.

A number of negative aspects of the digital-television transition have been analyzed above. One that has not been discussed is the planned obsolescence of over 200 million analog television sets, most of which will end up in local landfills unless suitable alternatives are provided. It is incumbent on the consumer- electronics industry to follow their brethren in the computer industry and begin a recycling program for analog television sets. Most older sets have lead in their glass tubes to limit radiation exposure to viewers and their circuit boards contain other toxic metals. These sets need to be recycled in a responsible manner.

The coming year is will be a fascinating period to study the wholesale transition of a large nation with millions of sets from one broadcast television system to another. All of the stakeholders in the transition, with the exception of consumers, are aware of the significant stakes involved. If everything goes as the government plans, the transition will be very smooth. If consumers and viewers do not respond according to plan, the ride could be excessively bumpy.

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