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The Transition to Digital Television in the United States: The Endgame

ABSTRACT

The switching off of analogue television on 12 June 2009 and the delays that led up to it are the focus of the analysis here. All digital transitions are difficult but the US transition was successful in the end, in spite of a number of decisions and policies that made life confusing and overly complicated at one time or another for all concerned. The decision to delay the analogue switch off from 17 February to 12 June 2009 was one of the first initiatives undertaken by the newly elected Obama administration. The delay was necessary because of the under-funding of a programme to provide coupons for analogue-digital converter boxes to those still dependent on over-the-air broadcasts.

KEYWORDS

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high definition
television (HDTV)
digital transition
analogue switch off
Federal Communications
Commission (FCC)
multicasting
must-carry rules

INTRODUCTION

The entire US broadcasting system made the transition from analogue to digital broadcasting on 12 June 2009; on this date, all analogue transmissions ceased, with only minor exceptions. The transition to digital television (DTV) was originally scheduled to take place at the end of 2006, but that deadline was

set back: first to 31 December 2008, then to 17 February 2009, and then finally to 12 June 2009. The setting back of these deadlines reveals a lot about contemporary American politics and even more about the politics of broadcasting.

To understand the debates over deadlines it will be necessary to review both the original decisions to adopt a DTV standard in the United States and those made later. One major factor in the most recent delay was the election of Barack Obama in November 2008, so some effort will be made here to discuss how the DTV transition became an issue during and after the 2008 presidential campaign.

One way to explain the delays is to examine closely the FCC's decisions in the 1990s to adopt a DTV standard during the Clinton administration, and subsequent FCC policies adopted during the administration of George W. Bush. The FCC (Federal Communications Commission) was the primary forum for decision making about how to implement the transition. It was responsible for monitoring the performance of other agencies, such as the National Telecommunications and Information Agency (NTIA), who were put in charge of certain aspects of the transition. The relationship between the FCC and Congress is central to explaining the FCC's policies. The relationships between the FCC and powerful private interest groups like the National Association of Broadcasters, the National Cable Television Association, and the Consumer Electronics Association were also important.

THE DECISION TO GO DIGITAL

The US government decided to adopt the Japanese standard for high definition television (HDTV) in 1985 but changed its mind when objections were raised, first by the European Union and then later by powerful domestic economic interests (Hart 2004). After the election of George H.W. Bush in November 1988, there was a brief flirtation with adopting a policy of direct government subsidies for the development of HDTV technology, but top advisers to President Bush shot down this policy. The task of defining how to respond to the challenge of the transition from an existing television system to a new one went to the FCC.

The FCC had already appointed an Advisory Committee on Advanced Television Services (ACATS) in 1987 (during the Reagan administration) to examine the question of how to make the transition to a new system of television broadcasting. ACATS decided that the best way to proceed was to establish a competition among groups of firms and research laboratories, who were asked to produce prototypes of advanced TV systems for testing in third-party laboratories. The main incentive for participating in the competition was the potential economic return from owning the intellectual property connected with developing the technologies for the new system.

Seven systems were proposed by the June 1990 deadline for testing. Several smaller firms and laboratories who had said they would submit proposals had already dropped out of the running by that time. Two days before the deadline, General Instrument announced that it was submitting a proposal based on a new method of compressing digitized HDTV video signals into a 6 megahertz bandwidth. As a result of this unexpected development, FCC Chairman Al Sikes expressed a strong preference for all-digital systems.

By summer 1991, there were only five major proposed systems left from the original seven: (1) the Advanced Digital Television (ADTV) system proposed by the Advanced Television Research Consortium made up of the

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Digital switchover in the United States: a Federal Communications Commission poster.

North American Philips Corporation, Thomson Consumer Electronics, NBC, Compression Labs, Inc., and the David Sarnoff Research Center in Princeton, New Jersey; (2) the Spectrum Compatible (SC) system proposed by Zenith and AT&T with support from Scientific-Atlanta; (3) the Narrow MUSE system proposed by NHK; and (4) and (5) two all-digital systems proposed by the American Television Alliance (MIT and General Instrument).

MIT and General Instrument formed the American Television Alliance as a joint venture in April 1991, the Zenith-AT&T partnership followed closely on its heels. The Advanced Television Research Consortium added the Compression Labs as a partner when it felt it needed more help with creating an all-digital system. Scientific-Atlanta joined the Zenith-AT&T team to help them develop a workable HDTV cable system (Sweet 1991). When it was absolutely clear that the FCC would not choose an analogue system – and just before it was NHK's turn to test its narrow MUSE entry – NHK withdrew from the competition. That left three teams with four systems in the race. The American Television Alliance – MIT and General Instrument – entered two slightly different systems in the competition: a joint entry with an 1125/60 interlaced production format and a MIT-only system with progressive scanning.

The FCC would make its final decisions on HDTV standards based on the recommendation of ACATS. The recommendations from ACATS would depend at least partly on the reported results of the Advanced Television Test Center (ATTC) and Cable Labs testing process. On 16 February 1993, Richard Wiley of ACATS reported that the tests had yielded 'no superior system', and that all of the proposed systems were quite similar but flawed in some respect. Accordingly, ACATS recommended two alternative courses of action: (1) ask the three teams to merge into a super team that would solve the remaining technical problems to the satisfaction of ACATS and the FCC; or (2) allow the teams more time to perfect their systems and then have a second round of tests. The first course of action was preferred because it would save the time and expense of a new round of tests and would eliminate the possibility that a losing team would initiate litigation over the fairness of the competition (Carnevale 1993). On 24 May 1993, the three teams announced their decision to merge.

The American system, therefore, would be a digital system. The Japanese Hi-Vision and European HD-MAC systems were both based on the delivery of analogue signals by DBS (Direct Broadcast Satellite) satellites. There was still some uncertainty whether it would be possible to devise practical means for delivering digital HDTV via terrestrial antennas, especially in noisy urban markets, but Chairman Sikes leaned strongly in this direction in hopes that an all-digital HDTV will be something the US electronics firms could do better than the Japanese and the European firms. The Japanese and European firms would still be major suppliers of HDTV components and systems for the American market, no matter what standard was selected, because of the Research and Development (R&D) work they had already done and because the US market was likely to remain open to imports and inflows of direct investment.

Most of the participants in this debate realized that an all-digital system would have important advantages over an analogue system in permitting manufacturers to add computer-like features to television sets and set-top boxes, and that these features would require some agreement to limit the types of image formats and digital information that the digital HDTV signal could carry. Thus, a compromise was worked out prior to the 24 May 1993 announcement of the formation of the Grand Alliance. This compromise called for the US digital transmission standard to be capable of encoding

Vertical pixels x horizontal lines	Frame rate in frames per second	Type of scanning
1280 x 720	24	progressive
"	30	"
"	60	"
1920 x 1080	24	"
"	30	"
"	60	interlaced

Note: See discussion below for an explanation of the difference between progressive scanning and interlacing.

