

April 2008

DIGITAL TELEVISION TRANSITION

Majority of
Broadcasters Are
Prepared for the DTV
Transition, but Some
Technical and
Coordination Issues
Remain





Highlights of [GAO-08-510](#), a report to congressional requesters

Why GAO Did This Study

The Digital Television Transition and Public Safety Act of 2005, requires all full-power television stations in the United States to cease analog broadcasting by February 17, 2009, known as the digital television (DTV) transition. Prior to the transition date, the television broadcast industry must take a series of actions to ensure that over-the-air programming will continue to be available to television households once the transition is complete. For example, broadcast stations must obtain, install, and test the necessary equipment needed to finalize their digital facilities, and some stations will need to coordinate the movement of channels on the day the analog signal ceases transmission. This requested report examines (1) the status of broadcast stations in transitioning to digital, (2) the extent to which broadcast stations are encountering issues, and (3) the actions the Federal Communications Commission (FCC) has taken to guide broadcasters in the digital transition. To address these issues, GAO conducted a Web-based survey of full-power television broadcast stations. GAO surveyed 1,682 stations and obtained completed questionnaires from 1,122 stations, for a response rate of 66.7 percent. GAO also reviewed legal, agency, and industry documents and interviewed public, private, and other stakeholders.

We provided FCC with a draft of this report, and FCC provided technical comments that we incorporated where appropriate.

To view the full product, including the scope and methodology, click on [GAO-08-510](#). To view the results of GAO's survey, click on [GAO-08-528SP](#). For more information, contact Mark L. Goldstein at (202) 512-2834 or goldstein@gao.gov.

DIGITAL TELEVISION TRANSITION

Majority of Broadcasters Are Prepared for the DTV Transition, but Some Technical and Coordination Issues Remain

What GAO Found

Television broadcast stations have made substantial progress in transitioning to digital television, with the vast majority already transmitting a digital signal. Approximately 91 percent of the 1,122 full-power stations responding to our survey are currently transmitting a digital signal, with approximately 68 percent of survey respondents transmitting their digital signal at full strength and 68 percent transmitting their digital signal on the channel from which they will broadcast after the transition date. However, some stations still need to complete construction of their final digital facilities, and others need to relocate their digital channel to complete the transition. For example, 23 percent of survey respondents indicated they will be moving their digital channel to their analog channel. In addition, other stations need to move to a completely new channel. While almost all full-power stations are already broadcasting a digital signal, 9 percent of stations responding to our survey indicated that they are not currently broadcasting digitally. Almost all of these stations, however, indicated that they plan to have their digital signal operational by February 17, 2009.

Some stations, including those already broadcasting a digital signal, need to resolve various technical, coordination, or other issues before their transition to digital is complete. For example, over 13 percent of stations responding to our survey reported that they need to install or relocate their digital or analog antennas. Some of these stations still need to order equipment, such as antennas, to build their final digital facilities. Furthermore, stations may have coordination issues to address to complete their final digital facilities. In particular, some stations are awaiting agreements with the Canadian and Mexican governments regarding their signals crossing the borders of these respective countries before they can complete their digital facilities. Stations also need to coordinate with cable providers and satellite companies to ensure that cable and satellite facilities receive digital signals when the analog signals are turned off. Lastly, the construction of broadcast towers or financial constraints might affect some stations during their transition.

FCC's actions have provided guidance to broadcasters throughout the digital transition, but at the time we completed our survey, some broadcasters were awaiting FCC decisions. Since 1987, FCC has directed broadcasters with a series of rulemakings and orders, including assigning digital broadcast channels and developing timelines for the construction of digital facilities. Furthermore, FCC has conducted periodic reviews of the transition and released a ruling on its third periodic review on December 31, 2007, in which FCC addressed a number of important DTV issues. However, some stations responded to our survey that they needed decisions from FCC, such as approval for a construction permit or for changes to their final digital channel. According to FCC, it will address remaining issues quickly and with the release of an order in March 2008, FCC stated that it believes broadcasters have everything they need from the commission to proceed with construction of their final digital facilities.

Contents

Letter		1
	Results in Brief	3
	Background	5
	Broadcast Stations Have Made Substantial Progress in Transitioning to Digital Television, and the Vast Majority Are Already Transmitting a Digital Signal	7
	Some Broadcast Stations Face a Range of Technical, Coordination, or Other Issues in Completing Their Transition to Digital Television	10
	FCC Has Taken Numerous Actions to Guide Broadcast Stations through the Digital Transition	23
	Agency Comments	26
Appendix I	Objectives, Scope, and Methodology	29
Appendix II	GAO Contact and Staff Acknowledgments	32
Related GAO Products		33
Table		
	Table 1: FCC Key Actions in Support of Broadcasters' Transition to Digital	24
Figures		
	Figure 1: Operating Status of Broadcast Stations Transmitting a Digital Signal, as of February 8, 2008	8
	Figure 2: Survey Respondents' Location of Digital Channels Once the Transition Is Complete	9
	Figure 3: Number of Broadcast Stations with Additional Steps Needed to Locate Their Digital Antenna	12
	Figure 4: Survey Respondents' Status Regarding U.S. Government Coordination with the Mexican and Canadian Governments	16
	Figure 5: Survey Respondents' Status in Coordinating with Cable Providers and Satellite Companies	18

Figure 6: Example of a Broadcast Station's Digital Signal Coverage
Compared with Analog Signal Coverage

Abbreviations

DTV	digital television
FCC	Federal Communications Commission
MHz	megahertz

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United States Government Accountability Office
Washington, DC 20548

April 30, 2008

Congressional Requesters

The Digital Television Transition and Public Safety Act of 2005¹ requires all full-power television stations in the United States to cease analog broadcasting by February 17, 2009. After that time, such television stations may only broadcast digital transmissions. This change is often referred to as the digital television (DTV) transition. Prior to the transition date, the television broadcast industry must take a series of actions. For example, broadcast stations must obtain, install, and test the necessary equipment needed for their final digital facilities, and some stations will need to coordinate the movement of channels on the day that they cease analog signal transmission. Most television broadcasters are already transmitting both an analog and a digital over-the-air signal to television households. However, prior to or on the final transition date, broadcasters will be vacating portions of the spectrum, and 108 megahertz (MHz) of spectrum will be reclaimed by the federal government.² The Federal Communications Commission (FCC), which is the federal entity responsible for guiding the transition, has reallocated 24 MHz of the spectrum for public safety purposes. In January 2008, FCC began auctioning the remaining spectrum for commercial purposes.

You asked us to provide information on technical issues surrounding the DTV transition. We reviewed (1) the status of broadcast stations in transitioning to digital, (2) the extent to which broadcast stations are encountering issues during the DTV transition and how these issues impact the broadcast community, and (3) the actions FCC has taken to guide broadcasters in the DTV transition and how those actions have affected the broadcast community. In November 2007, we reported on the status of consumer issues related to the DTV transition.³ We are continuing

¹Deficit Reduction Act of 2005, Pub. L. No. 109-171, title III.

²The radiofrequency spectrum is the part of the natural spectrum of electromagnetic radiation lying below 300 gigahertz. The spectrum is the medium that makes possible wireless communications, including cellular and paging services, radio and television broadcasting, radar, and satellite-based services.

³GAO, *Digital Television Transition: Increased Federal Planning and Risk Management Could Further Facilitate the DTV Transition*, [GAO-08-43](#) (Washington, D.C.: Nov. 19, 2007).

to review consumer issues related to the DTV transition and will provide an update on those issues later in 2008.

To obtain information on the status of the broadcast industry in transitioning to digital and the issues broadcasters were encountering, we conducted a Web-based survey of the full-power commercial and noncommercial television broadcast stations (such as network broadcast stations and public television stations) in the 50 states and the District of Columbia. Among other things, we asked the broadcasters questions related to their digital facilities, construction plans, and issues affecting the digital transition. We obtained the list of full-power stations from FCC in June 2007. Since FCC did not maintain e-mail addresses for all of the licensed broadcasters at that time, we needed to obtain contact information on the broadcasters through alternate sources. Of the 1,747 stations on FCC's list, we surveyed 1,682⁴ stations located in the 50 states and the District of Columbia for which we could obtain contact information. We conducted our survey from December 2007 through February 2008 and obtained completed questionnaires from 1,122 stations, for a response rate of 66.7 percent. Of those completed questionnaires, 72 percent were from commercial stations and 28 percent were from noncommercial stations. This report does not contain all of the results from the survey. The survey and a more complete tabulation of the results can be viewed by accessing the following link: <http://www.gao.gov/cgi-bin/getrpt?GAO-08-528SP>. Furthermore, we reviewed relevant law, public comments, FCC proposed and final rules, and various industry and private sector documents. We interviewed FCC officials as well as a wide variety of industry and other private sector stakeholders with an interest in the transition, such as broadcasters, manufacturers, and industry advocacy groups. Appendix I contains a more detailed discussion of our objectives, scope, and methodology. We conducted this performance audit from April 2007 through April 2008 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

⁴We did not survey 30 broadcasters for which we could not obtain contact information or 35 stations located in the territories of Puerto Rico, Guam, and the Virgin Islands.

Results in Brief

Broadcast stations have made substantial progress in transitioning to DTV, with the vast majority already transmitting a digital signal. Information obtained from our survey of broadcast stations indicates that approximately 91 percent of full-power stations are currently transmitting a digital signal. Our survey further indicated that approximately 68 percent of respondents are transmitting their digital signal at full strength. In addition, 68 percent of survey respondents are currently transmitting their digital signal on the channel from which they will broadcast after the transition date. Twenty-three percent of stations that responded to our survey indicated they will be moving their digital signal to their analog channel. In addition, other stations need to move to a completely new channel. While almost all full-power stations are already broadcasting a digital signal, 97 stations, or 9 percent of stations responding to our survey, are not currently broadcasting digitally. Almost all of these stations, however, indicated that they plan to have their digital signal operational by February 17, 2009.

Some stations, including those already broadcasting a digital signal, still have technical, coordination, or other issues that need to be resolved before completing their transition. For example, over 13 percent of stations responding to our survey indicated that they have to install or relocate their digital or analog antennas in transitioning to digital. Some stations still needed to order equipment, such as antennas, to build their final digital facilities. According to an antenna manufacturer we contacted, it can take from 6 weeks to 9 months to design, order, and install an antenna, depending on the antenna's complexity. This manufacturer told us that stations need to have their orders placed by the second quarter of 2008 to be assured of having the equipment installed prior to the transition date. Furthermore, stations may have coordination issues to address in completing their final digital facilities. For example, some stations are awaiting agreements with the Canadian and Mexican governments regarding their signals crossing the borders of these respective countries before the stations can complete their digital facilities. Stations will also need to coordinate with cable providers and satellite companies to ensure that cable and satellite facilities can receive digital signals when the analog signals are turned off; most of those responding to our survey indicated that they are coordinating with or are planning to coordinate with cable providers and satellite companies. Lastly, stations that have to construct broadcast towers or have financial constraints might be affected during their transition. According to our survey, 47 stations indicated that they need to construct a broadcast tower or reinforce an existing tower to build their digital facilities. Another 69 stations responding to our survey indicated that they have not started construction on their final digital

facilities, or that they have not begun broadcasting a digital signal due to financial constraints.

FCC's actions have provided guidance to broadcasters throughout the transition process, but at the time we completed our survey, some broadcasters were waiting for FCC decisions before they could finalize their transition plans. Since 1987, FCC has been working on the DTV transition, and its rulemakings and orders have provided guidance for broadcasters. For example, in 1996, FCC adopted a rulemaking on a final digital standard for broadcasters. Since then, FCC rulemakings and orders have directed the broadcasters through the transition process, including the assignment of digital broadcast channels and the development of timelines for broadcasters to complete their digital facilities. In 2002, FCC established rules to ensure that all new television and television-related equipment would have a digital tuner capable of receiving digital over-the-air signals. Furthermore, FCC has conducted periodic reviews of the DTV transition and released its third periodic review on December 31, 2007. In its report, FCC addressed several issues important to broadcasters' completion of the digital transition.⁵ For example, stations that meet specific requirements can now reduce or cease service on their analog or paired digital channel prior to the final transition date. FCC also required all stations to submit information by February 19, 2008, detailing each station's current transition status, the steps that are necessary to complete the transition, and the timeline to complete these steps. According to our survey of broadcast stations, a few broadcasters had issues that required FCC decisions—such as approval for a construction permit or for changes to their final digital channel. FCC officials said they would address the remaining issues quickly and with the release of an order in March 2008, FCC noted that it believes broadcasters have everything they need from the commission to proceed with construction of their final digital facilities.

We provided a draft of this report to FCC for review and comment. In response, FCC noted that since our survey results of broadcast stations were based on information received between December 2007 and February 2008, the percentages we cite do not necessarily match information FCC would derive from its records. FCC also provided

⁵Federal Communications Commission, *Third Periodic Review of the Commission's Rules and Policies Affecting the Conversion to Digital Television*, MB Docket No. 07-91, Report and Order (2007). The third periodic review and report and order was published in the *Federal Register* on January 30, 2008, putting into effect the rules, forms, and procedures outlined therein.

technical comments that we incorporated in this report where appropriate.

Background

The DTV transition has been in progress for over two decades. With a firm date established in law, all full-power television broadcasters will cease broadcasting their analog signal by February 17, 2009. There are numerous benefits to transitioning to digital-only broadcast signals, such as enabling better quality television picture and sound reception and using the radiofrequency spectrum more efficiently than analog transmission. With traditional analog technology, pictures and sounds are converted into “waveform” electrical signals for transmission through the radiofrequency spectrum, while digital technology converts these pictures and sounds into a stream of digits consisting of zeros and ones for transmission. While the digital signal disperses over distances, a digital receiver can adjust and recreate the missing zeros and ones from the digital transmission, thus making the digital picture and sound near perfect until significant fading occurs, at which point no picture can be seen.⁶

To facilitate the digital transition, Congress and FCC temporarily provided each eligible full-power television station (both commercial and noncommercial educational stations, including public stations) with additional spectrum so they could begin broadcasting a digital signal. This companion, or paired, digital channel simulcasts the analog program content in digital format. Assignment of the paired digital channel began in 1997 with the hopes that operating this digital channel would help stations learn about broadcasting a digital signal, in addition to raising consumer interest and understanding about the digital transition. The paired digital channel was intended to be used for a limited period until all stations were assigned a final digital broadcast station and were able to broadcast on their final digital channel. FCC completed the digital channel assignment for most stations in August 2007. A station’s final digital channel could be (1) the same channel as its paired digital channel, (2) the same channel that its analog signal uses to broadcast, or (3) an entirely new channel.⁷

The Digital Television Transition and Public Safety Act of 2005 addresses the responsibilities of FCC related to the DTV transition. The act directs FCC to require full-power television stations to cease analog broadcasting

⁶This is known as the “cliff effect”—a viewer either gets a clear picture or no picture at all.