Table 1: Six video formats in the Grand Alliance system as of November 1994.

and decoding both interlaced and progressively scanned source material. The interlaced material would have 960 scanning lines at 30 frames per second; the progressive would have 720 lines at 60 frames per second (see Table 1).

The original press release for the Grand Alliance announcement reported that all displays larger than 34 inches would be progressively scanned, but apparently that was an error. The Grand Alliance members felt that this would be an unnecessary handicap for them should non-members decide to offer (presumably cheaper) interlaced displays for large screen TVs. Since they could not legally force all non-members to use progressive displays, they decided to abandon the requirement.

In the meantime, Reed Hundt had not yet been confirmed as Chairman of the FCC and the Clinton administration initially showed little interest in HDTV or the ACATS deliberations. Hundt himself was noncommittal. He was influenced in his views by his discussions with Negroponte and other computer industry notables. Hundt was looking for HDTV to play a role in the emergence of the National Information Infrastructure (NII). He wanted HDTV to be more like what George Gilder called a 'teleputer' – a television/computer device that was seamlessly connected with computer networks. Wiley was worried that Hundt and the rest of the Clinton administration would scrap the HDTV deals made by the Republicans in the Bush administration. He felt that he no longer had the support of the Chairman of the FCC as he did under Al Sikes. The National Association of Broadcasters (NAB) chose this time of vulnerability to weigh in again against HDTV.

John Abel of the NAB began to focus on the opportunities presented by digital television as opposed to HDTV. Digital TV did not have to involve HDTV images. Instead, digital compression of standard definition signals would enable existing broadcasters to compress more than one programme service into a single channel, allowing them to provide a greater diversity of programming through what came to be called 'multicasting'. A digital broadcasting environment would permit broadcasters to offer all sorts of digital services such as data broadcasting, e-mail, paging, telephony, software delivery, etc.

In February 1994, Michael Sherlock, Vice President of NBC, said that many broadcasters were interested in using the second channel that they would be

given in the transition to HDTV for digital services. He knew that the only reason that the second channel was being given to broadcasters was so that they would be able to provide free over-the-air services for analogue (NTSC) set owners until a large proportion of the viewing public could receive digital broadcasts. Nevertheless, he argued that the non-HDTV digital services might be more lucrative for the broadcasters than HDTV itself (Brinkley 1997: 289–290).

Similarly, in March 1994, Rupert Murdoch began to talk about satellite and cable systems with large numbers of channels. In a March 1994 interview with *Forbes* magazine, Murdoch said

The current proposal is that the FCC will give us that spectrum for high-definition television. But high definition is a luxury. Compared with a modern TV set it's not that different. Why shouldn't that extra spectrum be given to me or you or anyone to put on that extra number of channels?

(Brinkley 1997: 304)

The NAB pursued this logic politically by proposing an amendment to the Telecommunications Act of 1995, called the 'broadcast spectrum flexibility amendment'. This amendment would broaden the range of services that broadcasters could provide on the second channel given to them in the transition to 'advanced television'. John Abel continued to argue that neither the broadcasters nor the consumers were demanding HDTV specifically, so broadcasters should not be forced to offer HDTV services (Brinkley 1997: 308–309). In 1995 the Telecommunications Act faced overwhelming Republican opposition to what they argued was an overly regulatory Democratic bill – the Republicans having been strengthened in their opposition by their resounding victory in the 1994 Congressional elections – and the Act was finally passed in 1996.

COMPLETION OF THE GRAND ALLIANCE SYSTEM

Testing of the Grand Alliance system continued through the end of 1993 and into early 1995. The Grand Alliance's schedule called for completion of the system in 1995 and a demonstration of its capabilities at the 1996 Olympics in Atlanta. Technical evaluations were performed in 1994 at the Advanced Television Test Center (ATTC) in Alexandria, Virginia and at the Cable Television Laboratories (also called CableLabs) near Boulder, Colorado. Subjective viewer tests were performed at the Advanced Television Evaluation Laboratory in Ottawa, Canada; the Public Broadcasting Service, the Association for Maximum Service Television, Inc. (MSTV) and CableLabs in Charlotte, North Carolina, conducted field transmission tests. The transmission tests demonstrated some of the peculiar characteristics of digital broadcasting – the quick break up of picture quality beyond the transmission range of the antenna – as opposed to the more gradual degradation of picture quality with analogue transmission, but on the whole they were successful.

At the beginning of 1995, completion of the Grand Alliance system was delayed because of technical difficulties. The main problem was the encoder that turned base band high definition video into compressed digital high-definition video at the transmission end. The two Grand Alliance companies in charge of this effort were General Instrument and AT&T. Due to delays in getting the new combined system to work, the companies requested a postponement of the final testing date. This time, instead of readily accepting the delay, FCC Chairman Reed Hundt decided to speed things up. He pushed

Richard Wiley, the head of ACATS, to put pressure on the Grand Alliance members to complete their system.

Hundt's perception of the value of HDTV had changed noticeably. Hundt was impressed with the emerging Grand Alliance system – particularly its usage of a packetized data structure similar to those used in telecommunications systems. A Grand Alliance HDTV receiver was a lot more like a computer than earlier HDTV receivers, as it had the ability to process a variety of video signals and to display both interlaced and progressive-scan images. The successful introduction of digital NTSC satellite services in the form of the Thomson/Hughes DirecTV or DSS services, using a direct broadcast satellite to deliver digitized signals to homes with small satellite dishes, satellite tuners, and regular NTSC televisions, may also have influenced Hundt's change of perspective. The rapid consumer adoption of DBS services was eating into the audience share of both cable operators and terrestrial broadcasters, thanks to the very high quality of the images and the large number of channels available on DBS services. Many of the successful satellite and cable channels in Europe and Asia also relied on digitized signals, especially for pay-TV channels where encryption was necessary to exclude non-subscribers from receiving the signal.

On 12 September 1995, the Chairman of the Senate Commerce Committee, Senator Larry Pressler (R-South Dakota), unveiled a plan to auction off HDTV and other advanced TV spectrum in the largest 25 television markets. According to Pressler, the auction would raise more than \$14 billion, which Pressler wanted to use to establish a trust fund for public broadcasting. Federal funding for NPR and PBS was under attack from the new Republican majority in Congress. The National Association of Broadcasters immediately criticized the plan and announced that they would oppose it. Pressler dropped his proposal on 28 September.