⁷Some stations were not assigned a paired digital channel.

after February 17, 2009.⁸ Stations are responsible for meeting this requirement and being prepared to commence digital broadcasting by this date; stations not ready to commence digital broadcasting risk losing interference protection and operating authority. The capability to provide a digital broadcast signal often involves a large outlay of capital and effort by broadcast stations. Sometimes a new broadcast tower or significant modifications to an existing tower is required. While a new antenna could cost a station several hundred thousand dollars, an industry association stated that stations could spend as much as \$2 million to purchase and install a new broadcast tower, antenna, and equipment. If new towers or antennas are not required, stations may still need to alter or upgrade existing towers. Alterations may include moving the digital antenna from a side-mounted antenna to the top of the tower to increase the coverage of the digital signal. Upgrades to an existing tower may include strengthening a tower before additional antennas can be added. For stations building new towers, installing new antennas, or making changes to existing structures, the stations must plan in advance to order the proper equipment and schedule construction crews.

In September 2007, FCC adopted an order designed to ensure that all cable subscribers, including those with analog television sets, can view digital broadcasts after the transition.⁹ FCC stated that all cable operators must make all broadcast signals viewable to all subscribers and cannot degrade any signal so that a difference in the cable signal and the broadcast signal would be perceptible to a viewer. According to the order, cable operators can meet this requirement in one of two ways, either (1) carry the signals of commercial and noncommercial must-carry stations in analog format to all analog cable subscribers or (2) for all-digital systems, carry those signals in a digital-only format, provided all subscribers with analog television sets have the proper equipment to view the digital signals. This requirement ensures that subscribers will have the ability to view a digital signal or an analog signal, depending on which best suits their equipment.

⁸Low-power broadcast and translator stations are not required to cease broadcasting in analog as of February 17, 2009. Although some of these stations already have or plan to independently transition to digital-only broadcasting, many will continue to broadcast in analog after the conclusion of the full-power transition. Thus, these stations' consumers might receive some programming in digital and some programming in analog after the transition date.

⁹Federal Communications Commission, *Carriage of Digital Television Broadcast Signals: Amendment to Part 76 of the Commission's Rules*, CS Docket No. 98-120, Third Report and Order and Third Further Notice of Proposed Rulemaking, 22 FCC Rcd. 21064 (2007).

While this ruling did not address satellite companies, FCC is considering how to apply the content and degradation requirements to satellite carriage of digital broadcast signals, and the commission expects to complete this ruling before the transition. Satellite companies already transmit digital signals to subscribers by digitizing broadcasters' analog signals.

Broadcast Stations Have Made Substantial Progress in Transitioning to Digital Television, and the Vast Majority Are Already Transmitting a Digital Signal

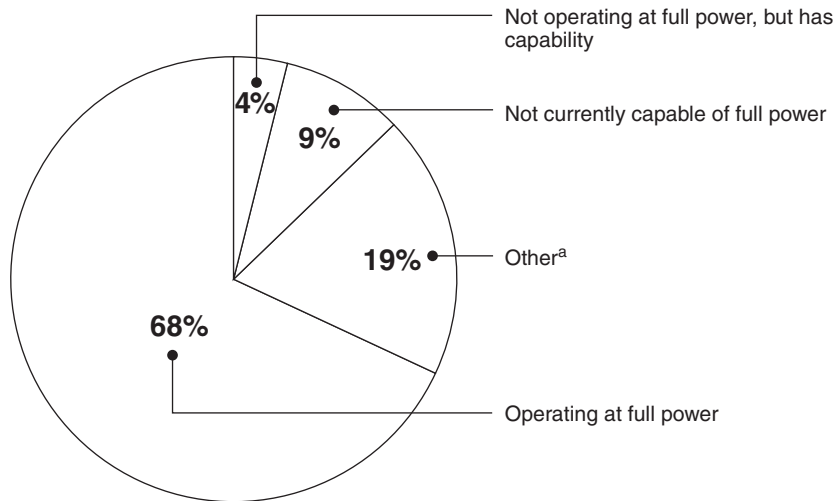
Most broadcasters have made significant progress in preparing their stations for the transition to digital, with 91 percent of survey respondents reporting that they were already transmitting a digital signal. Of the broadcasters already transmitting a digital signal and responding to our survey, 68 percent indicated that they are broadcasting their digital signal at full strength. In addition, 68 percent of survey respondents are broadcasting their digital signal on the channel from which they will be broadcasting after the transition. A small number of stations responding to our survey (9 percent) have yet to begin broadcasting a digital signal, but almost all of those stations expect to be broadcasting digitally by February 17, 2009.

Almost All Stations Are Broadcasting a Digital Signal, and the Majority Are Operating at Full Power

Our survey of broadcast television stations found that almost all stations (91 percent of respondents) are transmitting a digital signal.¹⁰ Of those stations transmitting a digital signal, the operating status of these survey respondents, as of February 8, 2008, is shown in figure 1.

¹⁰Several stations are not broadcasting an analog signal and are solely transmitting a digital signal. For example, 17 stations that responded to our survey indicated that they were only broadcasting a digital signal.

Figure 1: Operating Status of Broadcast Stations Transmitting a Digital Signal, as of February 8, 2008



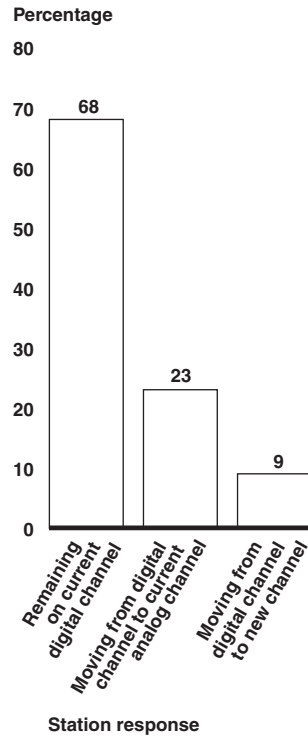
Source: GAO survey of full-power broadcast television stations.

^aBroadcast stations responding to the survey that indicated their operating status as “other” provided various comments on the readiness of their digital facilities, to include, among other things, those stations operating at full power, but moving channels on February 17, 2009; those stations operating only a digital signal; and those stations operating at full power, but needing to move their antennas.

As figure 2 shows, 68 percent of stations that responded to our survey said that their digital channel will not move after the transition.¹¹ However, about one third of stations are currently operating on a temporary digital channel and will move to another channel to complete their transition to digital. Twenty-three percent of survey respondents said they will abandon their current digital channel to begin broadcasting digitally at the channel location currently occupied by their analog channel. Approximately 9 percent of survey respondents will have to move to a completely new channel once the transition is complete.

¹¹FCC has identified 1,034 stations that have finished building digital facilities and are ready to cease analog broadcasts and broadcast solely in digital.

Figure 2: Survey Respondents' Location of Digital Channels Once the Transition Is Complete



Source: GAO survey of full-power broadcast television stations.

Nine Percent of Stations Responding to the Survey Are Not Broadcasting Digitally, but Almost All Stations Plan to Have a Digital Signal by February 17, 2009

Our survey of broadcast stations found that 97 stations, or 9 percent, are not broadcasting a digital signal. On the basis of the information provided by survey respondents, these stations serve a smaller number of households, on average, compared with those stations broadcasting a digital signal. In particular, survey respondents that are not broadcasting digitally transmit their analog signal to approximately 350,000 households, on average, compared with the average of nearly 775,000 households from stations responding to our survey that are already broadcasting digitally. Almost all of these stations that are not yet broadcasting digitally noted that they plan to have their digital signal operational by February 17, 2009. Three stations responded that they were not planning to broadcast a digital signal by February 17, 2009.

According to FCC, stations that are not currently transmitting a digital signal either (1) were granted a license to operate a digital signal along with their analog signal but have yet to begin broadcasting digitally or (2) were not given a digital license and plan to turn off their analog signal at the same time that they turn on their digital signal—known as “flash cutting.”¹² According to our survey, 5 percent (61 stations) of the stations indicated that they plan to flash cut to a digital-only broadcast. According to FCC, flash cutting may present challenges, since it will involve stations’ ending their analog television operations and beginning their digital television operations on their current analog channel or, in some cases, will require that a station change to a new channel to be fully operational. Of those stations responding to our survey that plan to flash cut, only 21 percent had begun constructing final digital facilities at the time of our survey. Furthermore, 64 percent of the flash cutters responding to our survey noted that they need to order equipment to complete their digital facilities.

Some Broadcast Stations Face a Range of Technical, Coordination, or Other Issues in Completing Their Transition to Digital Television

Before the transition to digital can be finalized, some stations still have to resolve technical, coordination, or other issues. According to stations responding to our survey, a major technical task for over 13 percent of the stations is the relocation of their digital or analog antenna. Other stations responding to our survey indicated that they have coordination issues to resolve prior to completing the transition, such as the U.S. government reaching agreements with the Canadian and Mexican governments and coordinating with cable providers and satellite companies. Our survey also found that other issues, such as the construction of broadcast towers or financial constraints, have affected some stations’ ability to finalize their digital facilities.

Some Broadcast Stations Need to Address Technical Issues in Building Their Digital Facilities

Broadcast stations and industry representatives have stated that technical issues might affect television stations’ ability to finalize digital operations. Technical issues that some stations need to address include (1) antenna and equipment replacement or relocation and (2) channel relocation.

¹²According to FCC, “flash cut” refers to the situation where a station simultaneously gives up its pretransition digital channel and begins digital service using its analog channel or a newly allotted channel.

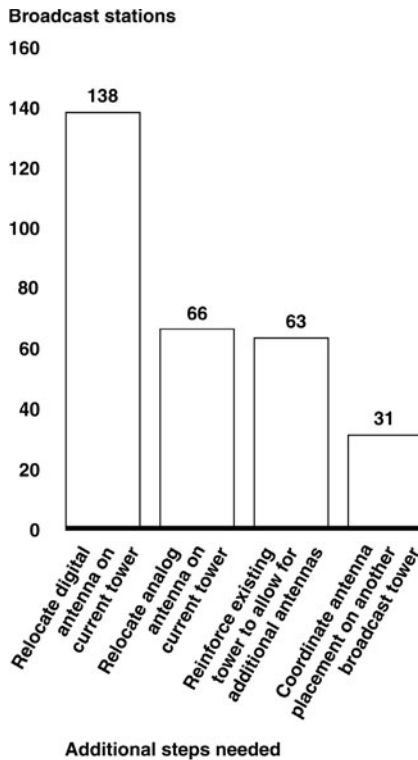
Issues with Antenna and Equipment Replacement or Relocation

One of the major tasks that many television stations have to complete to build their digital facilities is to install a digital antenna on the top of the broadcast tower, where the analog antenna resides.¹³ According to a broadcast industry representative, many stations need to have their digital antenna at the top of the tower to fully replicate the area that their analog service covers. The broadcast industry representative stated that stations have two options in placing their digital antenna at the top of the broadcast tower: (1) move the digital antenna to the top now, and buy a new side-mounted analog antenna, which would ensure that the analog signal continues until it is switched off and that the digital signal would be at full power, or (2) keep the analog antenna at the top of the tower until it is turned off on February 17, 2009, and then install the digital antenna at the top of the tower. The industry representative stated that both options, however, present problems for broadcast stations. For the first option, stations may have to purchase a new analog antenna, which will only be used for a few months. Also, as a result of the analog antenna being side mounted, stations' analog broadcast coverage area would be reduced by a range from 2 to 9 percent of the viewing market. Stations agreed that they might have to reduce their analog service prior to the transition date. For example, the owner of a station in Minnesota commented that it may not be possible to complete the construction of its digital facilities without significantly disrupting its analog operations as well as its digital operations. The owner said the power of its analog signal would have to be significantly reduced before February 17, 2009, which would affect a large number of its viewers.

Several survey respondents that were already broadcasting a digital signal reported that they needed to take additional steps to complete their digital facilities. According to our survey results, 151 stations (13 percent) indicated that they needed to relocate their digital or analog antenna on a current tower, reinforce an existing tower to allow for additional antennas, or coordinate antenna placement on another tower. Figure 3 shows the number of stations that need to complete these various steps, with some stations reporting that they have to complete multiple steps.

¹³We use the term "digital antenna" to refer to an antenna that is to be used to transmit a digital signal; the term "analog antenna" refers to an antenna used to transmit an analog signal.

Figure 3: Number of Broadcast Stations with Additional Steps Needed to Locate Their Digital Antenna



Source: GAO survey of full-power broadcast television stations.

Note: Some of the 151 stations indicated that they have to complete multiple steps.

FCC recognizes that there are many technical issues associated with antenna and equipment replacement or relocation that might force stations to terminate analog signals prior to the transition date. For example, FCC noted that there are 49 stations that have documented problems with side-mounted analog antennas. These stations will have to relocate their analog antenna to another location on their tower and operate with reduced analog facilities as they complete the transition. Other stations may have a tower at capacity, preventing the installation of an additional antenna on the tower. According to FCC, these stations will have to terminate analog operations prior to the end of the transition to mount their digital antenna. In addition, stations with an antenna that is located on a shared tower may need to reduce or terminate analog signals as the stations coordinate the configuration of their final digital facilities. Still other stations have equipment currently in use with their analog operations that they plan to use with their digital operations. Such a

situation will force stations to terminate their analog signals prior to the transition so that the equipment can be reconfigured for the final digital facilities. Although FCC established February 17, 2009, as the new construction deadline for stations facing unique technical challenges, FCC will also consider stations' requests to operate their digital facilities at less than full power until August 18, 2009—provided the stations continue to serve at least 85 percent of their viewers.

According to an antenna manufacturer with whom we spoke, stations will need to place orders for their antenna by the second quarter of 2008 for the stations to be prepared for the February 17, 2009, deadline. According to this manufacturer, the amount of time needed to design, order, and install an antenna can range from 6 weeks and 9 months, depending on its complexity. This manufacturer said a typical antenna serving one station requires about 4 or 5 months, from design to installation. In its third periodic review and order on the DTV transition, FCC noted that absent extraordinary circumstances, it would no longer consider a lack of equipment as a valid reason for granting an extension of time to construct facilities.¹⁴ FCC also said that stations demonstrating that they placed equipment orders well in advance will be considered eligible for an extension on these grounds.

Antenna work and replacement could be hampered by weather conditions for towers located in northern climates and on higher elevations. According to an antenna manufacturer with whom we spoke, although antenna work can be done during the winter months, it can be much more difficult, take longer, and entail additional costs. According to this manufacturer, winds over 10 miles an hour can be problematic for installing equipment. Installation crews need several days of limited wind speed to complete antenna work. In addition, ice and snow can present safety issues when installing antennas on towers. FCC recognizes that for some stations, work cannot be completed because of weather conditions, and that those stations facing legitimate delays will be considered for construction extensions. For example, if a station has a side-mounted digital antenna and can demonstrate that weather considerations would force it to reduce or terminate its analog signal well before the transition date to complete building of their final facility, it might qualify for an early

¹⁴A broadcaster may apply for an extension to the construction deadline defined by FCC as part of the broadcaster's construction permit or in the third periodic review. The deadline defines when construction must be complete and when the digital broadcast signal is operational.

reduction or termination of analog service prior to February 17, 2009. FCC states that in such situations, it could be preferable to accept a limited loss of analog service for a short time prior to the transition date to ensure the station is able to complete its transition to digital.