Debates over the desirability of spectrum auctions continued, however (see section below on round two of the auctions debate). The FCC issued a request for comments on the issue. The due date for comments was 18 October 1995. FCC replies were due 1 December 1995. Larry Irving of the NTIA continued to favour an auction. So did the Benton Foundation, Americans for Tax Reform, and Thomas Hazlett, an economist and an expert on telecommunications policy. In early December, the Clinton administration floated a proposal for the auctioning of HDTV spectrum to create a fund for subsidizing consumer purchases of digital TV converters. The proposal called for a subsidy of around \$50 per consumer. The NAB and MSTV again objected to the idea of auctions and Irving's idea was strongly opposed by an FCC official on a televised debate. Nothing more of substance on auctions appeared until the middle of the 1996 election campaign.

ACATS APPROVES THE GRAND ALLIANCE SYSTEM

On 28 November 1995, ACATS made its final recommendations to the FCC on the HDTV standard, based on the laboratory and field-testing of the digital Grand Alliance system. ACATS reported that each of the six formats proposed for the HDTV system (see Table 2) exceeded targets established for static and dynamic luminance and chrominance resolution. ACATS ruled that the MPEG-2 compression system was superior to the four original ATV video compression systems and it selected the Dolby AC-3 audio system as superior to competing systems, including DTS (a digital sound system engineered by Lucasfilm with some Microsoft backing that was already in use in movie theatres). According to

Vertical pixels by horizontal lines	Aspect ratio	Frame rates
1920 x 1080	16:9	60i, 30p, 24p
1280 x 720	16:9	60p, 30p, 24p
704 x 480	16:9	60i, 60p, 30p, 24p
"	4:3	"
640 x 480	4:3	"

Note: In the frame rates column, ‘p’ designates a progressively scanned and ‘I’ an interlaced image format.

Source: *Fifth Further Notice of Proposed Rulemaking*, FCC 96–207, Federal Communications Commission, MM Docket No. 87–268, adopted May 9, 1996, p. 4.

Table 2: Eighteen video formats in the ATSC DTV standard, May 1996.

ACATS, the Grand Alliance’s packetized data transport subsystem performed well, and appeared to be compatible with Asynchronous Transport Mode (ATM) telecommunications technologies. Finally, ACATS selected Zenith’s VSB (vestigial sideband) transmission system rather than QAM (quadrature amplitude modulation) or COFDM (coded orthogonal frequency division multiplex) as the best method for assuring high-quality terrestrial over-the-air and cable transmission.

The system recommended by ACATS to the FCC had been vetted earlier to the Advanced Television Systems Committee (ATSC). The ATSC was asked by ACATS to determine which aspects of the Grand Alliance system required action by the FCC in the form of mandatory standards and which should be voluntary. The ATSC divided into five groups of specialists and proceeded to recommend mandatory standards in five areas: video; audio; transport; RF/Transmission; receiver characteristics. For this reason, the ACATS recommendations presented to the FCC in November 1995 were later referred to as the ‘ATSC DTV Standard’ (FCC 1996b).

The National Association of Broadcasters announced that they would not oppose the adoption of the ACATS recommendations by the FCC, but were concerned about requirements to broadcast HDTV signals. As before, they worried out loud about the expense of equipping stations for HDTV broadcasting and their ability to obtain new revenues to offset these expenses. They continued to argue for the benefits of multicasting NTSC signals instead of moving to HDTV. John Abel, recently retired from the NAB, said: ‘Consumers have always gone for more video choices rather than higher video quality’. CBS lobbyist Marty Franks said that there was ‘no evidence that the public, if presented with one great picture or five pretty good ones, will pick just the one great one’. Some local broadcasters disagreed, arguing that multicasting would only further fragment audiences and thereby reduce advertising revenues. Phil Jones, President of Meredith Broadcasting in Des Moines, Iowa, said ‘People are smoking something funny if they think [multicasting] is good for local broadcasters’.

On 12 December 1995, the FCC held en banc hearings on advanced TV systems. At those hearings, FCC Chairman Hundt said that Congress, not the

FCC, would decide whether the spectrum needed for HDTV broadcasts would be auctioned, but that the FCC would still decide whether licensees were required to use their new spectrum for HDTV broadcasts. He also argued that broadcasters might be required to provide 'public services' in exchange for the privilege of licensing the new spectrum. Hundt raised the question of the degree to which the regulatory structure already in use for NTSC broadcasting would translate into an appropriate structure for the new digital broadcasting system. He left this issue open for future discussion and deliberation.

At the 12 December hearings, Bruce M. Allan, Senior Vice President for Business Development at Thomson Consumer Electronics, urged the FCC to give prompt approval for the Grand Alliance digital system. Allan argued that 'consumers are ready for the superior pictures and sound of digital TV'. The Advanced Television (ATV) Task Force of the Electronic Industries Association (which became the Consumer Electronics Association in 1999), an organization that primarily represented the manufacturers of consumer electronics equipment, agreed with Bruce Allan.

Also at the 12 December hearings, a new organization called the Computer Industry Coalition on Advanced Television Services (CICATS), represented by Joseph Tasker of Compaq Corporation, argued for abandonment of the interlaced video format. Tasker warned that:

Unless the deficits of the proposed standards are remedied, the potential of the technology revolution will be stifled at birth... Television will fail to live up to its potential, but will instead remain simply a vehicle for entertainment, news, documentaries, and advertisements.

The members of CICATS at this time were: Apple, Compaq, Hewlett-Packard, Intel, Microsoft, Oracle, Silicon Graphics, and Tandem Computers.

CICATS was to lead the fight in 1996 to alter the Grand Alliance system prior to its acceptance by the FCC, focusing particularly on the question of requiring equipment manufacturers to support both progressive-scan and interlaced video formats in HDTV receivers. CICATS took up many of the arguments first articulated by Michael Liebholt, but added a few new ones. More importantly, a wider variety of industry notables stepped forward as advocates of the computer industry position, including Bill Gates of Microsoft and Andy Grove of Intel, leaders of the emerging Wintel (Windows and Intel) coalition that was already setting de facto microprocessor and operating system standards for desktop and laptop computers worldwide. They also managed to get the support of a number of Hollywood directors, producers, and actors for their views on HDTV. At the same time, the cost for broadcasters of converting to HDTV transmission, the idea of auctioning spectrum instead of loaning it to broadcasters, and the right of broadcasters to choose NTSC multicasting instead of HDTV broadcasting for their 'second channel' all remained contentious issues.

From this point on, most people began to speak about digital television (DTV) or advanced television (ATV) instead of HDTV. The Grand Alliance system (also called the ACATS or ATSC DTV system) was more than a HDTV system because of its adoption of a packetized digital transport system and internationally accepted compression standards like MPEG-2. Now it was possible to think about flexibly combining both high and low resolution video (and other kinds of digital information) on the same channels using 'smart' television receivers. It was also possible to think of DTV as permitting both passive and interactive video applications.