Issues with Channel Relocation

FCC notes that the stations facing the most significant amount of construction to finalize their facilities are those that are moving to a different channel. According to FCC, 643 stations will move to a different channel to complete the transition. FCC states that 514 of these stations will relocate their current digital channel to their analog channel. Stations might prefer to relocate their digital channel to the analog channel because it is the channel that viewers recognize. For example, one station we visited has its digital signal on channel 16 but plans to relocate the digital signal to channel 9, which is the station's current analog channel and the channel number people recognize for that station. In addition, stations currently located on channels 52 through 69 need to relocate their channel because these channel frequencies will be used for public safety and new wireless services after the transition.¹⁵ According to FCC, 129 stations will move to a completely new channel once the transition is complete. Such moves entail additional challenges for these stations because they may need to address such issues as (1) can the stations use any of their current analog or digital equipment, (2) will their viewers be impacted during construction of their digital facilities, and (3) will the stations have to coordinate with other stations because the channel they are moving to will be occupied by another station until the transition date.

Because of the issues associated with channel relocation, FCC is allowing stations moving to a different digital channel to cease operations on their pretransition digital channels and begin operating digitally on their new channels before the transition date. Stations can operate on their new channel before the transition date provided (1) the early transitioning stations will not cause impermissible interference to another station and (2) the early transitioning stations continue to serve their existing viewers for the remainder of the transition, and commence their full-power, authorized posttransition operations upon expiration of the February 17, 2009, transition deadline. In addition, stations that are moving to a different digital channel for posttransition operations may temporarily remain on their pretransition channel while they complete

¹⁵The Digital Television Transition and Public Safety Act of 2005 requires that no full-power stations remain on out-of-core channels after the February 17, 2009, transition date.

construction of their final digital facilities. Stations can remain on their pretransition channel provided (1) they build facilities serving at least the same population that receives their current analog television and digital services so that over the air viewers will not lose service and (2) they do not cause impermissible interference to other stations or prevent other stations from making their transition.

Coordination between Broadcast Stations and Various Public and Private Entities May Be Necessary to Support a Smooth Transition

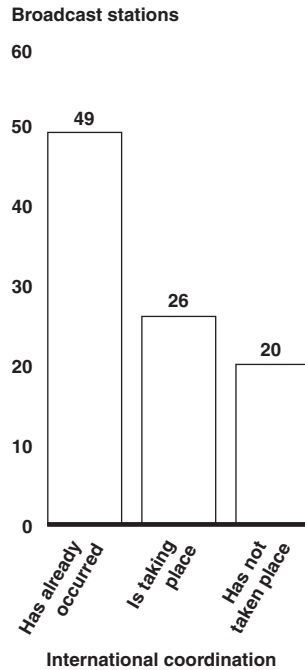
Coordination issues might affect television broadcast stations' ability to finalize their digital operations, according to stations that responded to our survey and our discussions with broadcast stations and industry representatives. Coordination issues that some stations face include (1) U.S. government coordination with Canadian or Mexican governments, (2) coordination with cable providers and satellite companies, and (3) coordination with other broadcast stations.

Coordination with Canadian and Mexican Governments

For some stations located along the northern and southern borders of the United States, agreements must be reached with the Canadian and Mexican governments regarding the coverage of the stations' digital signals that transmit across the borders.¹⁶ According to FCC officials, there are 139 and 43 U.S. stations that operate along the Canadian and Mexican borders, respectively. FCC officials stated that agreements are in place for most of these stations, and FCC expects agreements to be reached for all of the remaining stations. In responding to our survey, the stations that require coordination with a foreign government noted that different levels of coordination had taken place, as illustrated in figure 4.

¹⁶Mexico and Canada use the same spectrum for television broadcasts as the United States.

Figure 4: Survey Respondents' Status Regarding U.S. Government Coordination with the Mexican and Canadian Governments



Source: GAO survey of full-power broadcast television stations.

However, in responding to our survey, most stations with a signal that penetrates into Canada or Mexico were not concerned about analog interference. In particular, 81 percent of respondents operating along the Mexican border were not concerned about interference, while 86 percent along the Canadian border were not concerned about such interference.

In responding to our survey question regarding coordination with the Mexican and Canadian governments, one station commented that the lack of concurrence from the Mexican government has created significant concern about the station's ability to transition to its final digital operations, and that an agreement is needed as soon as possible. Another survey respondent stated that objection by the Canadian government to its final channel assignment was very late in the process and will seriously jeopardize its ability to build its digital facilities by the transition date. Another station that responded to our survey expressed concern about Canadian coordination being completed by the 2009 deadline. In its third periodic review and order, FCC stated that it will consider extensions of construction deadlines for stations encountering delays in cases where

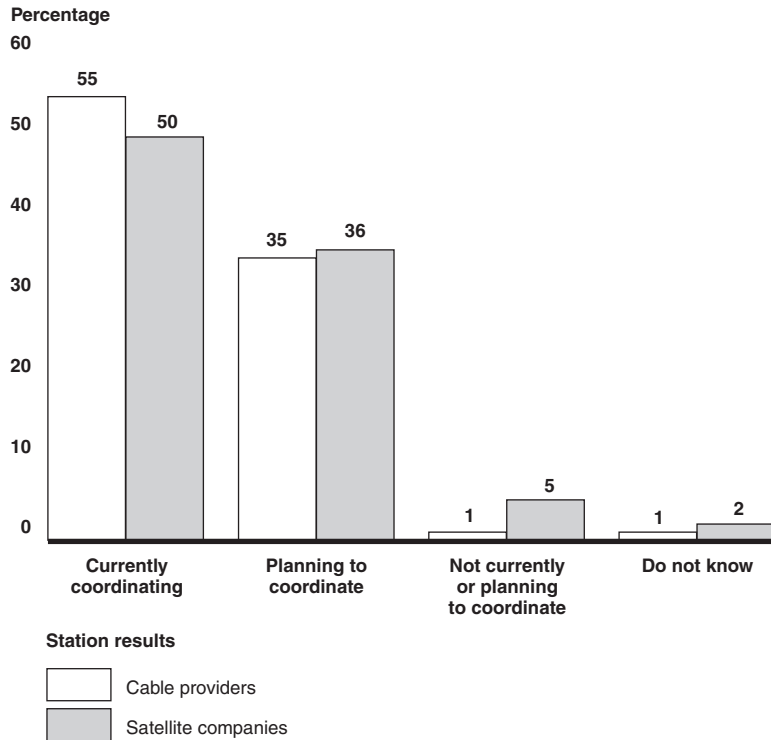
resolution of issues related to international coordination is truly beyond the control of the station. FCC also stated that if agreements cannot be reached, stations might be required to construct facilities with a smaller area of signal coverage. At the time of this report, there was a set of companion bills in the Senate and House known as the DTV Border Fix Act, which, if enacted, would authorize FCC to allow full-power television stations serving communities located within 50 miles of the U.S.-Mexican border to continue operating an analog signal until February 17, 2014. Among other requirements, stations seeking an extension would have to satisfy FCC that continued analog operation would be in the public interest.

Coordination with Cable Providers and Satellite Companies

As part of finalizing the transition to DTV, cable providers and satellite companies will need to make sure that their facilities receive digital signals from television stations when the analog signals terminate. In its third periodic review and order, FCC made no rules concerning the coordination between broadcast stations, cable providers, and satellite companies. However, FCC reiterated that broadcasters must work with cable providers and satellite companies to ensure a successful transition.