Congress, the White House and the FCC began talking about an accelerated transition to DTV of seven years instead of the ten to fifteen years mentioned earlier. This would speed up the return of the analogue channels to the FCC. The revenues obtained from auctioning that spectrum would then help to reduce the budgetary deficit a bit sooner than previously anticipated. FCC Commissioner James Quello objected to this policy shift because he thought that people would hang on to their NTSC sets for considerably longer than seven years and that they would be angry if they had to scrap them prematurely (Van and Jones 1996).

On 20 June 1996, at the Senate Commerce Committee Hearing on HDTV standards, Chairman Hundt again endorsed the idea of auctioning spectrum. Dr Peter Bingham, President of Philips Research Laboratories, said that the spectrum auction hung 'like a sword of Damocles over this digital revolution'. He argued that the auction would only produce a marginal improvement in deficit reduction but that it would certainly undermine the economic incentives for broadcasters to introduce digital television expeditiously.

During the week of 22 July 1996, the House of Representatives was scheduled to consider an amendment to the FY 1997 FCC appropriations bill proposed by Rep. Barney Frank (D-Massachusetts) that would prohibit the FCC from assigning licenses for ATV services. This amendment was designed to stymie efforts by the FCC to allocate ATV channels at a meeting on 25 July. Apparently the FCC was planning to free up channels 2–6 and 52–69 for non-television uses. The FCC promptly received a letter from the three major networks, ALTV, MSTV, NAB, Chris-Craft and Tribune opposing this. Senator McClain used the occasion to lecture Chairman Hundt in a letter to 'keep government intrusion to a minimum' and avoid freezing innovation by setting inappropriate standards. Nevertheless, the FCC voted to announce its intention to allocate ATV channels at the 25 July meeting, although it left the decision about what channels to allocate (and when) to a later time.

The combined lobbying efforts of the members of CICATS apparently convinced President Clinton to take a stand. On 23 September 1996, in an interview with a reporter from *Broadcasting and Cable* magazine, Clinton weighed in on the side of digital convergence:

The best standard would be one developed and supported by all the affected industries, which could then be endorsed by the FCC... We want to make sure that there are no roadblocks to future compatibility between televisions and computers.

(Corcoran 1997)

Accordingly, on 24 October 1996, Commissioner Susan Ness sent a letter to the Broadcasters Caucus, the Consumer Electronics Manufacturers Association and CICATS urging them to seek a consensus on DTV standards by 25 November. A series of intensive negotiations ensued; this resulted, ultimately, in a compromise to modify the ATSC DTV standard by removing the requirement that DTV receivers display all eighteen video formats in Table 2 and leaving it instead to each equipment manufacturer to decide how to display all the formats, even though they were required to decode all of them. Thus a small and less expensive ATSC compatible TV might be able to decode a 1080p signal but might (at the option of the manufacturer) display it as if it were a 480i signal. This compromise, in effect, recognized the split between computer and consumer electronics firms over interlaced formats and allowed

them to pursue their own strategies. It also helped to smooth over the conflict between the broadcasters and the set manufacturers, since few broadcasters at the time wanted to be forced to broadcast HDTV formats such as 720p and 1080p. The set manufacturers thought that it would be difficult to sell new sets if they were limited to displaying standard definition video. A letter documenting the compromise was signed on 27 November 1996, in Washington by Michael Sherlock of NBC, representing the Broadcasters Caucus, Gary Shapiro of the Consumer Electronics Association, and Paul Misener of Intel representing CICATS. This cleared the way for the FCC to issue its decisions on DTV without fear of further reprisals from the computer industry.

THE FCC DECISIONS OF 1996 AND 1997

On 27 December 1996 the FCC released its Fourth Order and Report accepting the recommendation of ACATS to adopt a modified version of the ATSC standard for digital television in the United States (FCC 1996b). The decision was strongly praised by the broadcasting and consumer electronics firms and their representatives. The computer industry and particularly the members of CICATS also expressed satisfaction with the outcome. Media coverage of the DTV decision began to emphasize some of the problems that conversion to DTV broadcasting would create for the smaller terrestrial broadcasters, consumer electronics retailers, and owners of NTSC receivers. The FCC turned to the question of how to allocate the channels it would loan to broadcasters for the transition to DTV.

In 1997, the FCC issued its *Fifth and Sixth Report Orders and Reports* in the US Advanced television proceedings. These documents spelled out in great detail the plans for allocating loaner channels to terrestrial broadcasters. The problems they had to solve had to do mainly with assuring existing broadcasters that their new digital channels would permit them to cover approximately the same territory as their old analogue channels. In addition, many low-powered television (LPTV) broadcasters in rural or mountainous regions were acting as repeaters for nearby terrestrial broadcasters. These stations were low-budget affairs with just enough revenues from advertising to generate a small profit. Such stations could not afford to quickly convert to digital broadcasting. Special provisions had to be made for them. A similar problem existed for public broadcasters, and they were granted more time to make the transition than commercial broadcasters.

An important part of the 1997 decisions was the plan to recover for non-television uses 138 MHz of spectrum – 60 MHz immediately and 78 MHz within ten years. 60 MHz would come from the former television channels 60 to 69 in the VHF band, which would no longer be reserved for television broadcasts (these channels were only infrequently used anyway, and then only in the most crowded urban areas). When the transition to DTV ended in 2006, all the NTSC channels would be returned to the FCC, which would make an additional 78 MHz of spectrum available. The recovered spectrum would be auctioned or otherwise allocated to licensees for various purposes. In the Sixth Report, the FCC committed itself to allocate 24 MHz of recovered spectrum in the VHF band for police and public safety purposes.

The idea of auctioning spectrum sooner rather than later was particularly appealing to the Clinton administration, which at the time was looking for a way to guarantee further reductions in the deficit before 2002. Hence, one initiative undertaken by Chairman Hundt was to try to get the broadcasters

in the largest urban media markets to accelerate their deployment of DTV. Instead of a transition period of ten years, he pushed the broadcasters to do it in two years. This generated great resistance on their part, but in the end the broadcasters committed themselves to a two-year transition in some major markets and a three-year transition in others.

Finally, an important aspect of the April 1997 decision was to reaffirm the earlier decision to allow broadcasters to choose between HDTV broadcasting and SDTV multiplexing, and between passive and interactive services, on their digital channels. Commissioner Hundt thought this proved that the FCC had embraced a 'market orientation' that would give 'broadcasters the flexibility to use the spectrum to respond to market opportunities' (FCC 1997: 1). Hundt's efforts to link the DTV spectrum allocation to new commitments on the part of broadcasters for public service announcements and children's broadcasting resulted in the appointment of a special commission to consider the matter.