Many broadcast stations are currently coordinating with cable providers and satellite companies. As shown in figure 5, 55 percent of the stations responding to our survey indicated that they are currently coordinating with cable providers, and 50 percent of the stations responding to our survey indicated that they are currently coordinating with satellite companies. In addition, nearly 35 percent of stations responding to our survey indicated that they plan to coordinate with cable providers, and 36 percent of stations indicated that they plan to coordinate with satellite companies. One percent of stations responding to our survey indicated that they were not coordinating with and were not planning to coordinate with cable providers, and 5 percent indicated that they were not coordinating with and were not planning to coordinate with satellite companies.

Figure 5: Survey Respondents' Status in Coordinating with Cable Providers and Satellite Companies



Source: GAO survey of full-power broadcast television stations.

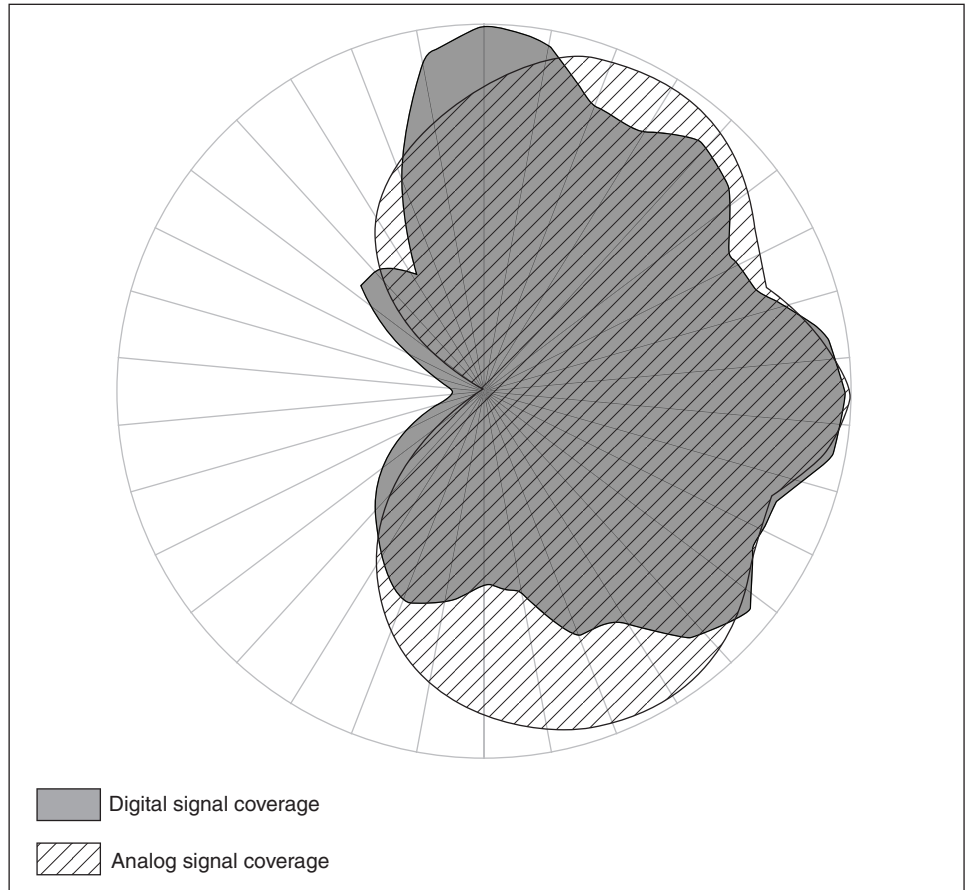
With some stations moving to a new channel or changing the coverage area of their broadcast signal, cable providers told us there is uncertainty about whether their cable head-ends will continue to receive the broadcast signals.¹⁷ For example, if a broadcaster’s digital coverage area differs from its analog coverage area, there is a possibility the cable head-end will no longer be able to receive that signal. Approximately 32 percent of survey respondents that are carried by cable, satellite, or both indicated that they

¹⁷Cable providers receive the local broadcast signals to their “head-ends.” Head-ends are the facilities where cable providers originate and distribute cable service in a geographic area. Cable providers receive and package television signals from a variety of television stations and networks and distribute the signals over coaxial or fiber-optic cable emanating from the head-end and terminating at subscribers’ residences. These signals can be received by the providers either over the air, across fiber, by microwave antenna, or by other means. Over-the-air signals could be lost completely on the basis of changes to the broadcast stations’ antenna placement or structure. Fiber and other means of receiving the broadcast signal may require changes in equipment.

are concerned their digital signal may not reach one or more cable providers' or satellite companies' facilities once the transition has occurred. One cable provider told us this issue could be particularly problematic in smaller markets where head-ends rely on over-the-air broadcasts to pull in the broadcast signals.

A cable provider and satellite company also told us that they need broadcast stations to inform them of their coverage areas, or signal contours, as soon as possible to help them identify areas where the digital signal may not reach cable head-ends or satellite receiver facilities. This information is important because even when stations do have their digital facilities fully operational, they may not broadcast their digital signal to the exact coverage area that their analog signal covered. As shown in figure 6, the digital signal coverage of a station can differ from its analog signal coverage.

Figure 6: Example of a Broadcast Station's Digital Signal Coverage Compared with Analog Signal Coverage



Source: FCC.

Officials with one cable provider with whom we spoke indicated that on the basis of potential changing signal coverage areas, the provider might need to reposition its antenna or otherwise update its head-ends so that it can continue to receive the broadcast signals. The officials went on to say that since their company has hundreds of head-ends, it could be time-consuming to update them. Officials of a satellite company told us that any change in the signal coverage area could seriously affect the company's ability to retransmit broadcast signals and might require it to build new facilities in the altered coverage area.

Information from our survey indicates that some stations will have a different digital signal coverage area compared with their analog signal coverage area. Of our survey respondents, 24 percent reported that their digital signal coverage area will vary from their analog coverage area. While some of these stations' digital coverage area could be increasing compared with the analog coverage area, some stations' digital coverage area will be smaller, at least in some parts of the coverage area, compared with their analog coverage area. This is evident by 11 percent of the stations responding to our survey reporting that they anticipate losing over-the-air viewers after the transition to digital. On average, those stations anticipating decreased coverage areas expect to lose 23,000 viewers.

Stations Coordinating with Each Other

According to our survey, 101 stations (9 percent) that have to relocate their current digital channel are moving to another channel that might be occupied by another station. Of these 101 stations, 13 survey respondents indicated that they are working with the other station to resolve coordination issues. According to a broadcast industry representative, the movement of channels will require television stations to closely coordinate with each other to minimize interference issues. The industry representative stated that the movement of channels could cause interference for neighboring channels if they move too early or if the neighboring channels move too late. The industry representative further stated that compounding this challenge is the fact that analog signals will be turned off on February 17, 2009.

Other Issues, Such as Construction Scheduling and Financial Constraints, Might Affect Some Stations during Their Transition

The construction of broadcast towers or financial constraints might affect some stations during their transition. Stations that must change their DTV tower locations might face considerable challenges, especially if the station must construct a new tower. Nineteen stations responding to our survey indicated that they needed to construct a broadcast tower to build their digital facilities. In addition, 62 stations responding to our survey indicated that they needed to reinforce an existing broadcast tower to finalize their facilities. A major television broadcast network stated that equipment manufacturing constraints and the limited number of tower crews and other key equipment installation resources available between now and the transition date will impede stations' movement to final digital channels by February 17, 2009. A representative with a major tower construction company told us that the company is already booked 6 months into 2008, and that other construction crews also have full schedules. The company representative stated he believes that there are a

significant number of stations that will wait until early 2008 to start making inquiries about work needing to be done on broadcast towers.