For a year or so after the 1997 decision, manufacturers were concerned about a challenge by Sinclair Broadcasting to the FCC decision to require transmission of DTV signals using vestigial sideband (VSB) modulation instead of Sinclair's favoured coded orthogonal frequency division multiplexing (COFDM). Sinclair filed a petition before the FCC for a reconsideration that was only finally rejected in February 2000. During the interim, broadcasters and equipment manufacturers were in limbo waiting for a resolution of this issue.

In 1993, the US debate on digital television focused on the feasibility of a unified Grand Alliance approach. After 1997 the debate shifted away from a focus on television per se toward a consideration of the broader implications of digital television for the future of the American broadcasting and electronics manufacturing industries. The increased importance of the Internet and the World Wide Web, particularly for the Clinton administration, but also for key players like Compaq, Intel and Microsoft, had made a big difference in the level of attention given to HDTV and digital television by major political forces in the country. The Grand Alliance and ATSC approach had helped to focus the attention of these other players on the DTV issue by adopting digital packetization and transport schemes that were consistent with the idea of digital convergence but deviated from that ideal by forcing manufacturers to make more expensive DTV receivers and set-top boxes in order to satisfy the concerns of their coalition partners.

The Chairman of the FCC, Reed Hundt, and Commissioner Susan Ness played a crucial role in forcing the members of the Grand Alliance coalition to compromise with the 'johnny-come-latelys' of the computer industry, but in doing so they were simply reflecting the ability of the computer industry to generate support at high levels in a White House that had already tilted in their direction on a number of other occasions. Efforts on the part of members of Congress, even presidential candidates like Bob Dole, to force the FCC to auction DTV spectrum came to naught. Congress was split on this issue, with Senators Dole and McCain countered by Senators Coats and Stevens. Congress was also split on whether to support the TV broadcasters and manufacturers or the computer industry at various points in the debate. The FCC normally leans in the direction of TV interests because of the way in which commissioners are recruited and selected, but in this case that did not occur because the Chairman confronted a divided Congress and a White House eager to placate the computer industry. The result was a compromise standard that reduced uncertainty about the future of digital television considerably but did not eliminate it.

The US was the first to opt for all-digital as opposed to a hybrid digital-analogue standard. The US government, unlike those in Europe and Japan, did not support standards put forward by a coalition of consumer electronics manufacturers and broadcasters. US regulatory institutions were sensitive to a number of issues that were ignored elsewhere, such as the cost to consumers of purchasing new equipment and the need to promote continued innovation in digital technologies. On the negative side, the final US government decisions on DTV standards resulted in considerable confusion on the part of manufacturers, broadcasters, and consumers. Coping with that confusion and dealing with the inability, or reluctance, of some broadcasters and customers to pay for new DTV equipment became the key challenge of completing the transition to digital television in the US.

COPING WITH CONFUSION

The key DTV decisions by the FCC in the 1990s guaranteed that there would be confusion in the marketplace of DTV equipment and services. No specific format for encoding or delivering DTV signals over the air was mandated. Broadcasters and manufacturers were left to figure out what types of signals customers would be willing to pay for at premium DTV prices. So, for example, some over-the-air broadcasters decided not to use their DTV channels to broadcast in high definition. Instead they experimented with multicasting: the use of a single channel to broadcast a number of standard definition (480i) DTV signals. This meant that the broadcaster was using the allocated spectrum to become a sort of mini-cable operator. The bet was that the customer would be willing to pay for more choice in programming (but not for higher picture quality).

Other over-the-air broadcasters were betting that customers would be willing to pay for better picture quality, but they disagreed on what quality increment was required. The standards debates leading up to the FCC decisions of the 1990s identified a range of choices for picture and signal formats. The ones that emerged with substantial corporate backing were 480p, 720p, 1080i and 1080p. The number in the number/letter combination stands for the number of scanning lines per image. The small letter 'p' stands for *progressive* scanning; the small letter 'i' stands for *interlaced* scanning. Interlaced scanning involves the sending of every other line in an image in one burst followed by the sending of the rest of the lines in the next burst and so on. Interlacing was invented in the early days of monochrome TV broadcasting to conserve spectrum. All standard definition televisions use interlacing. Progressive scanning involves the sending of all the lines in an image in one burst (not two). All computer monitors, unlike standard definition TVs, use progressive scanning. While progressive scanning is less conserving of spectrum, it has the advantage of eliminating certain visual artefacts in the final image like 'flicker'. Progressive scanning is better for the display of text information than interlacing.

480p provides a progressively scanned digital version of a standard definition TV image. It is the cheapest to provide but does not provide as large an increment in picture quality as the other alternatives. 480p is the format of choice for broadcasters who chose the multicasting option.

720p provides a higher quality image than 480p and possibly as high image quality as 1080i because it is progressive. ABC, NBC, and their affiliates opted for 720p and made major investments in production facilities for broadcasting in this format. They focused initially on converting broadcasts of sporting events to 720p.

1080i was the choice of CBS and its affiliates because of their strong belief that 720p did not provide a high enough quality increment over standard definition analogue TV to make consumers willing to pay the premium for DTV signals. Their preference for interlacing was partly the result of the relationship between CBS and Sony, in which the latter provided 1080i equipment to the former. CBS also had allies in the film industry, including Sony Pictures (formerly Columbia Pictures), who swore by 1080i as a better format in which to view movies.

1080p had the least support of the main alternative formats because it was the most expensive to produce and display. Some of the technological components necessary to produce content in that format were still not widely available in 2005. Nevertheless, all the chips that were in ATSC-compatible HDTV tuners (DTV tuners for short) were capable of decoding 1080p images and so some companies were betting that the higher picture quality of 1080p would eventually triumph over the other alternatives.

To deal with the diversity of signal formats, the FCC mandated in 2002 the progressive phasing in of TV sets with DTV tuners, requiring that new sets with a given screen size, or larger, contain tuners. Here are the specific phase-in requirements:

Receivers with screen sizes 36 inches and above – 50% of a responsible party's units must include DTV tuners effective July 1, 2004; 100% of such units must include DTV tuners effective July 1, 2005. Receivers with screen sizes 25 to 35 inches – 50% of a responsible party's units must include DTV tuners effective July 1, 2005; 100% of such units must include DTV tuners effective July 1, 2006. Receivers with screen sizes 13 to 24 inches – 100% of all such units must include DTV tuners effective July 1, 2007.

(FCC 2002)

By mid 2007, therefore, all new TV sets with 13-inch screens or larger would be required to have DTV tuners.