According to FCC, stations constructing a new tower should consider whether there are any existing towers that can be used or if a new tower must be constructed. FCC states that because of the lead times involved in purchasing or leasing land with the appropriate federal government clearances, local and state zoning requirements, and varying timelines for designing and constructing the new tower, stations must begin planning as soon as possible to have all of the work completed by the deadline.

Similar to weather conditions affecting work on antennas, winter weather could hamper tower construction in northern climates and on higher elevations. Television stations commented that working on towers in the winter months can be problematic, if not impossible. For example, a major broadcast network commented that many station transmitting sites are not readily accessible during the winter, especially to cranes and other heavy equipment necessary for tower rigging and equipment installation. In fact, the broadcaster commented that snow and ice make one of its stations accessible only by a special vehicle from October until March. Another station commented that it has been difficult to perform heavy construction at a remote and high-altitude transmitter site, and that the short weather window, difficult access, and complex work make the transition date hard to attain. A representative of a major tower construction company stated that weather is always a factor when determining the amount of time a project takes. The company representative stated that subzero conditions and ice are not conducive for tower work, and, although the work can be done, it is very dangerous and takes a much longer time to complete.

Stations encountering financial constraints may also have difficulties in completing the digital transition. According to our survey, 38 stations noted that financial constraints had been an issue during the process of constructing their final digital facilities. In addition, 39 stations that are broadcasting a digital signal, but have yet to begin building their final digital facilities, indicated that financial constraints were a reason they had not yet started construction. Furthermore, another 33 stations, or 42 percent of stations not yet broadcasting a digital signal, indicated that financial constraints contributed to delays in building their final digital facilities. One station commented that the digital transition has been a financial drain on small-market television stations. This station noted that the cost for the equipment is the same whether the station serves a small or large market, but large-market stations have a much higher financial base to pay for the equipment.

In its third periodic review, FCC acknowledged that some stations face financial obstacles to completing construction, but stated that it is imperative that stations devise and implement a plan to complete their final digital facilities. FCC established criteria for extensions of construction on final digital facilities due to financial hardship.¹⁸ To obtain an extension on the grounds of financial hardship, FCC requires a station to demonstrate that it (1) is the subject of a bankruptcy or receivership proceeding or (2) has experienced a negative cash flow for the past 3 years. FCC stated that while adopting the tighter financial hardship standard, it recognizes that some stations, including some noncommercial educational stations and some smaller stations, face extraordinary financial circumstances that do not fit within the new financial hardship criteria but may warrant an extension of time to finalize construction. Two stations that responded to our survey stated that they would qualify under FCC's new criteria of financial hardship. One station commented that it was in the process of filing bankruptcy after 3 years of negative cash flow. Another station commented that it would qualify for financial hardship due to costs associated with locating its analog antenna and operating with a digital-only signal for a period of time, which resulted in a 30 percent drop in viewers and a negative cash flow from the reduction of viewers.

FCC Has Taken Numerous Actions to Guide Broadcast Stations through the Digital Transition

FCC's actions have provided guidance to broadcast stations throughout the transition process. A recent FCC ruling addressed many issues important to broadcasters and provided increased flexibility for broadcasters in completing DTV transition tasks. At the time we completed our survey, however, some broadcasters were waiting for FCC decisions before they could finalize their transition plans.

¹⁸FCC previously had permitted consideration of circumstances where the cost of meeting build-out requirements exceeded the station's financial resources.

FCC Rulemakings and Orders Have Directed Broadcast Stations' Preparation for the Digital Transition

For many years, FCC has orchestrated the DTV transition using its rulemakings process to guide broadcast stations through important milestones. FCC determined that establishing a digital standard for broadcasters was critical to begin the transition to digital broadcast; the establishment of a digital standard was completed with the adoption of an order in 1996.¹⁹ Since then, FCC has taken additional actions to continue moving broadcasters toward the digital transition, as shown in table 1. For example, FCC assigned paired digital channels for stations that would be broadcasting both a digital and an analog signal prior to the digital transition. These paired digital channels were important to allow broadcasters time to gain experience in operating a digital service, stimulate interest in the DTV transition, and encourage consumers to begin purchasing digital equipment.

Table 1: FCC Key Actions in Support of Broadcasters' Transition to Digital

FCC key action	Description
Adopted a digital broadcast technical standard	<ul style="list-style-type: none"> Identified the development of a digital standard as critical to move the digital transition ahead. Collaborated with the industry in the development of this standard by appointing the Advisory Committee on Advanced Television Service. Charged the advisory committee with providing recommendations on technical, economic, and policy issues related to the introduction of DTV service. Subsequently, the advisory committee conducted an open competition to define a DTV standard, determined that a high-definition television system was possible, and recommended a set of DTV protocols.
Assigned broadcasters a paired digital broadcast channel	<ul style="list-style-type: none"> Defined criteria to determine which stations would be allowed a paired digital channel to simultaneously broadcast a digital and an analog broadcast signal prior to the transition. Adopted simulcast requirement for the paired digital channels and by what time all broadcast content must be simulcast on the paired digital channel. Established deadlines for stations to maximize the signal of their paired digital channel or lose interference protection on this channel.
Assigned broadcasters final digital broadcast channel	<ul style="list-style-type: none"> Created a multistep channel election process that allowed broadcasters to express their final digital channel preference. Designated construction deadlines for final digital broadcast channel that stations must meet or face potential loss of interference protection. Updated construction deadlines for final digital broadcast channel and created tighter standards for stations requesting any extension beyond the final transition date.

¹⁹Federal Communications Commission, *Advanced Television Systems and Their Impact Upon the Existing Television Broadcast Service*, MM Docket No. 87-268, Fourth Report and Order, 11 FCC Rcd. 17771 (1996).

FCC key action	Description
Established time frame for all new television equipment in the United States to have a digital tuner	<ul style="list-style-type: none"> Required that all new television equipment in the United States be capable of receiving a digital signal. Created a phased approach for the digital tuner requirement based on the size of television sets, beginning in July 2004 and ending in March 2007, when all sizes of television sets and all television equipment must be equipped with a digital tuner.^a

Source: FCC.

^aThe original end date for all sizes of new television sets and television equipment to be equipped with a digital tuner was July 1, 2007. However, in 2005, FCC moved the date to March 1, 2007.

In its December 2007 third periodic review and order, FCC finalized a number of actions to facilitate broadcasters' completion of the DTV transition. For example, the third periodic review and order addressed, among other things, (1) time frames for television stations to complete construction of their digital facilities; (2) information all full-power television stations must provide to FCC by February 19, 2008, detailing the station's current transition status, any additional steps needed to commence its full, digital operations, and its timeline to meet the February 17, 2009, transition deadline;²⁰ (3) when and for how long stations will be permitted to reduce or cease service on their analog or paired digital channel;²¹ and (4) guidelines for rapid approval of minor expansion of authorized service areas for stations that are moving their digital channel for posttransition operations to allow these stations additional flexibility to use their existing analog antenna.

²⁰Stations will also be required to update this information, as necessary, until construction of fully authorized digital facilities is completed and the station has begun operating its full posttransition facility. FCC intends to use this information to identify stations that are not communicating their progress and may contact stations directly to assess and discuss the stations' transition status. In addition, FCC is planning to prepare a comprehensive summary report of the information provided by stations no later than August 18, 2008, to assess the progress toward completing the transition. FCC will also require stations that have not completed construction of their final digital facilities to update their status by October 20, 2008.