In the meantime, consumers would continue to have to cope with complexity in stores where labelling of DTV sets and equipment includes such unfamiliar terms as HDTV-ready, HDTV-capable, HDTV-compatible, and HDTV-upgradeable. The sets themselves came in the following technological varieties: CRT (direct view), CRT-based projection, LCD flat panel, LCD projection, DLP projection, and LCOS projection (I will not bother to explain the acronyms here). On the back of the receiver there were the following kinds of 'secure' DTV connectors: DVI, HDMI, and Broadcast Flag. There were also a variety of connectors for antennas, VCRs, DVDs, DVRs, set-top boxes, and other such devices. Customers would be asked if they wanted to get their signal over the air, or via cable or satellite. If customers wanted to connect a DTV to a Windows Media Center personal computer, they would be in yet another vast new world of acronym-filled complexity. For the fanatics and insanely rich, there was the world of the 'home theatre' to master. The rich would simply pay someone who knew enough about all this stuff to do it for them, but then they were left with the problem of figuring out how to make it all work the way it was supposed to.

TURNING OFF ANALOGUE

The FCC DTV decisions of the 1990s resulted in the loaning of a second channel to over-the-air broadcasters to use for converting to digital broadcasting

while continuing to provide analogue services. The FCC's idea was that once the digital transition was complete the analogue channels would be returned to the government to dispose of as needed. The return of spectrum would permit the FCC to auction it off to the highest bidder, so the government had a strong incentive to get back all those old analogue TV channels as soon as possible. The revenues from auctions were already being included in estimates of future government revenues during the Clinton administration, so key members of the government were eager to push for the rapid completion of the digital transition.

The problem was that the FCC and Congress had recognized that the analogue signals should not be shut off until a good percentage of consumers were receiving or at least able to receive digital broadcasts. In 1997, when the DTV transition plan was launched, Congress passed a 'sense of Congress' resolution as part of an intelligence reform act that stipulated that the spectrum would be returned on 31 December 2006, but only if 85 per cent of the residents of any given local community had the necessary equipment to display digital signals. The interpretation of this somewhat vague rule would be left to the FCC.

Less than three percent of American homes had sets capable of decoding DTV signals as of early 2005, although a much larger percentage, perhaps more than 80 per cent, received TV signals in digital formats from either cable or satellite services and the 2006 deadline was fast approaching. The sales of such sets were growing rapidly, especially as lower cost DTVs started to be featured in the major consumer stores. The number of cable and satellite services offering HDTV-quality signals was also growing rapidly. In 2006, the prices of flat panel plasma TVs were expected to continue to descend below the current average price of around \$2,000, especially as the larger LCD TVs also were expected to decline in price from the current \$2,000 average to around \$1,000.

An additional problem, highlighted by outgoing FCC Commissioner Michael Powell was that many households possessed more than one TV, but were not likely to be receiving digital signals on every set they own. Also, a number of over-the-air broadcasters failed to comply with FCC orders to begin broadcasting in DTV formats, so households with DTV sets in those localities but without cable or satellite services would obviously not be able to contribute to meeting the 85 per cent goal.

As a result, the FCC, in its desire to get the spectrum back sooner rather than later, proposed a new deadline of 31 December 2008 and an easier test of the ability of households to decode DTV signals: i.e., that the use of cable or satellite services where the service provides a digital signal either to a set-top box, or, even less ambitiously, to a nearby connection point, would count toward the 85 per cent goal. If the household opted not to purchase a DTV set, therefore, it might still enjoy TV broadcasts if it either purchased or was given a box to convert the DTV signal to a standard definition analogue signal. All cable subscribers qualified as DTV-ready households by that standard. Problem of rapid transition solved!

That proposal, engineered in January 2005 by Kenneth Ferree, the Chief of the FCC's Media Bureau, had not been approved as of February 2005 (Ferree 2004). Ferree left the FCC soon after making the proposal. The plan was strongly opposed by NAB, whose members were not in a hurry to return their analogue channels to the federal government. They claimed that to meet the 85 per cent goal, 73 million sets not connected to a cable or satellite service would

have to be fitted with a converter at an estimated cost of around \$300 per unit (at a total estimated cost of \$22 billion). It should not come as a surprise that the \$300 price tag given by the NAB was contested. Motorola Corporation, for example, estimated the boxes could be produced in high volume for between \$50 and \$75 per unit. Motorola and other electronics manufacturers like Intel were interested in seeing the analogue spectrum returned and auctioned off for new wireless uses.

The important underlying issue, however, was that the shutting off of the analogue signals would greatly inconvenience millions of TV watchers, who either could not afford or were not willing to purchase the necessary converters and therefore raised the question of whether there needed to be government subsidies to allow these individuals to continue using their analogue equipment (Brinkley 2005).

MUST CARRY

Another difficult question was how to set the rules for the relationships between over-the-air broadcasters and cable and satellite service providers during and after the transition. Cable operators were bound by 'must carry' rules that impelled them to give their customers access to the analogue signals of local over-the-air broadcasters via the cable service. The cable operators did not get paid for this service, even though the local broadcasters continued to receive advertising revenues based on the audience (cable plus non-cable) that their signal could reach. This really irritated the cable operators so they looked for ways to get compensated for carrying the signals of local broadcasters on increasingly scarce cable bandwidth. No such must carry rules governed the relationship between local over-the-air broadcasters and satellite service providers.

Cable operators – led by Ted Turner initially – challenged the 'must carry' rules on constitutional grounds as a violation of their right to free speech, but ultimately lost this battle in the Supreme Court. They insisted that they could not be forced to carry digital signals the way they had been forced to carry analogue ones, especially multicasts, because this violated the intention of policy makers to promote a higher quality of broadcasts not simply a proliferation of channels. They wanted over-the-air broadcasters and cable network programmers to compete on an equal basis for cable bandwidth and obviously to pay for carriage, and they wanted local cable operators to have full control over the programming packages offered to cable customers in their service area. Cable companies particularly objected to efforts of broadcasters to get compensation for providing DTV signals for carriage by cable operators (especially HDTV coverage of popular sporting events). A spokesman for Time Warner Cable, Keith Coccozza, said 'The issue at heart is that broadcasters are trying to insist that they are compensated for something that they get from the government for free' (Walker 2005).

What the local broadcasters wanted was for both cable and satellite to be bound by 'must carry' rules for digital signals, especially those who had already invested in multicast technology (e.g. Belo). They also wanted the cable operators to pay them for carrying their content on cable networks. The DTV decisions of the 1990s gave the local broadcasters the right to use their digital channel either for HDTV or for other purposes including multicasting. Some broadcasting networks opted for multicasting, thus defining the choice for their local affiliates. The problem was that the cable companies did

not want to carry the multicasts, which they saw as direct competition. They wanted to be compensated for whatever they decided to carry. In short, disagreements over these matters were blocking cable carriage not just of multicasts but also of local- and network-produced HDTV-quality digital signals (Cotlar 2005; Frieden 2005–2006).

PLUG AND PLAY

Related closely to the must carry controversy was the question of what sorts of equipment consumers had to purchase or rent from cable operators in order to display DTV signals on their televisions. The decision of the FCC to mandate the inclusion of DTV tuners in new televisions meant that after 2007 it would not be necessary to include DTV tuners in the set-top boxes sold or rented to cable subscribers. Nevertheless, the cable operators continued to insist that they had the right to sell or rent set-top boxes because of the interactive (two-way) services they wanted to provide – such as pay-per-view, virtual digital video recorders, or electronic programme guides – that went beyond the one-way service of decoding DTV signals.

In the interest of saving consumers unnecessary expense and clutter, the FCC ordered in October 2003 that televisions that were ‘Digital Cable Ready’ should be labelled as such and that the two stakeholders (set manufacturers and cable operators) should work together to ensure that televisions so labelled would be compatible with cable services and equipment (FCC 2003). The Consumer Electronics Association (CEA) and the National Cable Television Association (NCTA) issued a Memorandum of Understanding in December 2002 calling for a ‘plug and play’ format for one-way signals from cable to DTV sets. Thus, to some extent, the later FCC order was an endorsement of the earlier CEA/NCTA agreement and a plea for further negotiations. The two industries were urged to go beyond the one-way plug and play agreement to negotiate a similar one for two-way interactive services.

One of the near-term consequences of the Digital Cable Ready Order of 2003 was the development of the ‘CableCard’ system. The CableCard was a card-shaped object that plugged into a socket in a Digital Cable Ready TV that gave the consumer access to the cable services of a specific cable provider. The primary function of the CableCard was to assure that only paying customers got access, but a secondary and quite valuable function was to do this in a way that did not require the purchase or rental of a set-top box with a redundant DTV tuner.

The CableCard system was similar to one developed for the DVB standard in Western Europe. From the consumer standpoint, not having to have multiple set-top boxes when subscribing to more than one service or to buy or rent a new box when changing services made a lot of sense. This decision, in short, assured that there would be lower switching costs for consumers and lower barriers to entry for potential competitors in local DTV cable service markets.

The cable operators resisted the CableCard initially because they thought it would reduce their ability to realize the revenues associated with proprietary features they planned to build into their next-generation set-top boxes. The set manufacturers worried that the increased cost of including a DTV tuner in sets would have to be passed along to consumers in the form of higher prices and that higher prices would reduce or delay DTV sales. Another disadvantage mentioned by critics of the CableCard decision was that some equipment purchased before the decision, like digital video recorders, might not work

with Digital Cable Ready televisions. The FCC held firm on both the Digital Cable Ready and 'plug and play' decisions, however, and both set manufacturers and cable operators began to plan their next moves accordingly.

THE DELAY UNTIL FEBRUARY 2009

Under the Digital Transition and Public Safety Act of 2005, part of the Deficit Reduction Act of 2005, Congress authorized the end of analogue broadcasting after 17 February 2009. Representative Joseph Barton (R-Texas), Chair of the House Energy and Commerce Committee, favoured 31 December 2006, as the deadline for the end of analogue broadcasts, but few other members of Congress thought this was realistic. The date chosen for the analogue switch off was 17 February 2009, so as to occur after the end of TV coverage of the Super Bowl. After the analogue switch off, the FCC would reallocate channels 52 through 69 for other forms of telecommunications. These channels were auctioned off in early 2008 for a sum of approximately \$20 billion. Most of the successful bidders were companies hoping to offer new or expanded commercial wireless services. Four channels, 60, 61, 68, and 69, would be reserved for use by first responders (e.g., police, fire, and emergency rescue services).

Besides setting a 'date certain' for the end of analogue, the bill also established a federally funded programme to provide coupons to consumers for the purchase of converter boxes for their analogue televisions. The value of the coupon was not to exceed \$40 and each household would be limited to two coupons. The converter boxes would allow them to convert over-the-air digital broadcasts into analogue signals that could be displayed on those sets. The converter-box coupon programme was to be administered by the National Telecommunications and Information Agency (NTIA). Democrats called for the funding to be at least \$3 billion, but Republicans were opposed to that amount and the two parties finally arrived a compromise level of \$890 million (22.25 million coupons), plus \$100 million for administration. There was an option in the bill to allow the funding to grow to \$1.34 billion (33.5 million coupons).

In April 2007, the FCC adopted labelling requirements so that sellers of analogue TVs would be required to tell consumers that they would need to purchase converter boxes for the TVs after the analogue switch off. In July 2007, the FCC proposed a rule to require television broadcasters to conduct on-air consumer education efforts. Members of the National Association of Broadcasters claimed to have spent \$1.2 billion on this effort (NAB 2009).

Critics argued that too many consumers would be surprised and upset after the switch off when their old analogue TVs displayed a blank screen. Democratic members of Congress were particularly critical of the current Chair of the FCC, Kevin Martin, not just for the decisions regarding the DTV transition but also for other policies. The Government Accountability Office (GAO) released a study that was highly critical of the converter-box coupon programme, focusing particularly on the level of funding (Goldstein 2008).

The converter-box coupon programme actually began on 1 January 2008. Two weeks later, the NTIA gave its approval for coupons to be used to pay for nineteen specific converter boxes. In January 2008, Nielsen reported that there were 13 million households that were not ready for the DTV transition or about 10.1 per cent of all households. To be included in this count, the household had to be dependent primarily on over-the-air broadcasts for a television that was not capable of decoding digital signals (i.e. an analogue TV without a converter box attached). By the end of 2008, 40 million coupons had

been requested but only 16 million had been redeemed. Nielsen estimated that 7.8 million households (6.8 per cent) were still completely unready for the transition.

THE DELAY UNTIL JUNE 12, 2009

Just after the election, the Obama-Biden transition team urged the passage of the Short-term Analogue Flash and Emergency Readiness (SAFER) Act of 2008. The purpose of this legislation, which was also called the 'DTV night-light bill', was to provide transition information to consumers who had not purchased DTV receivers and who still depended on over-the-air broadcasts via a short-term continuation of analogue broadcasts after the switch off date. Jay Rockefeller (D.-W.Va.) introduced the bill in the Senate on 1 October 2008. The Senate passed the bill on 20 November, the House approved its own version on 10 December, and President Bush signed it into law on 23 December (Reardon 2009a).