²¹Stations can now reduce or terminate their analog and paired digital broadcasts prior to the transition for a period longer than 30 days, if the station meets certain requirements. If approved for early reduction or termination, stations are required to notify their viewers. The third periodic review and order specifies what must appear in the notification, and that the notification must be broadcast at least 4 times a day for 60 days prior to the change in service for stations reducing service for longer than 30 days.

Some Broadcast Stations Required FCC Decisions Prior to Finalizing Their Digital Facilities

In our survey of broadcast stations, 128 respondents indicated they were “awaiting action from FCC” to complete building their final digital facilities. In following up with these stations after they had responded to our survey, our analysis suggested that the actions many stations were awaiting were addressed in FCC’s third periodic review and order. However, at that time, a few broadcasters still had issues that required FCC decisions—such as approval for a construction permit, petitions to alter their signal power, or FCC reconsideration of their final digital channel assignment. According to FCC, approximately 100 petitions for reconsideration of final DTV channel assignments were filed by broadcasters. FCC said these petitions needed engineering analysis performed to determine the feasibility and impact on other stations. FCC told us that the analysis had been completed, and released its decisions regarding the petitions in early March 2008.²² FCC noted that it believes broadcasters have everything they need from the commission to proceed with construction of their final digital facilities.

Agency Comments

We provided a draft of this report to FCC for its review and comment. In response, FCC noted that since our survey results of broadcast stations were based on information received between December 2007 and February 2008, the percentages we cite do not necessarily match information FCC would derive from its records. FCC also provided technical comments that we incorporated in this report where appropriate.

As agreed with your offices, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies of the report to interested congressional committees and the Chairman of the Federal Communications Commission. We will make copies available to others upon request. In addition, the report will be available at no charge on GAO’s Web site at <http://www.gao.gov>.

²²Federal Communications Commission, *Advanced Television Systems and Their Impact Upon the Existing Television Broadcast Service*, MB Docket No. 87-268, Memorandum Opinion and Order on Reconsideration of the Seventh Report and Order and Eighth Report and Order (2008).

If you or your staffs have any questions concerning this report, please contact me on (202) 512-2834 or at goldsteinm@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report are listed in appendix II.

A handwritten signature in black ink, appearing to read 'Mark L. Goldstein', with a long horizontal flourish extending to the right.

Mark L. Goldstein
Director, Physical Infrastructure Issues

List of Requesters

The Honorable Edward J. Markey
Chairman
The Honorable Cliff Stearns
Ranking Member
Subcommittee on Telecommunications
and the Internet
Committee on Energy and Commerce
House of Representatives

The Honorable Herb Kohl
Chairman
Special Committee on Aging
United States Senate

The Honorable Daniel K. Inouye
Chairman
Committee on Commerce, Science,
and Transportation
United States Senate

The Honorable Joe Barton
Ranking Member
Committee on Energy and Commerce
House of Representatives

The Honorable Fred Upton
House of Representatives

Appendix I: Objectives, Scope, and Methodology

The objectives of this report are to provide information on technical issues surrounding the digital television (DTV) transition, specifically, (1) the status of broadcast stations in transitioning to digital, (2) the extent to which broadcast stations are encountering issues during the DTV transition and how these issues impact the broadcast community, and (3) the actions the Federal Communications Commission (FCC) has taken to guide broadcasters in the DTV transition and how those actions have affected the broadcast community.

To obtain information on the status of the television broadcast industry in transitioning to digital and the issues broadcasters were encountering, we developed and administered a Web-based survey. Our intent was to survey all full-power commercial and noncommercial broadcast television stations in the 50 states and the District of Columbia. We asked the broadcast stations questions related to their (1) digital facilities and plans, (2) issues affecting the digital conversion, (3) antenna locations, (4) DTV information advertisements and public service announcements, (5) digital signal contour and coordination with cable and satellite, (6) relocation of digital channels, (7) digital and analog signal coverage, (8) international issues, and (9) translator stations. The initial sample frame for the study was all FCC licensed full-powered television stations as of June 2007—a total of 1,747 stations. Since FCC did not maintain e-mail addresses for the licensed broadcasters at that time, we needed to obtain contact information on the broadcasters through alternate sources. We requested and received contact information from the following sources: the Association of Public Television Stations, ABC, CBS, NBC, CW, FOX, and Telemundo. In total, we received contact information for 1,058 stations. For the remaining 625 stations, the engagement team spent 1 week compiling a list of contact information. Of the 1,747 broadcasters on FCC's list, we surveyed 1,682 stations located in the 50 states and the District of Columbia for which we could obtain contact information.¹ In several instances, we identified stations that were not on FCC's list of full-power broadcast stations, or stations for which we did not initially have contact information and subsequently sent the survey to these stations. From September 27, 2007, through October 16, 2007, we conducted a series of pretests with general managers of broadcast television stations to help further refine our questions, clarify any ambiguous portions of the survey,

¹We did not survey 30 broadcast stations for which we could not obtain contact information or 35 stations located in the territories of Puerto Rico, Guam, and the Virgin Islands.

and identify any potentially biased questions. Upon completion of the pretests and development of the final survey questions and format, we sent an announcement of the upcoming survey to 1,682 broadcast television stations on November 30, 2007. These stations were notified that the survey was available online on December 7, 2007. We sent follow-up e-mail messages to nonrespondents on December 14, 2007, December 21, 2007, January 8, 2008, and January 9, 2008, and then attempted to contact by telephone those stations that had not completed the survey.

The survey was available online until February 8, 2008. Of the 1,682 broadcast stations that were asked to complete the survey, we received 1,122 completed surveys, for an overall response rate of 66.7 percent. Of those completed questionnaires, 72 percent were from commercial stations and 28 percent were from noncommercial stations. The practical difficulties of conducting surveys may introduce errors commonly referred to as “nonsampling errors.” For example, questions may be misinterpreted and the respondents’ answers may differ from broadcast stations that did not respond to the survey. To minimize nonsampling errors, we pretested the survey and conducted numerous follow-up contacts with nonrespondents. In addition, steps were taken during data analysis to further minimize errors, such as performing computer analyses to identify inconsistencies and completing a review of data analysis by an independent reviewer. We also conducted a nonresponse bias analysis, comparing our survey estimates with estimates obtained from FCC records, and found small, but statistically significant differences. Because of the differences identified through the bias analysis, we decided to provide estimates only for respondents and not to project our results to the population. The survey results were reliable enough for our purpose because the bias does not appear to be more than a few percentage points. A difference of 5 percentage points in any of our estimates would not affect our findings. To view the survey and a more complete tabulation of the results, go to <http://www.gao.gov/cgi-bin/getrpt?GAO-08-528SP>.

Furthermore, we reviewed relevant law, public comments, proposed rules, and other industry and private sector documents. We interviewed officials with FCC as well as a wide variety of industry and other private sector stakeholders with an interest in the DTV transition, such as commercial and noncommercial broadcasters; antenna and equipment manufacturers; tower construction companies; and industry advocacy groups, such as the National Association of Broadcasters and the Association for Maximum Service Television. We conducted this performance audit from April 2007 through April 2008 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the

audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: GAO Contact and Staff Acknowledgments

GAO Contact

Mark L. Goldstein, (202) 512-2834 or goldsteinm@gao.gov

Staff Acknowledgments

In addition to the individual named above, other key contributors to this report were Sally Moino, Assistant Director; Andy Clinton; Colin Fallon; Simon Galed; Eric Hudson; Bert Japikse; Aaron Kaminsky; and Andrew Stavisky.

Related GAO Products

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