Responding to criticisms about the NTIA's administration of the DTV converter-box coupon programme, the Obama transition team began to suggest that new funding for the programme could be made available shortly after the inauguration, perhaps as part of the stimulus package that would be needed to deal with the threat of a long and deep recession. The NTIA stopped providing coupons on 5 January 2009, when the funding for the programme ran out. Even though many people who had received coupons failed to redeem them before they expired (one month after the issue date), the NTIA had been told by Republican Congressional leaders not to issue new coupons (Eggerton 2009).

On 8 January 2009, John Podesta, Co-chair of the Obama-Biden transition team, wrote a letter to Congress requesting a delay in the analogue switch off until June. The letter explained that this was necessary because of problems with the converter-box coupon programme and insufficient support for low income, rural, and elderly Americans (Podesta 2009).

The delay was supported by the Consumers Union, the Government Accountability Office, a number of mostly Democratic members of Congress, and the two Democratic members of the FCC (Michael J. Copps and Jonathan Adelstein). AT&T and Verizon supported the delay despite the fact that they got a major portion of the reallocated spectrum because they had an interest in setting back the date of entry into cell phone markets of competitors like Qualcomm. The delay was opposed by Qualcomm, Kevin Martin of the FCC, several Republican members of Congress, David Rehr of the NAB, Kyle McSlarrow of the National Cable and Telecommunications Association, and Gary Shapiro of the Consumer Electronics Association. The International Association of Chiefs of Police also opposed the delay because they wanted to start using (for public safety purposes) the spectrum that would be freed up after the analogue switch off.

On 21 January 2009, Jay Rockefeller introduced the DTV Delay Act of 2009 in the Senate. The Senate voted unanimously to approve the bill, but the House failed to approve its version of the bill on 28 January. The problem was that the desire of the new administration to expedite approval meant that a 2/3 majority was required for passage and not enough Republicans in the House supported the delay. Representative Joe Barton (R-Texas) led the opposition.

A new version of the bill came up again in the Senate on 29 January and passed easily. On 4 February, the House approved the bill. President Obama signed it into law on 11 February, with the understanding that the major networks and their affiliates asked to be permitted to go ahead with

the transition as originally planned on 17 February. During the signing ceremony, Obama said ‘Millions of Americans, including those in our most vulnerable communities, would have been left in the dark if the conversion had gone on as planned (Hart and Whoriskey 2009)’. On 20 February 2009, the FCC released an order stating that stations that wished to cease analogue transmissions before the new 12 June deadline could do so if they informed the FCC of their decision by 17 March 2009. The FCC wanted to make sure that each metropolitan area had at least one analogue broadcaster until 12 June. About half of the 1,787 full-power stations in the US switched over to digital prior to 12 June (Cheney 2009).

AFTER THE SWITCH OFF

On Friday, 12 June 2009, the analogue switch off finally occurred. It had been over twelve years since the FCC had announced its DTV standards decisions. Although the FCC received 317,000 calls from consumers on that day, consumers had to wait an average of only five minutes to get their questions answered. Most of the questions concerned how to operate converter boxes, but a large proportion of them also dealt with problems with antennas. 59 million coupons for converter boxes had been distributed and 31 million had been redeemed. The FCC had set up 600 walk-in centres for people who wanted hands-on assistance. Various community-based organizations volunteered to help indigent and elderly citizens install converter boxes and antennas (Sturgeon 2009). Less than 2.5% of households (roughly 3 million) were still unready for the transition (see Table 3) according to Nielsen, down from over 5% in February, so it is clear that the delay had eased the transition.

Date	Percentage
21 December 2008	6.8
18 January 2009	5.7
1 February 2009	5.1
15 February 2009	4.4
1 March 2009	3.9
15 March 2009	3.6
29 March 2009	3.4
12 April 2009	3.2
26 April 2009	3.1
10 May 2009	2.9
25 May 2009	2.7
7 June 2009	2.5

Source: The Nielsen company.

Table 3: Percentage of households completely unready for the DTV transition.

Commissioner Adelstein went so far as to say that ‘The digital transition is looking more like Y2K than the Bay of Pigs’ (Reardon 2009b).

CONCLUSIONS

There is certainly much to criticize about the handling of the DTV transition in the US. The original standards decisions resulted in confusing choices for both producers and consumers. Broadcasters were not required (as in other countries) to use their digital channels for HDTV and many chose to use them instead for multicasting. No clear must-carry rules were provided to cable and satellite operators until rather late in the game. The FCC’s CableCard decisions simply added expense to receivers without helping consumers because the cable companies insisted on providing their own set-top boxes with two-way capabilities. The FCC was slow to mandate an end to the production and sales of analogue TVs. The FCC relied too much on industry to educate consumers about the transition.

The Republican-controlled Congress did not adequately fund the converter-box coupon programme and the NTIA was forced to end the distribution of coupons too early. Partisan politics played a large role in Congressional oversight of the FCC and the NTIA. The Republicans, and especially the Republican appointees to the FCC, tended to favour the broadcasters and the consumer electronics manufacturers over consumer groups like the Consumers Union. Democrats and their appointees to the FCC were more concerned about consumers, minorities, the poor and the elderly, and less willing to follow the lead of broadcasters and equipment manufacturers.

When Barack Obama ran for the presidency in 2007–2008, his campaign took a relatively strong position on the DTV transition consistent with the views of influential Democrats like Ed Markey, John Dingell, and Jay Rockefeller. After the 2008 election, the FCC, the Congress, and the White House arrived at a set of policies that helped to make the long-awaited transition successful. Delaying the transition from February to June of 2009 helped to avoid major disruptions to the daily lives of citizens, while additional efforts undertaken by the FCC and the NTIA after the November elections to fix the converter-box coupon programme and educate consumers helped to reduce adjustment costs for the poor and the elderly.

The US DTV transition was a large and complicated affair. One of the basic problems in digital transitions is the problem of properly timing the switching off of analogue. Doing it successfully depends on many uncertain and often unpredictable variables like the willingness and ability of consumers to purchase digital receivers or converter boxes or to subscribe to cable and satellite services. It also depends on the cost of equipment and services, which is itself a function of many hard to predict variables. All of this occurs within a broader social and political context where democratic partisanship and the politics of social inequality can further complicate the transition.

It is unlikely that digital transitions in other countries will be simpler. In wealthy democratic countries, there will generally be a combination of governmental mandates and reliance on the market and consumer choices. In poorer countries, authority may be more centralized in the government and consumer interests may be ignored, but at the expense of forcing consumers to pay for services that they may not be able to afford. Nevertheless, it is helpful to analyze carefully each transition as it comes along in the search for answers about how to do it better next time (see, for example, Galperin 2004; Block 2008).

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Switching to Digital Television: UK Public Policy and the Market

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